

Cara-Julie Kather

THE EPISTEMIC VIOLENCE OF MATHEMATICS

Decolonial-Feminist Re-Writings
of the “Rational” and the “Human”



[transcript]

Cara-Julie Kather
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Editorial

The book series **Philosophy – Enlightenment – Critique** aims to promote philosophical thinking dedicated to a future worth living for everyone in times of global crisis. Climate change, political and religious authoritarianism, and growing social inequalities – the manifold and interconnected issues of our time require a return to the power of reason. In the spirit of a new enlightenment, the series initiates a dialog between different philosophical schools and traditions that critically scrutinize the past and present and explore the ramifications of sustainable alternatives. This requires a re-examination, re-interpretation and revision of the philosophical canon. The series also reveals the emancipatory potential inherent in the interplay between philosophy and other disciplines such as technology or aesthetics.

Cara-Julie Kather is a feminist theorist and writer. She works in academic as well as literary modes and all the inbetweens and beyonds to these categories and conducted research on mathematics as a technique of thinking as part of her PhD at Leuphana Universität Lüneburg. She works on questions of sexual violence, autistic womanhood, and neurodiverse sexuality in Montreal. Her work generally centers the diversity of modes of thinking and living and the interwovenness of ontological and epistemic matters in relation to questions of violence.

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Decolonial-Feminist Re-Writings of the "Rational" and the "Human"

[transcript]

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She was slowly straying from that zone where things have a set shape and edges, where everything has a solid, immutable name. She was sinking deeper into the liquid, quiet, unfathomable region, where mists hung as vague and cool as those of the dawn.

Clarice Lispector, Near to the Wild Heart (2014), 187

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Preface by Kira Herff

I am on the phone with my dad. The device is squeezed between my shoulder and ear, as I unlock the door. I take a second set of keys from the letterbox. I pause in the hallway in front of the flat. The lock gives way with a small click, the sound carrying into the empty rooms beyond. My reply to my father is muffled, yet it seems to echo through the silence.

I look around. Everything is clean and tidy. The kitchen stands bare, its grey concrete floor stained and rough. I am early. My appointment with the caretaker is in twenty minutes. I take a deep breath, sit down on the windowsill in the living room, and turn my attention back to my father. He recently had an accident, and we have been talking on the phone since then every day. I have been sitting there for scarcely two minutes when the doorbell rings. I cut my father off and walk through the empty room.

It used to be a cosy room with lots of fairy lights and books, crammed into a huge bookshelf. Here I have shared some of my best conversations: about academia, about what it means to be marginalized, about resistance in these current times. We spoke about how to imagine a life beyond capitalism, and how to dismantle patriarchal and heteronormative structures.

I emptied Cara's cabinets and cupboards a few days ago. It was a warm day. Boxes were packed to the beat of good music, as I hurried back and forth through the flat. Once I had started emptying the huge bookshelf, I stopped the music and fell silent. Seeing all the wonderful female authors' names rushing through my hands as I put their books into boxes moved me to tears. This profound sentiment of immense gratitude towards the exceptional and extraordinary women who have committed their thoughts to paper. They were women—women who wrote.

As Hélène Cixous says in her text *The Laugh of the Medusa*: "Woman must put herself into the text – as into the world and into history – by her own move-

ment.” All these names, all these books I held in my hands, were exactly that: tangible proof, the materialization of women who wrote.

Women who raised their voices from a position of suppression, questioning the colonial and imperialist framework of the Western scientific system and forming a queer-feminist, decolonial worldview.

It was a very precious moment, sitting amidst the chaos, feeling a thin film of sweat on my arms, and realizing that I am in the flat of a woman who also writes. A woman who embodies exactly the thinking of all these authors and philosophers. Cara is both an academic and a non-academic author, and in her work she continues this legacy. Helene Cixous urges us: “Write, let no one hold you back, let nothing stop you: not man; not the imbecilic capitalist machinery [...].” Cara has been doing exactly this for as long as I have known her.

Cara’s writing is clear, accessible, inspiring, and builds an imaginative structure in her thinking that is a joy to follow. What you will be reading is her PhD research, but it is evident that she always envisioned this project as a book. When I first read her thesis, I found myself taking notes and forming thoughts in the same way I do when reading books that truly transform my perspective on the world. I had a lot of fun doing it! I hope you will too, as you engage with her theory.

My mind ran through all the moments we shared before she left to pursue her doctoral studies in Canada: all the sweet moments, the long talks, and being there for each other. We formed a network of solidarity, a system of support that gives us the strength to raise our voices and to write. It is precisely this support system that kicks in as I walk to the door.

It was a very kind caretaker from a well-known German property management, carrying a tablet in front of him, who was happy to make the appointment earlier, because he heard me entering the flat. I needed to text Cara with a few questions, since Canadian addresses don’t work the same way as German ones. Then I signed the completion contract via the tablet and handed over the two sets of keys. Thankfully, the procedure was quick and straightforward.

Cara had hoped to keep the flat by subletting it, but the decision was suddenly reversed and everything had to be cleared out within three months. Situations like this are just one example of how vital a support system is for a scientist living abroad — a network of people who help you manage crises, share the burden, and give you the strength to keep going.

Academia in the West is white, patriarchal, and hierarchical. The systemic problems within the academic system are numerous and varied: abuse of power, temporary positions with no long-term prospects, the “publish or

perish” culture, excessive unpaid overtime, and uncertain and yet existential funding — just to name a few.

According to the 2022 international UNI-Safe survey, more than two-thirds of female students and staff at universities, including Professors, have experienced gender-based violence. This can be attributed to patriarchal thought patterns and hierarchies. Studies also show that first-generation academics and people with a migration background are particularly affected. Moreover, a survey from March 2024 found that the careers of BIPOC researchers in Germany depend heavily on their social environment. Supportive contacts, colleagues, and supervisors help in building a career, while the absence of networks or unsupportive supervisors can hinder it. In such cases, even individual research achievements often take a back seat.

I am one of many cogs in the necessary supportive network that allows Cara to survive as a neurodivergent woman in this system. None of this work is ever done alone; it is always the result of collective effort. Care takes many forms — sometimes as small as handing over an apartment, sometimes as simple as talking to your father every day.

One of my favorite examples that demonstrates the fundamental role of care work in knowledge production is Adam Smith. Smith’s mother, Margaret Douglas, performed the domestic and organizational care labor that enabled him to devote himself entirely to writing. From a feminist perspective, this division of labor is problematic, as it reflects historically gendered and patriarchal expectations around work and intellectual authority. Everyone knows Adam Smith’s name and associates him with his famous book, “An Inquiry into the Nature and Causes of the Wealth of Nations”. However, almost no one knows the name of Margaret Douglas, although her labor was equally necessary for the production of this canonical text. Yet this example highlights that intellectual work depends on care work to become possible in the first place. The invisibility of her contribution illustrates how white, male imaginaries of rationality came to define knowledge as autonomous and detached, while the labor that sustains thinking was systematically obscured. As Ciani-Sophia Hoeder puts it in “Vom Tellerwäscher zum Tellerwäscher” (*From Dishwasher to Dishwasher*): Some people work, others think. Knowledge is produced not in spite of care, but through it. This is why I want to encourage you to reach out right now to people in your own network who may be struggling within academia. The evidence is clear: the academic system in the West requires deconstruction and decolonization of its path-dependent structures and habits. Shout out to every FLINTA* and BIPOC person fighting against and within

these structures. Cara's work, and especially her research as part of her PhD, is a thread in the fabric resisting epistemic violence and suppression.

If you are unfamiliar with the term 'epistemic violence', this thesis provides an excellent introduction to the concept, offering concrete examples. Building on this foundation, Cara's theory of a "*Mathematics-Rationality-Human Continuum*", outlined in the opening chapters of this book, resonated deeply with my own experience as a student of physics and (classical) philosophy. It is about who speaks, who teaches, and who feels confident enough to stand up and present a solution to a homework problem in front of the entire class. It is about who participates in discussions, which books are read, and how we decide what counts as truth.

Cara's theory raises important questions about what we consider to be valuable science and research. How, over decades, a picture of a white-masculine-neurotypical version of Rationality has evolved. How being and thinking cannot be separated from one another. How power structures shape not only our ways of thinking, but also our very understanding of what it means to be human. Perhaps your first thought when seeing the book's cover was something like: *What could possibly be wrong with mathematics?* Mathematics is often understood as a purely rational, objective discipline built on axioms; it is reproducible across time and space and is considered universal. How could one even question mathematics without holding a PhD in the subject? These are valid questions. But they reveal how deeply we have internalized a particular understanding of the "*Mathematics-Rationality-Human Continuum*" and how strongly we associate mathematics with neutrality and objectivity.

This book looks behind that curtain and asks why mathematics is so rarely questioned in the first place.

As you read this book, I hope you are inspired not only by the ideas on the page but also by the commitment and courage they represent. Which brings me to where I most want to end: Congratulations, Cara, on completing your PhD, and on all your dedication, situated knowledge and inspiring writing. I hope this is just the first of many forewords I'll have the chance to write, and I am deeply grateful for the opportunity to fill this space with my own perspective and words.

Let this book remind us all that change in academia is possible, but only if we support each other, resist, and keep building the networks that make such work meaningful.

Introduction

Exploring the *Mathematics-Rationality-Human* Continuum

it was the system of knowledge itself;
it's not a matter of what you can do
inside it

*PROUD FLESH INTER/VIEWS: SYLVIA
WYNTER (2006), 31*

These pages originate from a simultaneity that I feel requires space to become a force for change. The simultaneity is this one: as I am writing these words and as you are reading this mathematical knowledge is being killed. And with this killing of mathematical knowledges ways of thinking and ways of living are killed too (Brunner 2023, Elías 2020, Spivak 1988).

Histories of Indigeneity and histories of womanhood teach us that killing has many layers and some of them are epistemic layers. The witch hunts in early modern times targeted the bodies of women connected to knowledges that did not move in accordance with capitalist-patriarchal interests such as knowledge about abortion (Brunner 2023, Chollet 2023, Federici 2014, 61 f.) The witch hunts committed as part of colonial takeovers and attacks targeted nonwhite bodies bearing knowledges that threatened Western supremacy and the project of colonialism (Elías 2020). So, I speak of the killing of knowledge because this phrasing brings up the killing of bodies and the two are inextricably interwoven in (at least) three ways: the killing of bodies is a killing of knowledge, the killing of knowledges brings the killing of bodies, and the killing of bodies comes with epistemic systems and movements that legitimate the killings of bodies (e.g. Federici 2014, 61 f.).

When mathematical knowledge is killed our stomachs ought to twist because we know that whenever knowledges are killed it is never the only killing. And as with patriarchal-colonial-capitalist witch hunts, the killing has a system to it that actualizes ongoing hegemonic power relations shaped

by intensely intertwined histories of colonialism, patriarchy, capitalism, and ableism. There are hegemonically powerful actors in place that fashion the universalization of a particular knowledge in an attempt to ban all other manners of thinking and knowing to a realm of ‘non-knowledge’: In the context of the witch hunts, the hunted women and their practices of knowing and knowledge-making were conceptually devalued and stigmatized through the same movements that fashion the figure of the witch as another mode of working against knowledges in that do not accord with capitalist-patriarchal systems (Chollet 2022, Federici 2024). In the context of mathematical knowledge, it is Indigenous mathematical knowledges and practices that continue to be excluded from school curricula world-wide only for Western mathematics to be instituted as the only mathematics – *the universal one* or *the neutral one* (Hottinger 2017, Shulman 1996, Bishop 1990). This universalized Western mathematics is what I will refer to as *Mathematics* – a distinctly Western, patriarchal, and hegemonic understanding and practice of mathematics that is instituted as if it were the only to exist.

This erasure of Indigenous mathematics qualifies as a form of epistemic violence as Spivak originally defined it as the silencing of knowledge formed from marginalized positions or the silencing of knowledge that does not actualize hegemonic relations of power (see Spivak 1988, 67, 77, 93). This kind of epistemic violence is realized precisely through the conceptualization and institutionalization of *Mathematics* as the only – *the universally true* – mathematical knowledge. This epistemic violence enables and legitimizes the ongoing epistemicide (the killing of knowledge¹) of Indigenous mathematics. To summarize what we know so far: there is epistemic violence realized through *Mathematics*. However, this thesis will argue that the epistemic violence actualized through *Mathematics* is even deeper and more extensive than instances of mathematical epistemicide. In fact, I believe those instances are the tip of the iceberg to what I understand as the core of epistemic violence: the *Mathematics-Rationality-Human Continuum*. Exploring the continua of violence and the continua of killing in their relation to the *Mathematics-Rationality-Human Continuum* will be at the core of this work, because it enables us to mathematical practices in their potentialities for violence and their potentialities for resistance.

1 Epistemicide describes the systematic erasure of knowledge often connected to genocide on people, see e.g. Brunner 2023 and Elías 2020. On the erasure of Indigenous mathematics see Hottinger 2017 and Bishop 1990.

Tracing Epistemic Violence

Mathematics – Rationality – Human

In light of this aim, this thesis the first tackles the objective to explore Mathematics as a form of epistemic violence. This objective brings up two questions: 1) What is understood as *Mathematics* in this work? 2) What is understood as *epistemic violence* in this work? In answering these two questions, I lay the foundation for my following claims: *Mathematics* is an *Image of Thought* in the way Gilles Deleuze establishes the notion (Deleuze 1968, 169 f.). Mathematics is both a notion of what thinking is and a way of thinking. In my understanding of Deleuze's notion, this *Image of Thought* actualizes an *Image of Being* in the sense that it realizes notions and ways of being. Resultingly, an Image of Thought is never a purely epistemic creature, but an ontological one too because an Image of Thought actualizes distinct modes of perception. These distinct mode of perception then structure being² – they shape and legitimize the possibilities, impossibilities, and widely known ways of being. My reading of Deleuze here is inspired by Sylvia Wynter and reads Deleuze's notion of the Image of Thought in light of her work on the interwovenness of exclusive genres of thinking and exclusive genres of being (Wynter 2006, -2003).

Epistemic violence is a term that different works and discourses relate to in a multitude of ways. I believe there is a spectrum of ways to relate to the notion of *epistemic violence* that is structured by two poles. There are ways to relate to the notion in a very specific, focus manner – such as when applying the notion for critiquing the philosophical canon (see e.g. Bratu 2024 or Schulz 2024) – and there are ways to relate to the notion of *epistemic violence* in a deliberately extensive manner with an emphasis on 'knowledge itself' (Spivak 1988, 67, 77, 93 and Wynter 2006 (interview), – 2003, – 1994). I understand epistemic violence with strong emphasis on Spivak's work and by relating the notion to the work of Sylvia Wynter. As such, in my understanding the hegemonic exclusiveness of the Human lies at the core of epistemic violence and is inextricably interwoven with exclusive epistemic modes and resources with limiting

2 I understand 'structuring being' as similar to the notion of preemption by Brian Massumi (see Massumi 2007). What is actualized is actualized even before it comes into existence and even without being actualized because that which partakes in preemption shapes what comes into existence and how it does so. This is similar to mathematical performativity on the finance market where the dynamics of the market become increasingly similar to mathematical models applied to describe the market.

modes of thinking and a white-masculine-neurotypical version of rationality (*Rationality*). So, to me the *Rationality-Human* continuum both is and actualizes epistemic violence. Understanding epistemic violence by reading Spivak and Wynter together speaks to the ontological dimensions of epistemic violence, i.e., that *thinking* and *being* are inextricably interwoven.

In bringing these two answers together and back to the objective of exploring *Mathematics* as a form of epistemic violence, the proposition of this thesis arises: there is a *Mathematics-Rationality-Human* Continuum that forms an exclusive *Image of Thinking* that actualizes epistemic violence. I modify the Deleuzian term *Image of Thought* to *Image of Thinking* to emphasize that I am speaking here of a practice, a process, and a doing³. The *Mathematics-Rationality-Human* Continuum consists of its three interwoven founding concepts each one being an *Image of Thinking* that bears and shapes an *Image of Being*. As a continuum they operate to actualize epistemic violence and a multitude of hegemonic *Images of Thinking* and *Images of Being*.

I employ the notion of *being* here in the sense of *being as a practice*, drawn from both Wynter and Deleuze in their shared insistence on the interwovenness of *thinking* and *being*. *Being* in this account is a continuous process that does not amount to any result or a path leading to a point X. *Being* is a process and a practice, but it does not imply leading any place as it is not a path – it is a manner of existence. I choose to stay with this notion of *being*, because I believe in a notion of *being* that describes a practice and that exceeds ontological terminology. The belief I have in *being* as a notion partly stems from the two-layered meaning of the word: *being*. *Being* can mean a) the substantiation of 'to be' or can b) stand in as a synonym for 'creature.' I understand this double meaning of the word 'being' as conceptually relevant and philosophically helpful, because it contributes to imagining and seeing various manners of existence in relation to the creatures (the beings) those manners of existing (manners of being) foster. In writing *thinking-being* in this work I imagine this double meaning too: I am a thinking-being and I am practicing thinking-being and the two are infinitely closely intertwined. It is this continuous becoming that is organized by the *Mathematics-Rationality-Human* continuum in an exclusive, an epistemically violent manner.

3 Understanding the *Image of Thought* as a doing and thinking practice is what Deleuze does as well. My slight modification thus moves in accordance with his work while rhetorically emphasizing that I read Deleuze through the work of Wynter and thus relate his concept of the *Image of Thought* to her understanding of *thinking* and *being*.

At the core of this thesis lies the question of *Mathematics* and my belief that what Wynter terms the *Man*-centric world is always the *Mathematics*-centric world too. The world that centers ‘the Rational Human’ (*the Man* in Wynters terminology) is the same world that centers *Mathematics*. This is because only through *Mathematics* as part of the continuum do *Rationality* and *the Human* enfold all the flavors of violence they actualize.

To put forth my understanding of *Mathematics* I employ *Image of Thinking* and *epistemic violence*. *Mathematics* is therefore a notion of thinking and a mode of thinking that forms modes of being. The contents of *Mathematics* as an Image of Thinking, as well as the consequences of *Mathematics*, are epistemic violence because they actualize hegemonic notions of *Rationality* and *the Human*. Crucially, I understand *Mathematics-Rationality-Human* as a continuum and thus write hyphenate them and when only one is mentioned the other two are always there too because *Mathematics-Rationality-Human* are layered into one another. Furthermore, I understand epistemic violence to bear an ontological dimension because I understand *thinking* and *being* to be inextricably interwoven – conceptually and practically.

I write ‘worlds’ here and throughout this work to re-call María Lugones (1987)⁴. Lugones’ work illuminates that there are different worlds in place now, many actualized, many more in-the-making, and in the realm of possibility, and impossibility. I understand ‘worlds’ to encompass this multiplicity. Furthermore, ‘worlds’ gives a sense of the depth and abundance of ramifications when it comes to epistemic violence. With the use of ‘worlds,’ I differentiate my understanding from accounts of epistemic violence that center on specific instances of epistemic violence i.e., on individualist accounts or on the notion of a system or a structure. Epistemic violence as I understand it makes worlds. These worlds then foster and center forms – potential norms of thinking and being. ‘Worlds’ emphasizes the importance of being (human) in relation to *thinking* when considering epistemic violence. As such, particular instances of epistemic violence, as well as systemic forms of violence or structural invisibilizations and erasures, are part of trans-historical movements of epistemically violent worlds.

4 The notion of ‘world’ and ‘world-making’ in this thesis is not drawn from Immanuel Kant but rather stands in the tradition of decolonial-feminist works, mainly the work of Lugones (1987) and the work of Julietta Singh (2021).

Exploring the Continuum

Mathematics – Rationality – Human

The primary aim of this thesis is to explore the epistemically violent *Mathematics-Rationality-Human* Continuum. This endeavor bears four temporalities, mirrored by the four chapters of this thesis.

The first chapter, *Bodies of Meaning: Mathematics, Rationality, Humanism*, moves in a historical temporality. Here I establish the *Mathematics-Rationality-Human* Continuum through exploration of its foundational moments in the history of philosophy. This chapter provides both evidence for and depth to the existence of this continuum by highlighting exemplary works in contemporary work on mathematics, in Ancient Greek philosophy, and in the philosophy of the Enlightenment.

The second chapter, *Epistemic Power as a Crisis of Subjectivity: Knowledge, Violence, Subjectification*, moves in a contemporary temporality. I explore the forms of violence actualized through the *Mathematics-Rationality-Human* Continuum with a special focus on im-/possibilities realized through the continuum. This is the exploration of *the now* and its violences. One crucial violence explored here is sexual violence as a violence rooted in the *Mathematics-Rationality-Human* Continuum.

The third chapter – *Meaningful Resistance: Epistemic Disobedience and Political Subjectivity* – moves at the temporality of a *future 1* – a future that is conceptually close to *the now* because it directly relates to *the now*, that is to say to the epistemic violence of the contemporary situation. Here the objective is to explore mathematical forms of disobeying *Mathematics*.

The fourth chapter – *wild mathematics: Towards epistemic wildness* – moves at a temporality of *future X*; that is a temporality from a different world and logic than the contemporary world. *Future X* is not necessarily far away in terms of hours/weeks/months/years, but it is of an entirely different fabric than the worlds that are actualized through the *Mathematics-Rationality-Human* Continuum. In this chapter, I move in relation to many traditions of epistemic resistance and to many endeavors of re-making worlds by relating them to mathematical practice. The objective is to propose a *wild mathematics*: an *Image of Thinking-Being*, that exceeds the *Mathematics-Rationality-Human* – centric worlds. This *wild mathematics* in an *Image of Thinking-Being* because *wild mathematics* commits to the interwovenness of thinking and being. The fourth chapter is the chapter of decolonial-feminist practice as a practice of thinking-being differently.

All four chapters follow their own respective methodology and together they map a landscape: the landscape that is moved and shaped by the interwovenness of mathematical knowledges, thinking-being, and varying forms of violence. These four different and particular methodologies arise from the four different temporalities these chapters are tending to: the historical, the contemporary, the future 1, and the future X. All of these temporalities are temporalities inhabiting and originating from the landscapes of the *Mathematics-Rationality-Human Continuum*.

The Thinking-Being of the *Mathematics - Rationality - Human Continuum*

The first chapter establishes the *Mathematics-Rationality-Human Continuum* with a distinct focus on *Mathematics* by conducting a historical study situated in the history of philosophy. My starting point is with contemporary works on *Mathematics* from the fields of psychology, philosophy, sociology, and physics. I establish the existence of the *Mathematics-Rationality-Human Continuum*, focusing on how *Mathematics* is actualized through the continuum and how *Mathematics* actualizes *Rationality* and *the Human*. I then establish this continuum as one that bears deep historical dimensions that has been with Western thought for thousands of years. Although its specific shape has shifted with through time, the continuum itself has a transhistorical existence. I exemplify this claim and further contextualize *Mathematics* by exploring selected works of Ancient Greek philosophy and of the philosophy of the Enlightenment. I choose these periods because they are both of distinct philosophical relevance in the sense that both periods of philosophy are especially present in philosophy curricula and thus intensely shape philosophical discourse. Throughout this endeavor I focus on how *Mathematics* and the *Mathematical Proof* are constructed and how these constructions and these makings are intrinsically related to philosophical logic.

The mathematical and non-mathematical practices exceeding *Mathematics* and the *Mathematics-Rationality-Human* continuum are always written diagonally across the continuum and always have been. However, the continuum works to turn those diverging practices into that which deviates from 'epistemic and moral goodness.' So, the universalization built into and built by the continuum is not a practice that erases what it conceptualizes as 'the Other' but it does seek this erasure. As such, it continuously practices and makes at-

tempts at erasure, but precisely because the erasure is never fulfilled both while epistemicide and survival of *the deviant happen, wild* knowledge happens too.

Thus, this chapter is located in a historical temporality, bears three dimensions, and fulfills three purposes: 1) to establish the transhistorical existence of the *Mathematics-Rationality-Human Continuum*, 2) to characterize *Mathematics* as an Image of Thinking, and 3) to introduce the relationship of *Mathematics* and Philosophy, which is mediated through the figure of *logic* and *proving*.

The Lives of the Continuum Subjectivity, Sense-Making, and Meaning

The second chapter explores the epistemic violence contemporarily actualized through *Mathematics*. To do so, it analyzes the layers of the *Mathematics-Rationality-Human Continuum* through lenses of Feminist Epistemology, Black Feminist Thought, and Decolonial Philosophy. As a result of these lenses, I focus on the forms of violence and limitation that *Mathematics* actualizes for subjectivity, sense-making, and meaning. The central concept of this chapter is the concept of epistemic violence, which I understand in relation to three notions. Firstly, epistemic violence as the exclusion from the human produces exclusive forms of subjectivity. Secondly, both forms of sense-making and meaning-making are epistemically violent and stabilize hegemonic relations of power. Thirdly, epistemic violence minoritizes thinking-being in non-accordance with the *Mathematics-Rationality-Human Continuum*.

Throughout this chapter sexual violence is explored as a case study in which violence serves as a continuum that implicates epistemic violence as well other forms of violence such as sexual violence. I propose to explore sexual violence as a dimension of the *Mathematics-Rationality-Human Continuum*.

At the heart of this chapter lie three objectives: 1) to establish *Mathematics* as a form of epistemic violence that results from the *Mathematics-Rationality-Human Continuum*; 2) to establish and showcase the inextricable interwovenness of epistemic violence with other forms of violence such as sexual violence; and 3) to expose the consequences of epistemic violence for processes of subjectification. All of these three objectives are brought back to *Mathematics* and situate *Mathematics* as a site/form of epistemic violence because of its role in the *Mathematics-Rationality-Human Continuum*.

Disobeying the Continuum

Subverting *Mathematics* – *Rationality* – *the Human*

The third chapter moves at a temporality of *Future 1*. The objective is to establish *Mathematical* forms of epistemic disobedience against the *Mathematics*-centric world. Crucially, in doing so the objective is not to abolish or exceed *Mathematics*, but to connect to the very real bodies of meaning, mattering⁵, and sensing⁶ it creates and to subvert, twist, and turn them. I do not understand this endeavor to be in any way opposed or even fundamentally different to movements that aim for a beyond-*Mathematics*. Rather, I believe there is a spectrum of possible and potential resistance against the *Mathematics-Rationality-Human* Continuum. One end of the spectrum of resistance is characterized by seeking strategic connectivity to the hegemonic body of meaning and the other end is defined by making it a point to not make the hegemonic bodies of mattering into a point of reference in endeavors of resistance.

Throughout this chapter I bring in forms and theories of epistemic disobedience and relate them to the case of *Mathematics*. Thus, the core objectives are: 1) to relate the case of *Mathematics* to established work on epistemic disobedience, and 2) to propose forms of mathematical disobedience.

Exceeding the Continuum

More Than-human *Mathematics*

The fourth chapter moves at a temporality of *Future X*. This temporality is constituted by the resistance that already moves in the different worlds as it actualizes in that very movement. The temporality of future X is the temporality of radical difference, the temporality of decoloniality – of thinking-being differently. Here, I draw from practices of epistemic resistance and relate them to

5 The notion of mattering is understood in close relation to the work of Karen Barad (Barad 2007) and Denise Ferreira da Silva (da Silva 2017): I understand mattering to be related to meaning and to questions of value. Crucially, I believe questions of mattering to be interwoven with questions of the meaning for the beings that *matter* i.e., those construed as *human*.

6 I understand sensing as any form of witnessing meaning and mattering. I understand sensing as the underlying interpretations and understandings that shape this world. Mattering is therefore the consequence of how meaning is structured as meaning decides what matters.

mathematical practice. Accordingly, I ‘think-with’ (Manning 2020) resistances already practiced in order to propose an Image of Thinking-Being – *wild mathematics*. These movements of thinking-with are a sensing, playing, and believing – a practice not in accordance with a figure of ‘writing about’ or ‘thinking about’ for the core is relationality, not hierarchy. This *wild mathematics* reappropriates the notion of wildness historically used for the stigmatization of marginalized people in moving with and as an epistemic wildness and a wildness of being. The notion of *wildness* here is employed in a similar vein to how Clarissa Pinkola Estés reads and writes the word (Estés 1995, 36) in which *wild* thinking-being is a practice of remembering and practicing what has always already existed with the bodies and beings made other to the *Man-Math*-centric worlds⁷.

The core objectives of this chapter are to: 1) commit to a practice of thinking-with the works that I relate to; 2) to establish *wild mathematics* as an Image of Thinking-Being; and 3) to propose *epistemic wildness* as a force that moves towards the worlds ever so different to the *Mathematics-Human*-centric world.

The Termite Tunnels of the Continuum

Locating This Work

When writing about one’s positionality in and one’s own relation to ‘the power/knowledge diagram’ Erin Manning brings up the image of termites: the termites chew away at the walls of the university to form their tunnels – they ‘eat the walls’ and ‘reshape them to their needs.’ In doing so, they bring ‘more-than human movements and durations’ (Manning 2020, 4). Furthermore, she writes: *In the end, we are the termites. We eat away at the structure, residing in the holes we create* (Manning 2020, 22). This work is conducted from within the termite tunnels and is itself a *chewing of the walls* – at the walls of the *Mathematics-Rationality-Human* Continuum.

I understand *epistemic violence* and the endeavors of this thesis as theoretical movements, which are interwoven with political and day-to-day struggles through violent worlds such as decolonial struggles, struggles against and amidst racism, feminist struggles, movements towards neurodiverse worlds, and against misogyny, and against sexual violence and misogynoir. With

7 Furthermore, my use of *wildness* is in alignment with how Jack Halberstam employs the notion as a pathway to thinking “race, sexuality, and the undercommons” (Halberstam 2024).

regards to some of these struggles, I carry situated knowledges with me as well as theoretical ones. With regards to others, I do not carry with me any situated knowledge and am especially indebted to those who taught me about the depth of coloniality, racism, and whiteness.

I understand the movements I have listed and many more as inextricably interwoven, because these forms of violence have been built to stabilize one another. I refer to the intricacies of this interwovenness by writing ‘decolonialfeminist’ non-separated.

I believe what is shared through various experiences of violence and struggles for resistance is the exclusion of the realm of *the Human* and of the realm of *the Rational*. However, this is not to say these experiences of exclusion are homogenous or happen to the same degree, which for both is not the case. What it does mean is that there is a ‘we’ moving through this work that bears immense multiplicity and difference – a ‘we’ that is not an academic one, and not one of one movement in particular. Rather it is a ‘we’ that realizes the moments where one has been banned from the logics of *the Rational* or *the Human* and from the metrics of the *Mathematics*-centric world. It is the ‘we’ of the very crazy ones. It is the ‘we’ of the disturbed ones – those disturbed by the worlds that are in place and disturbed by the *Mathematics-Rationality-Human*-centric world. *Craziness* here is not primarily a diverging from norms of thinking, but rather it is a practice of epistemic wildness – a practice of that which always writes itself diagonally across the continuum-based scripts. It is the ‘we’ of *woman* in the *Écriture féminine* or the ‘we’ of *Mad Studies* (e.g. Cixous/ Clément 1986, Fawn Montgomery 2018). It is the ‘we’ of radical difference to the continuum-centric world, and it is the ‘we’ of the ones who are kept awake because they can feel the need for different worlds haunting their very beings.

1. Bodies of Sense-Making

The *Mathematics-Rationality-Human* Continuum

In what ways do histories of mathematics help us to think about ourselves as human, as rational, as modern? Who is invited to see themselves within these histories and who is excluded from these histories?

Sara N. Hottinger, Inventing the Mathematician (2016), 12

1.1 *Mathematics* as an Image of Thinking

This is a thesis on the epistemic violence of *Mathematics*, which as I wrote in the beginning pages of this thesis, gives rise to the question –what is *Mathematics*? This first chapter is dedicated to this very question. I provide a historical study of *Mathematics* as an Image of Thinking. This exploration has or is structured by two goals: a) to characterize what defines *Mathematics* as an Image of Thinking and b) to historically contextualize these epistemic characteristics and *Mathematics* as an Image of Thinking.

Conceptualizing *Mathematics* as an *Image of Thinking* guides this historical study. Crucially, I do not explore *Mathematics* primarily as an academic discipline or as an accumulation of specific epistemic operations. Rather my objective is to account for everything that *Mathematics* is that exceeds its existence as an academic discipline. So, *Mathematics* here denotes an *Image of Thinking* that permeates all areas of contemporary social life as an epistemic notion and practice. In doing so, I explore how contemporary Western culture is permeated by a specific epistemic concept and practice of *Mathematics*, which in turn relates to the notion of *Rationality* as well as the notion of *the Human*. I understand *Mathematics*, *Rationality*, and *the Human* as both notions and practices of

thinking by building on the concept of an *Image of Thought* as put forth by Gilles Deleuze (Deleuze 1997, 169). My variation of his term emphasizes that I am exploring the notion of a practice as a practice itself. It emphasizes thinking as a doing, which I believe aligns with the nature of Deleuze's notion and his work more generally as Deleuze's notion of an *Image of Thought* is developed precisely to describe a notion of what it is to think *and* a practice of thinking and his notion accounts for the inextricable interwovenness of a practice and a notion of what it is to think (Deleuze 1997, 169 f.). Because I believe it is crucial to explore *Mathematics* as both a notion *and* a practice of thinking I draw from Deleuze to understand *Mathematics*. My variation of speaking of an *Image of Thinking* rather than an *Image of Thought* gives special attention and emphasis to thinking as a practice because the core focus of my work is to understand what kinds of epistemic practices and operations originate from epistemic notions and values.

My understanding of *Mathematics* as an Image of Thinking is interwoven with an understanding of *Western*¹ thought that diverges from employing 'Western' as a primarily geographical term. I draw from Andrea Nye (1990), Bonnie Shulman (1996), and Sara N. Hottinger (2016) in employing the term *Western* in a political sense in which *Western* refers to a historically embedded entitlement to and upkeep of power. Following Bonnie Shulman (1996), Denise Ferreira da Silva (2017), and Sara N. Hottinger (2016), I understand a highly distinct and yet deeply universalized understanding of *Mathematics* to be the product of Western thought and Western maintenance of power. Hence, the capitalized and italicized writing of the word 'mathematics' emphasizes that a) I am referring to a specific understanding of mathematical notions and practices, and b) that this understanding of what it is to 'think mathematically' is deeply universalized as it is alleged to be the *only way of engaging in mathematical practice*.

The practice of universalization is not an erasure of *wild mathematics* nor of epistemic wildness, but rather a constant practice of attacking the thinking-being in non-accordance with *Mathematics*-centric scripts in an attempt to erase them.

1 I choose to capitalize 'Western' because it aligns with my capitalization of the universalized Western mathematical practice as '*Mathematics*'. In both cases, the capitalization symbolizes the universalization built into these very notions, which serves to then remind us – just upon reading the word – how these are in fact distinct modes and concepts that are made to appear universal.

I explore how *Mathematics* is thereby formed through a particular and distinctly Western and patriarchal manner of understanding *mathematical truth* and *mathematical proving*. I explore how both the notion of *truth* and the notion of *proving* draw from an axiomatic method, which identifies itself through the aim to establish *truth beyond doubt* by deducing further knowledge from propositions understood as epistemically certain (*axioms*) (cf. Shulman 1996, 429). This first chapter explores the axiomatic as an Image of Thinking itself to explore its relation to *Mathematics* and its historical and political context and texture.

My study of *Mathematics* as an Image of Thinking begins in contemporary scholarship on *Mathematics* and moves from there into a historical study. I begin with contemporary works, because this thesis originates from the question of *Mathematics* as an implicit reference point in contemporary Western politics.

I employ the notion of politics in a deliberately wide-ranging manner that draws from Isabelle Stengers usage of the notion in which political is that which is concerned with authority (Stengers 2007). I favour this term over 'societies' or 'culture' as it does not evoke any imagery of closed-off systems but rather focuses on a dynamic or a movement of the makings and unmakings of authority.

For my historical study I choose two periods in the history of philosophy that are – implicitly as well as explicitly – referenced in contemporary understandings of *Mathematics*: Ancient Greek philosophy and the philosophy of Enlightenment.

Ancient Greek philosophy is widely recognized as the place of origin of the axiomatic method (cf. Shulman 1996, Nye 1990), which makes it a crucial period to study as part of a core part of this chapter's endeavor to trace the relationship of *the axiomatic method* and *Mathematics*.

The philosophy of the Enlightenment is often referred to as crucial reference point for *Modern Science* and the expansion of *Rationality* (e.g. Pinker 2018). Furthermore, as I will show through my study of contemporary scholarship, the period of Enlightenment often forms a reference point for contemporary self-understandings of Western cultures (see *ibid.*). Therefore, the period of Enlightenment is the second historical study I choose to conduct to analyze the relationship of *Mathematics* and *Rationality*.

My contemporary study explores scholarship from different disciplines to establish that *Mathematics* has an existence that exceeds disciplinary boundaries because it moves through them all in its own way. My two historical stud-

ies then focus on crucial philosophical work of the periods of Ancient Greece and the Enlightenment. I focus on philosophical works because in both periods philosophy played a distinct role in shaping and showing the *Zeitgeist* of its period, which makes crucial philosophical works of each period relevant and suitable representatives and thus exemplary case studies of the respective *Zeitgeist* and the *Zeitgeist's* relation to *Mathematics*. Furthermore, I focus on philosophical works, because researching the makings of *Mathematics* through philosophical work helps to explore the relationship of *Mathematics* and *Philosophy* – a task I consider to be part of understanding *Mathematics* as an Image of Thinking.

In my study of contemporary works on *Mathematics*, I consider the books of psychologist Steven Pinker, physicist Michael Brooks, and mathematician Jordan S. Ellenberg. Their best-selling books mirror various disciplines and therefore reflect the wide-ranging appeal and acceptance of the understanding of *Mathematics* they contain. In examining these works I focus on the epistemic characteristics and practices they associate with *Mathematics* and on how these characteristics and *Mathematics* extend beyond *Mathematics* as an academic discipline. In particular, I focus on the relationship of *Mathematics* with bodies of Western self-understanding and politics as it can be traced in these books.

In my study of Ancient Greek philosophy, I draw from the philosophies of Parmenides, Plato and Aristotle. Using exemplary text passages, I establish the core characteristics of the concepts of *truth* in the respective philosophies and analyze the relationship these notions of *truth* have towards *Mathematics*. As this chapter leaves no room for discussion and interpretation of these philosophies, I only draw from those aspects that can be proven both in primary literature itself and in various supporting works of secondary literature.

In my study of the philosophy of Enlightenment, I turn to René Descartes and Immanuel Kant. As both are prominent figures in Enlightenment philosophy itself as well as in its contemporary reception today (cf. Pinker 2018, 4), I choose to examine them in this historical retracing that moves from a point of contemporary political concern to retrace the intellectual histories that got us here – that got us this *Mathematics* and this *Rationality*. Here, too, I work closely with primary literature of the two philosophers as well as secondary literature whose analysis supports the primary sources and is well-received. Resultingly, I focus on the question of how *Mathematics* is related to *Rationality*.

The Deleuzian notion of an *Image of Thinking* guides these studies: An Image of Thinking describes a relational field of epistemic values, operations, and

practices. And this is precisely what I research here. As I research *Mathematics* as an Image of Thinking, I aim to establish what characterizes its existence as an Image of Thinking and to explore the relationship of *Mathematics* to other Images of Thinking such as *Rationality* or to epistemic ideals such as *truth*.

1.2 The Politics of *Mathematics*

Violence and Nonviolence in Contemporary Times

This first section of my historical reconstruction of *Mathematics* as an Image of Thinking focuses on contemporary works and attitudes towards *Mathematics*. In doing so, it traces the *Mathematics-Rationality-Human* Continuum to account for a) the context and construction of the continuum and to b) investigate the images of thinking established by the continuum. Here I focus on showing how *Mathematics* exists as an image of thinking that is anchored in the consciousness of Western society as a whole in which *Mathematics* forms the notion of *common sense*, what is understood as *Mathematical thinking*, and also what is construed as *thinking* more generally. In my analysis grounded in contemporary times I choose to examine three non-philosophical works. This allows me to first establish *Mathematics* as an Image of Thinking exceeding *Mathematics* as an academic discipline by showing the deep-rooted reality of the *Mathematics-Rationality-Human* Continuum, which forms worlds in which *Mathematics* moves as a largely unspoken conceptual point of reference for *the Rational* and *the Human*. All three chosen works share a broad popularity in scientific as well as extra-scientific spaces and are exemplary cases of the *Mathematics-Rationality-Human* Continuum at work for they showcase the continuous making of a conceptual relationship between *the Mathematical* and *the Human* that is mediated through the notion of *the Rational*.

I begin my analysis with the book *Enlightenment Now – The Case for Reason, Science, Humanism and Progress* by Steven Pinker (2018). I draw on this work to show the conceptual interwovenness of the notions of *reason*, *humanity* and *progress*. All three of these notions are strikingly prominent in Pinker's work and in his understanding of *the Enlightenment* as a distinct form of intellectuality. I will show how this concept constructs a *reason-human* continuum and attributes the label of *progress* to this continuum and resultingly is an endeavor of world-making, which always implicitly references and centers *Mathematics* as a mode and notion of thinking – and eventually, a notion of being too.

I will then turn to two works that are more explicitly about *Mathematics*. I draw from *How Not to Be Wrong – The Power of Mathematical Thinking* by Jordan Ellenberg (2014) to further examine the interwovenness of *Mathematics* with the notions of *reason* and *thinking*. I draw from *The Art of More – How Mathematics Created Civilization* by Michael Brooks (2021) to further analyze the conceptual interwovenness of *Mathematics* and Western modes of self-understanding, which are represented through the notions of *civilization* and *progress*.

So, let me begin this examination with Pinker to establish the intellectual landscape that fashions the *Mathematics-Rationality-Human* Continuum. *Enlightenment Now* refers, as the title suggests, to epistemic and political ideals, which Pinker understands as ‘Enlightenment ideals.’ His understanding of the Enlightenment is primarily based on Immanuel Kant’s statement on ‘the liberation from self-inflicted immaturity’ (cf. Pinker 2018, 7). He understands Enlightenment ideals to help in ‘understanding the human condition’ and advocates for employing the ‘ideals of the Enlightenment’ to contemporary times and politics (Pinker 2018, 5, 6). The notion of a distinct ‘human condition’ plays a central role for Pinker in the very scope and conceptual make up of his endeavor; therefore, establishing early on that the notion of *the human* is central to Pinker and his understanding of the other core concepts of his work such as *Rationality*, *progress*, and *reason* (Pinker 2018, 5, 6).

Pinker associates the era and philosophy of the Enlightenment with a distinct hope for political as well as day-to-day contexts writing that ‘some good’ will come from recalling ‘the ideals of the Enlightenment’.: This is one of many instances, where Pinker constructs an epistemic goodness he believes to be an ahistorical creature, which is ‘good’ precisely because of its alleged ahistoricity and impartiality (Pinker 2018, 349–350). He goes on to establish the three notions he understands as ‘Enlightenment ideals’: *reason*, *science*, and *humanism* (Pinker 2018, 349–350). Accordingly, the notion of ‘goodness’ that Pinker puts forth is characterized through the notions of *reason*, *science*, and *humanism*. This is crucial because it shows how Pinker moves at an intersection of epistemic and normative questions and ideals.: The ‘good’ he envisions is realized through epistemic values, beliefs, and practices (Pinker 2018, 349–350). For Pinker the normative and the epistemic form a continuum too in the sense that according to Pinker there are good epistemic practices and bad epistemic practices in which ‘good’ and ‘bad’ are moral as well as epistemic categories for Pinker and in which they are distinctly constructed as ahistorical (Pinker 2018, 349–350). This continuum of the normative and the epistemic will become more apparent as we read Pinker in his own words.

For now, let me say that I understand this conflation of the normative and the epistemic woven through with a concept of ahistoricity as a decisive aspect of the conceptual landscape of the *Mathematics-Rationality-Human* Continuum. The continuum is normative in that it fashions norms, normativity, and normalcy for images and modes of thinking and being.

Pinker characterizes *reason* as follows:

Opposing reason is, by definition, unreasonable. But that hasn't stopped a slew of irrationalists from favoring the heart over the head, the limbic system over the cortex, blinking over thinking, McCoy over Spock.

Enlightenment Now (2018), 351

In this excerpt, it becomes clear how universally and binarily Pinker thinks of the concept of *reason*. To Pinker, *Rationality* and *Irrationality* exist, with the former being the hero and the latter the antagonist. He bases the *universality* of this *goodness* of *Rationality* in defining the *other* to *rationality* as the *irrational*. This reference thereby expresses a claim to epistemic authority for notion that *thinking* is considered *rational*. The reference to the definition of *Rationality* is thereby the consolidation of what Deleuze calls *common sense*: the existing understanding of what is *credible thinking* and *knowledge* in which what is not is set as its indisputable basis (Deleuze 1992, 171 f.). The moral dimension of this binary distinction is treated as a necessary one, which is not understood as worth discussing as the sense that *Rationality is the higher value* over *Irrationality* seems to be a universal and necessary one for Pinker. However, this view is more than a judgment, which is made and culturally shaped; he ascribes to it an ahistorical character.

Following this, he names a series of judgments that he understands as exemplary of decision-making or of *Irrationality* over *Rationality*, in which he portrays the idea of *body* and *mind* as opposite, likewise hierarchized modes into the same binary that defines his *Rationality* and *Irrationality* in which the sphere of the *corporeal* is conceptually linked to the idea of *Irrationality* and the idea of the *mind* to the idea of *Rationality*.

The relationship in which Pinker places the idea of *Rationality* to the sphere of the political is also a fundamental aspect of his concept of *reason* and is exemplified in the following excerpt in which Pinker refers to a study where participants were categorized according to their political orientation and asked to assess the *truthfulness* of individual *news reports*:

If the left and the right are equally stupid in quizzes and experiments, we might expect them to be equally off the mark in making sense of the world. [...] I've been arguing that the main drivers [of human progress] were the nonpolitical ideals of reason, science, and humanism, which led people to seek and apply knowledge that enhanced human flourishing.

Enlightenment Now (2018), 362–363

Pinker uses this study to conjure up the image of *reason* that is clouded and misled by *politics*². He positions political attitudes and beliefs to appear as sources of the transfiguration of this *reason* and thus positions *reason* as *outside the political* – as a way of thinking without an inherent political dimension. The first headline which he quotes as a summary of the study refers explicitly to *Mathematics* and reads the results of the study as proof that *politics* is demolishing "our" ability to *think mathematically*. This title is based on an understanding of *Mathematics* that renders *mathematical thinking* as maximally *apolitical thinking* and thus evokes particular potential for indignation in relation to its linking with *politics* in the title. The second title cited works in a similar way, describing thinking that is guided by political conviction as *stupid*. Certainly, Pinker cites both titles as the exaggerations they clearly are; however, they also tellingly applies the same morally dimensioned binary of *reason* and *politics*.

This moral binary becomes particularly clear in the second paragraph of the quote in which Pinker chooses thinking against the background of political convictions as the antagonist by specifically marking it as *stupid*, thus explicitly banishing it from the concept of *reason*. The heroes are *non-political ideals* of *reason*, *science*, and *humanism*. In declaring these ideals as *non-political*, Pinker ignores the political dimension and history inherent in all these concepts. He thus declares the political implications of *reason*, *science*, and *humanism* to be *apolitical* and given thereby granting them unprecedented epistemic authority. This authority has a direct moral dimension: being on *the good side* means granting this epistemic authority. The idea of reason as apolitical or politically neutral is one that Pinker repeatedly puts forward:

[...] It's in the very nature of argument that people stake a claim to being right. As soon as they do, they have committed themselves to reason [...].

Enlightenment Now (2018), 351–352

2 Pinker uses the term "politics" to refer to political convictions as well as a general view of the political dimension of narratives, events, etc.

Here Pinker universalizes and naturalizes striving for epistemic authority – through the act of wanting to *be right* – as an inherent part of all human argumentation and debate.

As demonstrated by the following excerpts, the moral dimension of his concept of knowledge and reason is essentially fed by the connection between these ideas and his concept of humanism. Progress consists of deploying knowledge to allow all of humankind to flourish in the same way that each of us seeks to flourish.

The goal of maximizing human flourishing [...] may be called humanism. [...] Knowledge of the world is derived by observation, experimentation, and rational analysis. Humanists find that science is the best method for determining this knowledge [...].

Enlightenment Now (2018), 410–411

Pinker describes *humanism* here as a specific way of producing and applying *knowledge*, which assumes universal aspirations of “human flourishing”. Resultingly, he deepens the political and moral dimension of his concepts of *knowledge* and *reason* by construing them as the means of fulfilling *universal human needs*.

The construction of *epistemic goodness* that goes hand in hand with this conceptual interweaving becomes clear in the following quote:

The same is true of the common argument that the claims of science are untrustworthy because the scientists of some earlier period were motivated by the prejudices and chauvinisms of the day. When they were, they were doing bad science, and it's only the better science of later periods that allows us, today, to identify their errors.

Enlightenment Now (2018), 391

Pinker assumes that *bad science* as an epistemic and moral category exists ahistorically and universally. In doing so he overlooks the fact that *epistemic and scientific goodness* are concepts that are themselves subject to processes of change and interpretation and are inherently political in that they negotiate questions of the authority of *knowledge* and expression.

Finally, I draw on an excerpt from Pinker's work that shows how his understanding of *knowledge* as *politically neutral* affects his understanding of violence:

Isn't internet trolling a form of violence? Isn't strip-mining a form of violence? Isn't inequality a form of violence? Isn't pollution a form of violence? Isn't poverty a form of violence? [...]

As wonderful as metaphor is a rhetorical device, it is a poor way to assess the state of humanity. [...] It [moral reasoning] also requires distinguishing rhetoric from reality. [...] Finally, improving the world requires an understanding of cause and effect. Though primitive moral institutions tend to lump bad things together and find a villain to blame them on, there is no coherent phenomenon of "bad things" [...].

Enlightenment Now (2018), 47 [*Italics not my own*]

Here Pinker establishes that he understands different concepts of violence as semantic gimmicks or metaphors thus dismissing a) the existence of various forms of violence and b) the interwovenness of different forms of violence with one another. Furthermore, he strongly advocates for a separation between different situations of precarity.

I advocate for understanding violence as a continuum, through which various forms of violence make one another happen. In other words: one form of violence is never to be separated from another in my mind. Understanding violence as a continuum means troubling accounts of violence that cling to the logic of *separateness*³ like Pinker's does.

Pinker constructs the idea of different forms of violence as inherently *irrational* thus rendering it 'undiscussable' in the context of his thinking: As a result, the only understanding of violence that can be 'credible' to Pinker one that aligns with Pinker's understanding of 'ahistorical-apolitical knowledge', which according to his metric is an understanding of violence construed through the logic of separateness. It This understanding of violence through a logic of separation is a consequence of how Pinker understands knowledge, for, if he were to admit different concepts of violence, he would have to consider epistemic violence as well as violence that historically situates 'goodness' and 'badness', but his very worldview depends on a normative-epistemic understanding of violence that claims to be an ahistorical creature. Thus, we can summarize Pinker's

3 In alignment with the work of da Silva (da Silva 2016) and Erin Manning (Manning 2020) I understand *separateness* and *separability* to be concepts interwoven with whiteness and – in my understanding – with masculinity too. *Separability* is how both whiteness and masculinity come into existence because the notion is part of their fabric as concepts and practices.

image of (*Mathematical*) thinking through the following claims characteristic of his work.

- 1) Pinker constructs 'credible knowledge' in relation to *Mathematics* as an image of thinking by establishing the knowledge-creation based in *Mathematics* as form of logic – e.g. *data* and the *sciences* – are forms of knowledge-creation that are *rational* and *credible*. This construction is exactly what I draw attention to when employing the notion of the *Mathematics-Rationality-Human* Continuum in which *The Rational* as an Image of Thinking only exists in relation to *the Mathematical* as an Image of Thinking and *the Rational* as an Image of Thinking is interwoven with *the Human* as an image of thinking-being. This too shows how thinking and being build a continuum making *the Mathematical*, *the Rational*, and *the Human* into scripts for thinking-being.
- 2) Pinker constructs *reason*, *knowledge*, *progress* and *humanism* as universal and ahistorical notions. Not only does this understanding distinguish these four notions, but it also serves to ground the normative superiority Pinker attributes them. They are the ideals he advocates for precisely because he inhabits an intellectual world-making that believes these four notions to be 'good' in an ahistorical sense of the word 'good.' This world-making is the world-making of the *Mathematics-Rationality-Human* continuum in which *Mathematics* builds a continuum with *reason*, *knowledge*, *progress*, and *humanism* by representing a form of proof of the universalism and ahistoric epistemic certainty that *reason*, *knowledge*, *progress*, and *humanism* strive for – according to Pinker.
- 3) The notion of *reason* is inherently 'good' and desirable in Pinker's thought. *Reason* is constructed as a) an ideal for *thinking* and b) as the thing one partakes in through every endeavor of thought. This second aspect is especially crucial because it establishes that thinking and being in fact build a continuum as in Pinker's world-making 'human thinking' is defined through *reason*. So, *reason* becomes a signifier for *the human* because it signifies the thinking that makes a creature *human*.
- 4) Pinker presupposes an ahistorical 'epistemic goodness' and 'epistemic badness,' while is simultaneously always a moral goodness and badness too. *Mathematics* is woven into this construction of epistemic goodness and into the construction of its ahistoricity. As a result, it is knowledge that references *Mathematics* as an Image of Thinking – like numbers or calculations –

that Pinker construes as ‘epistemically good.’ Mathematics thus authorizes Pinker’s notion of ‘epistemic goodness.’

I now examine the work of mathematician Jordan Ellenberg to move my examination of the *Mathematics-Rationality-Human* continuum more explicitly to a) an analysis of *Mathematics* as an Image of Thinking and b) to engage a conception of *Mathematics* as it is referenced in more general notions of *thinking*.

In his book, Ellenberg sets himself the goal of providing an introduction to *Mathematical thinking* which also simultaneously advocates for *Mathematical thinking* as a particularly reliable way of thinking, i.e., a way of thinking through which one ‘is *not wrong*.’ In doing so, he explicitly interweaves *Mathematics* with more general understandings of *thinking* and *knowledge*. This serves to which showcase and reproduce the *Mathematics-Thinking* continuum built into the *Mathematics-Rationality-Human* continuum. He begins his book as follows:

Math is woven into the way we reason. And math makes you better at things. Knowing mathematics is like wearing a pair of X-ray specs that reveal hidden structures underneath the messy and chaotic surface of the world. Math is a science of not being wrong about things [...]. With the tools of mathematics in hand, you can understand the world in a deeper, sounder, and more meaningful way.

How Not To Be Wrong (2015), 2

In this excerpt, Ellenberg describes *Mathematics* as a way of thinking that does not only take place in those spheres that are commonly understood as the realm of *Mathematics*; rather, as a way of thinking that is fundamentally inscribed in thinking and reasoning. For him, *Mathematics* is in this sense a more developed form of fundamental *Human Rationality*, which according to Ellenberg, makes one fundamentally *better at thinking* because it is a thinking technique of ‘*not being wrong*.’ This formulation assigns epistemic authority to *Mathematics* and the thinking that relies on it. Furthermore, it highlights epistemic dominance as an underlying goal for Ellenberg, as this concern of thinking is not made explicit or justified as such, but rather implied as a matter of course – as if all thinking were such that has epistemic dominance (‘not being wrong’) as its goal.

Ellenberg goes on to explain his understanding of the relevance of *Mathematics* along the lines of the concept of *common sense*:

Mathematics is common sense. On some basic level, this is clear. How can you explain to someone why adding seven things to five things yields the same result as adding five things to seven? You can't: that fact is baked into our way of thinking about combining things together.

How Not To Be Wrong (2015), 10–11

Ellenberg describes *Mathematics* here as *common sense* in that he understands *Mathematical Thinking* as that thinking which is precisely that of *common sense*. He thus conceptualizes the concept of *Mathematics* along the lines of what is generally considered *good, sensible thinking* and vice versa. In doing so, he universalizes and idealizes *Mathematics* and constructs *Mathematics* and *common sense* in mutual dependence thus organizing his concept through constructing a relationship of mutual authorization, which interweaves the two images of thought.

In this excerpt, he also raises the figure of inexplicability. According to Ellenberg, *Mathematical Thinking* is inexplicable because it shows the *most fundamental truths*. Like Pinker, he applies the same idea to *thinking* and *logic*.

On the following pages, Ellenberg describes the relationship between *Mathematics* and *Common Sense* in more detail:

Mathematics is the study of things that come out a certain way because there is no other way they could possibly be. [...]

Math is like an atomic-powered prothesis that you attach to your common sense, vastly multiplying its reach and strength. [...] I find it helpful to keep in mind an image of Iron man punching a hole through a brick wall. [...]

Without the rigorous structure that math provides, common sense can lead you astray.

How Not To Be Wrong (2015), 12–13

He begins his description, by reintroducing the figure of *mathematical knowledge* as the *necessary knowledge* – the *knowledge* that cannot be otherwise. He thus by definition places *mathematical knowledge* in a position of special epistemic authority.

Following this, he describes *Mathematics* as an extension and elevation of *common-sense thinking* – *normal, logical thinking* – and describes *Mathematics* as an epistemic hero, similar to Pinker's description of *reason*. This element of heroization is reinforced by the reference to *Iron Man* which also underpins the moral dimension observable in Pinker. As in most superhero films, there is no

serious debate about which *side* is *right*. Ellenberg also assumes a universal *epistemic goodness* and uses both *Mathematics* and the idea of *common sense* as examples of this epistemic goodness whereby neither this moral binary itself – nor the assignment of *Mathematics* and *common sense* is explicitly up for discussion.

Ellenberg expands on the idea of *common sense* with reference to Marquise de Condorcet when he writes explicitly about the relationship between *truth* and *majority*:

If the majority of people believe something, Condorcet said, that must be taken as strong evidence that it is correct. We were mathematically justified in trusting a sufficiently large majority [...]. 'I must act not by what I think reasonable' Condorcet wrote, 'but by what all who, like me, have abstracted from their own opinion must regard as conforming to reason and truth.'

How Not to Be Wrong (2015), 388

Ellenberg argues that majority is thus an indication of *truth* and refers to *Mathematics* as an authorization of this argument by describing this thesis as *mathematically justified*. However, he does not explain what this *mathematical justification* actually consists of and why it should be credible. Instead, he ends this section by quoting Condorcet's call for trust in majority opinions. The idea that the majority can secure *truth* implies a fixed concept of truth that is not a matter of negotiation and overlooks the fact that positions capable of winning a majority are often shaped by historically and culturally specific *common-sense knowledge*. This section thus also shows that Ellenberg understands common sense knowledge not as situated, but as *neutral, ahistorical knowledge*.

The fact that for Ellenberg *Mathematics* is not an accumulation of certain facts, but actually a way of thinking that symbolically stands for the ideal of absolute epistemic certainty and its fulfillment becomes clear in the following excerpt:

They [mathematical ideas] are the go-to tools on the utility belt, and used properly they will help you not to be wrong.

How Not To Be Wrong (2015), 16

Here Ellenberg explicitly describes how *Mathematical Thinking* goes beyond what is conventionally understood as *mathematical*. He understands *mathematical thinking* as that thinking which establishes complete *epistemic certainty* in which he describes *Mathematics* almost as a place of certainty – is possibly

not only *epistemic certainty*, but also a fundamental sense of definiteness and constancy. He therefore understands *mathematical thinking* as tools of thought that are designed *not to be wrong* – that is, to have epistemic authority.

The last sentence of the section paints an image of *Mathematics* as a sphere that is, as it were, far removed from the world – or at least a world of *disorder* and *indeterminacy*. Here, too, an understanding of (*Mathematical*) *Truth* that is universal and ahistorical is it is clearly implied. and defines *Mathematics* as the epistemic sphere that is politically and culturally untouchable and untouchable.

Similar to Pinker, Ellenberg's evaluation along a binary of *certain* and *uncertain knowledge* is a fundamental element of his work, which is expressed particularly explicitly in the following quote:

People usually think of mathematics as the realm of certainty and absolute truth. In some ways that's right. We traffic in necessary facts: $2 + 3 = 5$ and all that.

But mathematics is also a means by which we can reason about the uncertain, taming if not altogether domesticating it.

How Not To Be Wrong (2015), 425

Here Ellenberg construes *Mathematical knowledge* as 'certain knowledge' and *Mathematics* as the way of thinking that 'domesticates' spheres of uncertainty – thus making uncertainty into a creature to be tamed and *Mathematics* into a technique of taming. There is a hierarchized binary of 'certain versus uncertain knowledge' implied here: 'uncertain knowledge' is the knowledge to be tamed by 'certain knowledge.' This implies a similar sense of normativity as I have found in Pinker in which there is a 'good knowledge' and a 'bad knowledge', and it is the notion of certainty that separates the two.

Ellenberg's *image of Mathematical thinking* can be summarized through the following core claims:

- 1) Ellenberg understands *Mathematics* as a way of thinking that leads to particularly strong 'epistemic certainty.' Thus, he conceptualizes *Mathematics* through a notion of epistemic certainty much like Pinker did. Ellenberg understands thinking as a striving for epistemic certainty and *Mathematics* as a mode of thinking, which is particularly strong at creating this 'epistemic certainty.' With this claim, By construing *Mathematics* as the way of thinking that fulfills what all other thinking strives to achieve, he conceptu-

- alizes *Mathematics* as a reference point for thinking more generally. Indeed, this is the *Mathematics-Thinking* continuum at play through which thinking itself comes into existence with only an implied reference to *Mathematics*.
- 2) He understands *Mathematics* and 'common sense' in relation to each other. *Mathematics* is the extension of 'common-sense thinking.' This further establishes and strengthens the *Mathematics-Thinking* continuum moving through Ellenberg's work as it moves through Pinker's work: *thinking* is *thinking* in relation to *Mathematical thinking*.
 - 3) Ellenberg identifies the notions of *majority* and *normality* with *truth* by establishing the *majority* and *normality* as indicators of *truth*. His notion of *normality* here is resultingly conflated with *majority* and both are conceptualized as reliable indicators for *truth*. This construction renders any understanding of violence or exclusion built into notions of *normality* non-credible.
 - 4) *Mathematics* symbolizes 'secure knowledge' and even more so 'epistemic goodness,' which is understood as a universal value. This further authorizes the *Mathematics-Thinking* continuum in its normative dimension.

My final case study for the study of *Mathematics* as a contemporary image of thinking-being is the book *The Art of More* written by physicist Michael Brooks (2021). Similar to Ellenberg, his aim is to make *Mathematics* accessible and to arouse fascination for it. His concrete strategy consists of a kind of retelling of (Western) world history with *Mathematics* as the hero.

Brooks begins his book with a localization of *Mathematics* in "our culture," whereby he focuses exclusively on Western culture, without explicitly naming it:

[...] you learned to count because of cultural pressures. Those pressures came from an interesting place: a deeply ingrained cultural wisdom that tells us that mathematics matters.

The Art of More (2021), 2

Brooks paints an image of a *deep-seated cultural wisdom* about the meaningfulness of *Mathematics*, whereby he understands meaningfulness as an intrinsic element of *Mathematics*, rather than as a subject of culturally specific negotiation and the scene of discourses on the politics of meaning. He goes on to write:

[...] mathematics is supernatural, in that we have used it to go beyond the natural.

The Art of More (2021), 2

This section shows the element of mystification in the image Brooks draws of *Mathematics* and also shows similarities to Ellenberg's superhero metaphor. Positioning *Mathematics* as *supernatural* in terms of its epistemic practice and potentiality is therefore an authorizing mechanism of authorization, which functions – quite literally – by conceptually placing *Mathematics* above *normal, natural thinking*.

Brooks combines the systematic idealization of *Mathematics* with the idea of *being human*:

I learned none of this at school. [...] I never learned what mathematics had done for us as a species or how we came to invent it.

The Art of More (2021), 4

Here Brooks already hints at what he wants to show in the course of the book. Firstly, that he starts from *Mathematics* as a special achievement of *human thought* and that secondly he ascribes it a special relevance in the history of 'man' as a whole species. The connection between *Mathematics* and *human history* authorizes *Mathematics* and positions it as a respectable, even honorable entity and establishes a strong conceptual proximity between *Mathematics* and 'man'. The concept of the *human species* is already an exclusive one, insofar as Brooks writes about a specifically Western *Mathematics* without naming it.

The chapters of the book are based on this very image of *Mathematics* as the *hero of history*. Brooks tells individual stories, which he understands as "challenges for humanity" (here, too, he moves almost exclusively in the context of Western culture) while describing a sub-area of *Mathematics* as salvation. He does so in order to then explain this sub-area of mathematical discipline in its basic features. This pattern can be exemplified by his summary of HIV and AIDS:

Today, just over a decade later, HIV infection is no longer a death sentence. In fact, people with HIV live relatively normal lives. What happened? Calculus.

The Art of More (2021), 128

At this point, I will ignore the fact that this way of narrating historical events is largely under-complex and in some cases, highly misleading. Instead, I will focus on how this narrative pattern conceptualizes *Mathematics*. *Mathematics* appears as a hero and is thus, on the one hand, assigned the part of a specifically masculine trope⁴ and thus constructed as an aspect of *masculinity* in the binary of *masculinity* and *femininity*. In addition, this narrative deepens the authorization of *Mathematics* as a special epistemic achievement, which in a sense plays "in a different league" than other epistemic practices.

There is also a link between the idea of a *modern world* and the idea of *Mathematics* that runs through Brooks' work and comes to a head with the following claim:

[...] this strange mathematical creature [imaginary numbers] is real enough to power almost everything in the modern world.
The Art of More (2021), 178

Brooks uses the Western-influenced concept of modernity frequently throughout his book – always without reflecting on the cultural and historical context of the term. For Brooks, the *modern world* appears as a consistently positive figure that is associated with the idea of progress and universalized as a value in itself. The idea of the 'modern world' and that of *Mathematics* mutually authorize each other.

In the following excerpt, the aspects of Brooks' image of *Mathematical thinking* that have been emphasized so far appear grouped together:

Developing math allowed us to dissect and dismantle nature's patterns and symmetries and, like gods, recast them in ways that serve our interest. [...] eventually we found ourselves establishing civilizations. [...] We call these calculus, and they enable us to realize a range of human aspirations [...]. [...] the human story itself is inextricably interwoven with mathematics. Columbus' journey to the Americas relied on understanding the properties of triangles [...]. Mathematics provides the sculptor's chisel that shaped the Renaissance and the ammunition that has engendered centuries of military

4 Sara Hottinger discusses this heroization of *mathematicians* as a *masculine* and *Western* construction: according to Hottinger, it creates "a specific subjectivity – highly rational, alienated from humanity, a hero who shapes Western culture." For more details on the power-critical consideration of the heroization of mathematicians, see Hottinger 2016, 89–125.

success.

The Art of More (2021), 3–4

Mathematics appears here explicitly in the role of the dominant designer. It is described as the basis for taming nature and reshaping it according to one's own ideas. Following on from this image, Brooks links *Mathematics* with the concept of *civilization*, which is also not illuminated in its colonial historicity and significance. He conceptualizes *Mathematics* and *civilization* already here in a direct connection and also creates a relationship of mutual authorization between the two concepts as well as the universalization of underlying values. *Civilization* appears as a value in itself and *Mathematics* is understood as valuable insofar as it founds *civilization*, which is *civilization* understood as valuable insofar as it founds *Mathematics*.

Similar to Pinker, Brooks also applies a universalized concept of *human aspirations*, which is based on inherently human interests and works with an exclusive and Western-centric concept of the *human being*. The same can be said of his concept of *human history*. He presupposes that there is one *human history*, while he actually narrates Western-centered history. This exclusive and colonially influenced concept of the *human being* is here directly interwoven with *Mathematics* in that he understands *Mathematics* as a structural element of the supposedly universal *history of mankind* and the fulfillment of supposed universal *human ambitions*. In doing so, he conceptualizes *humanness* specifically with reference to *Mathematics*, and in doing so, constructs both concepts as Western and masculine.

His linking of *Mathematics* and *civilization* is a central part of his summary at the end of the book:

Scholars rarely agree on what exactly defines a civilization [...].

[...] This should, in fact, be the first – perhaps the only – requirement. I'm talking about mathematics, of course. [...]

The Art of More (2021), 285–286

Brooks proposes here to declare *Mathematics as the* primary or even sole defining characteristic for the concept of *civilization*; thereby, strengthening the conceptual link between *Mathematics* and *civilization*, which in turn is linked to the idea of *being human*.

Mathematics has shaped the very experience of what it means to be human and left its mark on all of us [...]. So [...] perhaps we can now all agree on something: that mathematics created all of us.

The Art of More (2021), 291

Brooks here establishes his understanding of *Mathematics* as signifying and characterizing what it is to *be human*. He further showcases the *Mathematics-Human* continuum as it moves through his work through his use of an exclusive 'us,' that too is signified by *Mathematics*. There is a 'human we' moving through Brook's work that is always implicitly Western and defined by a decisive relationship to *Mathematics*. Brooks employs *Mathematics* here as an idea to form this exclusive 'us' and to universalize and thus authorize it. He ends his book by officially defining *Mathematics* as the one signifier – the identifying element of the notions of *humanity* and *civilization*. This further establishes the *Mathematics-Human* continuum at the core of his work and the notion of civilization therein points towards the colonial exclusivity of this Human that is the *Human* of the *Mathematics-Human* continuum.

Brooks' image of (Mathematical) Thinking can be summarized as follows:

- 1) Brooks understands *Mathematics* as an instance of the realization of universalized 'human aspirations' and conceptually links *Mathematics* to Western history and an exclusive concept of *being human*. This showcases the *Mathematics-Rationality-Human* continuum and hints at the exclusivity of the thinking-being legitimized through and within the continuum.
- 2) Brooks conceptually interweaves *Mathematics* with *civilization* and *modernity* through relationships of mutual authorization and mutual legitimacy. This once more allows us to understand the normative quality of the *Mathematics-Rationality-Human* continuum as establishing *Mathematics* as a thinking-being with distinct epistemic authority.

The works of Pinker, Ellenberg, and Brooks all partake in the making of a contemporary *Mathematics* that is characterized through the following criteria:

- 1) *Mathematics* is understood to form knowledge with a distinct and special epistemic authority.
- 2) The special epistemic authority attributed to *Mathematics* bears a moral dimension of 'epistemic goodness'.

- 3) *Mathematics* is conceptually interwoven with more general notions of thinking, ‘common sense,’ and of *being human*.

1.3 Inventing *Mathematics*

The Axiomatic Method in Ancient Greek

Now that we have witnessed three instances of the *Mathematics-Rationality-Human* continuum at work, I seek to trace some of the historical makings of both *Mathematics* and the *Mathematics-Rationality-Human* continuum. *Mathematics* as an image of thinking is fundamentally grounded in the axiomatic method that draws from Ancient Greek Philosophy (Shulman 1996). The *Mathematics-Rationality* continuum is often attributed to the Enlightenment and the philosophy of this period. Therefore, my next two destinations in the study of *Mathematics* are the philosophy of Ancient Greece and the philosophy of the Enlightenment.

As the man who first developed the image of thinking that was later formed into the axiomatic method, Parmenides is generally regarded as the “father of logic” (cf. Steuben 1981, 94). The axiomatic method thus became the heart of *Mathematics* and *Rationality*⁵ as images of thinking (cf. Shulman 1997, 429). Only a fragmentary didactic poem of his philosophy has survived, which itself does not mention *Mathematics*, but is strongly associated with *Mathematics* as ‘a method of thinking’ (cf. Steuben 1981, 67).

This poem narrates a story in which Parmenides is the human protagonist introduced to the art of recognizing *truth* by various goddesses (cf. Shulman 1997, 430). This ‘world of truth’ has the character of an irrefutable system that is explicitly separated from ‘the sphere of error,’ which is ‘the common sphere of mortals’ (cf. Steuben 1981, 37).

Various aspects and scenes of the didactic poem are still the subject of polarizing debate today (cf. e.g. Steuben 1981, 115 or Nye 1990, 9). These include, above all, the question of whether Parmenides’ path to truth has the character of a revelation or that of a personal intellectual endeavor (cf. e.g. Steuben 1981, 86). However, there is agreement that Parmenides describes a realm of infinite *truth* that is not actually accessible to humans, but to which there exists a

5 I use italics to clarify the character of a conception: *mathematics*, for example, is a specific epistemic structure that is subsumed under the term *mathematics* - not all mathematical understandings or conceptions.

path that humans can take –the path that will later be referred to as ‘the axiomatic method’ (cf. Shulman 1997, 429). This narrative conceptualizes *the human* and *the world* separate from said *human*. In this narrative, *the human* can access this different world through the epistemic endeavor described in the poem and later named ‘the axiomatic method.’

In my examination of Parmenides’ poem and the associated discourse, I am interested in the concept of *truth* and the *thinking* that promises to lead to this very *truth*. Such *thinking* promises to enable *the human* to access *the world* allegedly separated from him. My analysis identifies 10 aspects in Parmenides’ poem, which I understand as the central elements of his image of thinking. All these aspects of Parmenides’ image of thinking are interwoven with one another. As such, they are interdependent and mutually grounded – like a body in which one organ nourishes the other and keeps it alive.

Parmenides describes a lyrical self⁶ that is led to a goddess (cf. *ibid.*). The goddess will reveal the truth and the path to truth to Parmenides. First, she welcomes him and describes the nature of what she intends to give him:

It is no ill chance, but right and justice that has sent thee forth to travel on this way. Far, indeed, does it lie from the beaten track of men! Meet it is that thou shouldst learn all things, as well the unshaken heart of well-rounded truth, as the opinions of mortals in which is no true belief at all.

Parmenides’ didactic poem, trans. by John Burnet (2005), 197

Parmenides is greeted here by the goddess as she announces that she will show him the *truth* and teach him to recognize it. What interests me most in this passage is how she characterizes *truth and in particular*, which demarcations and promises go hand in hand with this great word. Reading with this question in mind already reveals some aspects that become increasingly relevant to Parmenides’ image of thinking as the poem progresses:

The *truth* that the goddess wants to show Parmenides is universally valid; it is “the unshakeable heart of truly convincing truth.” I consider this universalism to be the first characteristic of the Parmenidean image of thinking in which *truth* is *universally valid* knowledge.

6 For the sake of simplicity, I do not differentiate in my discussion between Parmenides and the lyrical self that he writes. I thus follow the conventional way of writing about Parmenides’ didactic poem.

This universalism simultaneously establishes a demarcation of *truth* from *other knowledge*, and it is demarcated from "the opinions of mortals, in which there is no true reliability." *Truth* is here demarcated from *being human* and from the realm of *opinions* and *non-reliability*. *Resultingly*, its universality feeds on its *non-humanness* – its *non-mortality* – its *sacrality*, is symbolized in the fact that *truth* is achieved through a goddess as an explicitly *non-human* figure.

This demarcation also reveals a fundamental binarity that continues to permeate the poem. This binarity consists in the idea that there exists the realm of *mortal*, *transient opinion* and that of *eternal truth* in which both spaces appear as worlds that only become what they are in opposition to each other.

This binarity is not simply an opposition, but specifically a hierarchized binarity. Parmenides' pursuit of *irrefutable truth* is explicitly named by the goddess as a *good* endeavor – as a "divine providence" and even as his "right." In this, the question of *truth* is already given an explicitly moral dimension by opening up the idea of a *morally good* sphere of *eternal truth*.

All these aspects are ultimately based on the organ that presumably represents the heart of the Parmenidean image of thinking: the idea that *truth* feeds on *necessity* – precisely that which cannot be otherwise is *true*.

The goddess continues to give Parmenides hints for the path to this *truth*:

Come now, I will tell thee [...] the only two ways of search that can be thought of. The first, namely, that *It is*, and that it is impossible for it not to be, is the way of belief, for truth is its companion. The other, namely, that *It is not*, and that it must needs not be,—that, I tell thee, is a path that none can learn of at all. For thou canst not know what is not—that is impossible—nor utter it; for it is the same thing that can be thought and that can be.

Parmenides' didactic poem, trans. by John Burnet (2005), 197–198

This excerpt describes precisely one of the two central basic ideas of the axiomatic method as a *path to truth*. Namely, it shows that certain, *necessary principles* count as *foundations of truth* in that they are themselves *necessarily true*. The goddess in her subsequent sentences therefore states the following *axioms*: the *truth of being* and the *falsity of non-being*.

The *idea of necessity*, which has already been mentioned, is woven into this idea of the *axiom*. The *axioms* form the basis of the epistemic body because they are understood as *necessary*. This and this alone justifies their role. This aspect is illustrated, for example, through the goddess' emphasis that the two propositions presented, and their consequences are the only way of investigating *truth*.

This emphasis already hints at a link between *truth* and authority, which will become clearer as the poem progresses.

After her introduction to the character of *truth* and the method of the path to it, the goddess carries out the area opposite to that of *truth* – that of *error*:

I hold thee back from this first way of inquiry, and from this other also, upon which mortals knowing naught wander two-faced; for helplessness guides the wandering thought in their breasts, so that they are borne along stupefied like men deaf and blind. Undiscerning crowds, in whose eyes it is, and is not, the same and not the same? and all things travel in opposite directions!
Parmenides' didactic poem, trans. by John Burnet (2005), 198

Here the link between *truth* and *power* and thus the dimension of authority becomes explicit. *People* who are not in possession of the *truth* or aware of the path to it are affected by "powerlessness" precisely because of the absence of *truth* in their world. Indeed, they are *powerless because they are mistaken*.

And they are *mistaken* insofar as they do not observe the laws of binarity and contradiction: "peoples for whom being and non-being are the same and not the same again." This sentence reinforces the link between *truth* and *binarity* by all the more firmly establishing the idea of *binarity* as the path to *truth*.

This scene also deepens the moral dimension of *truth* and its differentiation from *mortals (humans)*. *Humans* are described as those who are usually without *truth*, because this is actually, in a sense, above them – that is, above all – even above their mortality – in immortality. It is precisely in this characteristic that they are explicitly devalued, for example in the phrase "the double-headed." Furthermore, this de-valuation is portrayed through an ableist metaphor of 'blindness' as a stand-in term for 'stupidity' deepening the exclusionary language on modes of perception and thinking.

Finally, I would like to note the phrase "in a rational way." The "rational way" appears here as that which is conducive to finding the *truth*. I would like to note the conceptualization of *Rationality* as a path to *truth* as a further aspect of the Parmenidean image of thinking.

In conclusion, Parmenides' divine teacher focuses on the character of being as *truth*:

One path only is left for us to speak of, namely, that *It is*. In it are very many tokens that what is is uncreated and indestructible ; for it is complete! immovable, and without end. Nor was it ever, nor will it be; for now *it is*, all at

once, a continuous one. [...]

Therefore must it either be altogether or be not at all. Nor will the force of truth suffer ought to arise besides itself from that which is not.

Parmenides' didactic poem, trans. by John Burnet (2005), 199

This scene reveals the last aspect of the Parmenidean image of thinking that I would like to examine. This aspect is also the second decisive criterion of the axiomatic method, as it will be treated and applied later, following Parmenides (cf. Shulman 1997, 432): the idea of *seclusion*. The idea of seclusion appears here in two senses. The goddess describes *truth* as a system that is self-contained and is secluded in itself – separate other systems. This conceptualization of *truth* as a self-contained system is an essential organ of the Parmenidean image of thinking. Parmenides' teacher emphasizes the *complete immutability* of this system, from which its *necessary truth* is supposed to feed. Accordingly, this conceptualization turns separability into a logic through which to seek *truth* and 'epistemic certainty.' This system of truth also consists of aspects of the system insofar as individual truths all have an inner unity and yet are connected as a system.

In light of this analysis, I therefore summarize the Parmenidean image of thinking, which is often referred to as the *Mathematical image of thinking* (cf. Steuben 1981, 67 and Shulman 1997, 430), through reference to ten core claims⁷:

- 1) *Truth* appears in Parmenides' poem as 'universally valid knowledge.' This establishes the concept of an a-historicity as definitive for *truth*. Given that Parmenides' poem is received and receives uptake as a characterization of *Mathematics*, this aspect extends to Mathematics. As such, mathematical

7 The aspects that I list here result from on the one hand a close reading of Parmenides' didactic poem and on the other hand their recognition in the established discourse on his teachings. Therefore, each aspect is followed by an exemplary reference to secondary literature, which is in addition to the references to the poem itself and can be read as exemplary of the relevant research discourse. The respective points can be found as examples in the following secondary literature: Re 1): Nye 1990, 17/Shulman 1997, 427/, On 2): Nye 1990, 16/Steuben 1981, 104, Re 3): Nye 1990, 17/Shulman 1997, 433/Steuben 1981, 108, Re 4): Shulman 1997, 432/Steuben 1981, 131, Re 5): Nye 1990, 11, 19/Shulman 1997, 430, Re 6): Nye 1990, 11/Shulman 1997, 431, Re 7): Nye 1990, 17/Steuben 1981, 42, Re 8): Nye 1990, 12/Shulman 1997, 429, Re 9): Nye 1990, 12/Shulman 1997, 432, Re 10): Shulman 1997, 430/Steuben 1981, 111

thinking is constructed as the path to truth and to ‘universally valid knowledge.’

- 2) This ‘universal validity’ is construed as secured through *epistemic necessity*. This means that a-historicity and universal validity is not only ascribed to *Mathematical knowledge*, but also to the intellectual technique described as *Mathematics* in the poem.
- 3) *Truth* is explicitly related to power insofar as it is the knowledge of special authority. This too is related to *Mathematics*, because *Mathematics* as an image of thinking, has been constructed with reference to this poem. *Mathematical knowledge* is thus knowledge with distinct epistemic authority – as we have already witnessed in the work of Pinker, Ellenberg, and Brooks.
- 4) *Truth* itself, as well as the search for it, has a moral dimension. Truth and its pursuit are honorable and *good*. This establishes a normative, moral dimension of *Mathematics* too; insofar as *Mathematics* is understood as a path to epistemic certainty it is also a morally superior path and a noble intellectual endeavor.
- 5) *Truth* (because of its eternity) lies outside the actual sphere of *human beings* and it is explicitly demarcated from *humans*. The method described in the poem – *the Mathematical image of thinking* – is the way for humans to access what is outside of them – *truth*.
- 6) *Rationality* is conceptualized as the *thinking* that leads to *truth* and as the intellectual method which brings *the human* to the *eternal truth*.
- 7) Parmenides constructs *truth* in relation to the concept of ‘a system.’ Truth is understood as a closed, eternally existing system of unchanging propositions. This implies that truth is conflated with a logic of separability, because ‘truth as a system’ is construed as epistemically believable precisely because it remains enclosed and separated from other systems.
- 8) There are *necessarily true principles* that must be assumed on the path to *truth*, i.e., –what is later termed ‘axioms.’ Axioms are statements characterized as being *necessarily true*. *Axiomatic Mathematics* is therefore rooted in the very notion that there is *necessarily true knowledge*, from which further knowledge can be derived by means of *Mathematical necessity*. The notion of (*Mathematical*) *necessity* identifies the notion of the axiom and thus identifies *Mathematics*.
- 9) The individual sentences of the system that *truth* is – are understood as self-contained. The sentences making up the truth-system are separated from one another.

- 10) The path to *truth* emerges as a path of *binary logic*. *and contradictions* are to be recognized as ‘a symptom of error.’ The notion of contradiction as a signifier of error is constructed through a binary logic, as only in a two-value system (a system, where things are either *true* or *false*) can contradiction count as a signifier of falsity. So, thinking in binary logic is construed here as the only reliable path to truth and it is constructed as a necessary part of thinking.

Some of these aspects of *Mathematics* as an image of thinking – such as *Mathematical knowledge* as knowledge with special authority or the moral dimension of epistemic certainty – have already been observed above in the works of Pinker, Ellenberg, and Brooks. These aspects have thus sustained themselves for a long time and bear a transhistoricity as they move through Ancient Greek work and contemporary works – albeit not in the same way, but in an inherently related way.

As the second voice of Ancient Greek philosophy, I consider the work of Plato. Despite differences to the work of Parmenides, Plato takes up central features of his thought and expands and deepens significant moments of the Parmenidean *image of (Mathematical) thinking* (cf. Swarder 2013, 10).

In contrast to Parmenides, Plato himself explicitly addresses *Mathematics* in his philosophy and basic features of Plato’s perspective show important correlations with the current prominent understanding of *Mathematics* (cf. Lassere 1963, 7).

Plato’s work is much larger in scope than what is left of Parmenides’ philosophy. Plato’s understanding of *Mathematics* does not appear in a specific work as one comprehensive theory or position (cf. Swarder 2013, ix). My discussion of Plato will therefore draw on various dialogues and be oriented towards the works and quotations that are particularly frequently used in the discourse on Plato’s *Mathematics*. I will focus on the part of the *Politeia* in which Plato first talks explicitly about *Mathematics* and then goes on to make use of the allegory of the cave, which Plato’s teaching is associated with in a particularly dominant way (cf. Swarder 2013, 35/*Politeia* 510 c to 530 a).

Some crucial elements of the Parmenidean image of thinking are directly adopted by Plato and are therefore only mentioned here. This is because my examination centers the elements that are extensions or changes in compari-

son to the Parmenidean image of thinking⁸. Plato retains Parmenides' idea of a *necessary truth* (cf. Sworder 2013, 10 and 27/e.g. *Politeia*, 511 b) as well as its identification with something divine (cf. Sworder 2013, 114, 115). This is accompanied by the description of a fundamental insight from which everything else is derived (the *axiom*) and which is itself the result of an 'intuition,' rather than an effort of thought (cf. Sworder 2013, 27).

The summary of the Platonic image of thinking is particularly complex due to the large volume of work and the ideas on *Mathematics* that are repeatedly scattered throughout Plato's work. Therefore, I also consult secondary literature. The aspects discussed in the passages I have chosen are thus shown to be those that can be understood as a fundamental component of Plato's understanding of *Mathematics*.

First, I will establish the main features of the Platonic theory of ideas and its relationship to Plato's image of *Mathematical thinking*. Plato's *allegory of the cave* is used – both in Plato's work and in reference to it to illustrate Plato's theory of ideas. In the allegory of the cave, Plato describes people bound to a cave so that they can only ever see the shadows cast on the wall they face – the shadows of the things moving behind them. The shadows and the originals that cast the shadows are representative of the relationship between an idea and one of its cases (cf. *Politeia* Book 7, 514a to 515c, Sworder 2013, 9). The *idea* here is the *truth*, and the 'instances of the idea' participate in the idea to varying degrees (cf. Deleuze 1992, 90).

The *ideas* as a concept have a similar function to the notion of *being* in Parmenides' work and are closely related to this concept as they are *the true being* that receives its *truth* through its *eternity* (cf. Shulman 1997, 435).

This idea is brought in relation to 'mathematical entities' by Plato himself as well as others. Thus, the idea that mathematical objects lie in a separate, eternal sphere and therefore have a specific ontological status bearing the name *mathematical Platonism*. Contemporary mathematicians, such as Marcus du Sautoy, refer to this idea with conviction:

What about the question of whether mathematical objects really exist? I certainly am a Platonist at heart. There are some things out there that are inde-

8 Plato further develops Parmenides' method of division in the dialogue *Timeon*. Due to the explicit focus on *Mathematics* here I do not include *Timeon* in my re-readings of Plato. However, it can be helpful to note that Plato draws from Parmenides more explicitly in *Timeon*, especially further establishing Parmenides' method of division.

pendent of our existence or act of imagining them.

Du Sautoy 2011, 23

This notion of a specifically mathematical ontological status borrows directly from Plato's theory of ideas and is linked above to a specific claim and concept of *truth*, which consists in the postulate of *independence*. Ideas are *true* because they are not in the sphere of *human life* and the measure of perfection of the Idea can never be fully attained by its cases (cf. Deleuze 1992, 90 and Sworder 2013, 9). In precisely this sense, ideas are ideals, which consist precisely in the fact that they cannot be attained (cf. *ibid.*). Thinking in terms of mathematical Platonism, this applies precisely to mathematical objects or *Mathematics* as a sphere – a sphere in which it is the ideal of thought to which all other thought aspires due to the premise that this aspiration can never be completely fulfilled (cf. *ibid.*).

In the context of his theory of ideas, Plato explicates another element that we today naturally associate with *Mathematics*, and possibly with *thinking* in general: the element of *abstraction* and specifically its connection with the idea of *universal validity*.

In the 'abstract forms' of contemporary mathematics we recognize the axioms of Euclid's predecessors, and in the 'aspects of experiential reality' Plato's mathematical universe.

The Birth of Mathematics in the Age of Plato by Francois Lasserre (1964), 14

For Plato, *Mathematics* is part of the description of the world of ideas that exists in the realm of the *abstract* and the *non-worldly*. – it is that which passes through the world without existing in it as an explicit, recognizable object (cf. Shulman 1997, 434). And precisely this property of abstractness appears not only as an ontological property, but also an epistemic one. Thus, the character of abstractness is what *universal validity* is supposed to result from, "[...] seeking to see those other things themselves that one cannot see except by means of thought." (Politeia 510c 5).

In this section, Plato distinguishes between four different spheres of human understanding and understands *Mathematics* as part of the sphere (*noesis*) that "can only be seen through thinking" (cf. *ibid.* and Sworder 2013, 27).

In the context of the postulate of completeness and abstraction, Plato deepens the idea of *truth as a system*, which was already recognizable in Parmenides. Plato's world of ideas consists of different ideas that are related to each other

and that together form a self-contained system that is complete for all eternity. Plato writes the following in the dialog *Menon*:

As the whole of nature is akin, and the soul has learned everything, nothing prevents a man, after recalling one thing only—a process men call learning—discovering everything else for himself, if he is brave and does not tire of the search, for searching and learning are, as a whole, recollection.

Plato, Meno, trans. by G.M.A. Grube (1997), 81c 9–d 4

Various central aspects of Plato's doctrine become clear through his presentation of the world of ideas as one that is given to *all human beings*. In doing so, he also links the experience of mathematical entities and order, insofar as they are part of the world of ideas, with human experience (cf. Sworder 2013, 10 and 27). The ideas he inputs or ideas are what I have previously described with the term axiom, i.e., they are what *everything else*, that is all *possible knowledge* and the entire functioning of the system, can be derived from (cf. Sworder 2013, 27):

He makes the experience of being the perception of a single aspect of a complex system of eternal unchanging ideas.

Mathematical Plato by Roger Sworder (2013), 27

Here Plato deepens in several respects the axiomatic image of thinking that was already recognizable in Parmenides at the beginning. According to this concept, the search for *truth* is based on certain *unchangeable* and *unquestionable* propositions from which a system is formed that determine the limits of validity.

The relationships within this system are those of *logical necessity* and their investigation and their determination is the task of *Mathematics* (cf. Sworder 2013, 27). Philosophy, on the other hand, has the task of determining and evaluating the unquestionable propositions – the axioms (cf. Sworder 2013, 38):

[B]y the other subsection of the intelligible, I mean that which reason itself grasps by the power of dialectic. It does not consider these hypotheses as first principles but truly as hypotheses—but as stepping stones to take off from, enabling it to reach the unhypothetical first principle of everything. Having grasped this principle, it reverses itself and, keeping hold of what follows from it, comes down to a conclusion without making use of anything visible at all, but only of forms themselves, moving on from forms to forms,

and ending in forms.

Plato, Republic, trans. by G.M.A. Grube and C.D.C Reeve (1997), 511 b

Philosophy and *Mathematics* therefore both move within the axiomatic system and they both move as the world of *truth*, yet they end up in different positions in their respective explorations.

This link between philosophy and *Mathematics* is a central aspect of Plato's teaching. In the academy he opens, there is a prominent focus on the teaching of *Mathematics* and *Mathematics* is also an explicit and significant part of the program in his concept of 'the good state,' outlined in the *Politeia* (cf. Lasserre 1967, 27). So, as I have shown in Pinker above, there is a political dimension – a political hope to *Mathematics*. *Mathematics* is a central component of the development of *the whole of truth* and is described by Plato as 'the highest form of fulfillment,' and as a thinking with special merit, special significance (cf. Sworder 2013, 10).

In many respects then, Plato already implies the interwovenness of *Mathematics* and *being human* – so the *Mathematics-Human* continuum observed in Pinker and Brooks, also appears in Plato in its own way. Plato understands *Mathematics* as 'the greatest fulfillment of human passion' and the central movement in the search for *truth*, the fulfillment of which is understood as a deep, and distinctly *human* need (cf. *ibid.*). These are instances of the *Mathematics-Human* continuum in Plato as well as the concept that constructs *Mathematics* and *being-human* as being a part of one another. as understanding *Mathematics* as a fulfillment of a distinctly human desire, is to identify *Mathematics* as an inherent part of *the human*.

I summarize the Platonic *image of (Mathematical) thinking* in five core claims. The Parmenidean image of thinking was not yet linked to *Mathematics* by Parmenides himself, whereas attribution to *Mathematics* explicitly applies to all the following aspects of Plato's philosophy⁹:

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- 9 The respective points can be found as examples in the following secondary literature:
 Re 1) Shulman 1996, 433/Sworder 2013, 27
 Re 2) Nye 1990, 24/Sworder 2013, 28
 Re 3) Nye 1990, 37/ Shulman 1996, 434
 Re 4) Lasserre 1964, 7/ Shulman 1996, 433/Sworder 2013, 27, 32
 Re 5) Nye 1990, 30/Sworder 2013, 21–22

- 1) Plato deepens the idea of the *axiom* as an infallible, fundamental premise and relates it directly to *Mathematics*. The notion of the *axiom* arises from the idea of *epistemic necessity*. It is the very notion of *epistemic necessity* that constructs *Mathematics* and is in turn constructed by *Mathematics* as an image of thinking.
- 2) The deepening of *truth* is a perfect, self-contained and eternal system. Individual elements are linked to one another through 'logical relationships,' and relationships of *necessity*. This further establishes the centrality of *necessity* to *Mathematics*. Also, this aspect establishes the logic of separability as a part of *Mathematics* as an image of thinking because the notion of the self-contained system relies on of a logic of separability, *self-containment* is to be *separated* from another thing.
- 3) Plato explicitly constructs *Mathematics* and the idea of *the human* in mutual relation: Showcasing one of the central instances of the *Mathematics-Human* continuum in Plato, *Mathematics* is constructed as the knowledge, the thinking, which 'all human can recall' and that brings 'the highest human fulfillment.
- 4) Plato links *abstraction* and *universality* and classifies *Mathematics* as *abstract* and *universally* valid. This explicit conflation of *the universal* and *the abstract* is in comparison to Parmenides' philosophy, but is familiar to that done by Pinker, Ellenberg, and Brooks.
- 5) Plato's teaching deepens the idea of *eternal concepts* through his theory of ideas. This notion of eternal concepts is explicitly identified with *Mathematics* because *Mathematical entities* are understood as eternal concepts in Plato's work.

Each of these elements, which still exist today, are part of the axiomatic system, that emerges in Plato's time and in explicit reference to Plato (cf. e.g. Shulman 1996, 433). Thus, the notion and practice of the axiomatic system lives a trans-historical life—it moves through different historical periods, not by being constant, but by adapting its core characteristics to its specific existence.

I examine the work of Aristotle as my last stop in my travels through Ancient Greek philosophy. Unlike Plato or Parmenides, Aristotle's work contains a section that is decidedly devoted to the design of a mathematical ontology that take up from Plato and at the same time deviates fundamentally from his 'doctrine of the heaven of ideas' (cf. Lear 1982, 161). Aristotle's work on *Mathematics* is situated as an ontological work, a study of being. This is crucial, because both Plato and Parmenides have moved on a primarily epistemic, or thinking-

oriented level, while Aristotle studies *Mathematical entities* as *beings*. As I have shown in my examination of Pinker, Ellenberg and Brooks there is a *thinking-being* continuum present in *Mathematics* and in the *Mathematics-Rationality-Human* continuum. So, the study of Aristotle will partly be devoted to studying the relation of *thinking* and *being* in Aristotle's account of *Mathematics*.

To begin, I focus on Aristotle's philosophy of the ontological status of *Mathematical objects* in order to explore the question of how Aristotle understands *Mathematical truth*. My second focus is then his method of *sylogism*, which is a method of demonstrating *immutable truth* (cf. Nye 1990, 52). Aristotle applies the latter not only to *Mathematics* but understands it as a philosophical logic whose application in *Mathematical* contexts is of particular merit within his philosophy. I first provide an explanation of the main features of Aristotle's mathematical ontology and syllogism by analyzing selected parts of the writings *the Categories* and *Metaphysics*¹⁰.

Aristotle's philosophy of *Mathematics* begins with an ontological question that he poses following Plato. Plato asserted the claim of *Mathematics*, as the sphere of the *immutably true knowledge*, by locating it in a sphere of its own – that of 'the heaven of ideas' (cf. Lear 1982, 161). Aristotle understands this explanation as unsatisfactory in the sense that it is unable to explain why statements about the physical world can be made based on *Mathematical objects* (cf. *ibid.*). The dilemma is the following: if mathematical objects exist in a world that is not that of material objects then how can we believe that *Mathematics* can produce *truth* in relation to the world of material objects?

Thus Aristotle, like Plato, wants to assert that *Mathematics* can produce knowledge about the *immovable* and the *unchanging*, and wants to explicitly dispense with the idea of a *mathematical heaven of ideas* in his explanation of how this can be possible (cf. *ibid.*). Accordingly, from the very starting point of Aristotle's philosophy of *Mathematics* there is a conflation of *thinking* and *being*. Aristotle studies *Mathematics* from an ontological standpoint to explain the epistemic status of *Mathematical knowledge* and he studies *being* to speak on *knowing*.

The basic ideas that Aristotle outlines in this project are still largely relevant today for both *mathematical-philosophical* questions and conventional ideas

10 In the selection of text passages, I stick to those that are quoted particularly frequently in the context of Aristotle's philosophy of mathematics and his concept of syllogism, which are considered the relevant excerpts on these questions. My central references in the selection are Nye 1990, Lear 1982, Gillies 2015.

about why *Mathematics* is capable of producing reliable knowledge (cf. Gillies 2015, 146). So let us first investigate the main features and basic theses of Aristotle's project:

It has, then, been sufficiently pointed out that the objects of mathematics are not substances in a higher degree than bodies are, and that they are not prior to sensibles in being, but only in definition, and that they cannot exist somewhere apart.

Aristotele, Metaphysics XIII Book (M) trans. by Jonathan Barnes (1984), 1077b

Here Aristotle begins by stating two of his central starting points. Firstly, he assumes that mathematical objects exist. Secondly, he assumes that they do not do so in their own separate sphere. The existence of mathematical objects is a central conviction for him, which he subsequently emphasizes further:

[...] it is true also to say without qualification that the objects of mathematics exist, and with the character ascribed to them by mathematicians.

Aristotele, Metaphysics XIII Book (M) trans. by Jonathan Barnes (1984), 1077b|1078a

From here Aristotle poses the question as to how and in what way mathematical objects exist:

[...] so too is it with geometry; if its subjects happen to be sensible, though it does not treat them qua sensible, the mathematical sciences will not for that reason be sciences of sensibles-nor, on the other hand, of other things separate from sensibles.

Aristotele, Metaphysics XIII Book (M) trans. by Jonathan Barnes (1984), 1077b|1078a

In this section, Aristotle develops one of the central theses of his theory on the status of being and truth and thus claims of *Mathematics*, which is referred to as *the thesis of embodiment* (cf. Gillies 2015, 152): Mathematical properties and objects are said to have real existence without being able to exist independently of material objects. However, Aristotle does not reduce mathematical objects to their so-called accidentals, i.e. the material objects in which they occur, but distinguishes mathematical objects from their material accidentals.

These ontological questions are of central importance for Aristotle's view of *Mathematics* and its claim to truth as it is nothing less than an ontological investigation of the question of whether and, if so, why *reliable knowledge* can be expected from *Mathematics* and of what character, and above all, what status

of reliability and *Truth*, this knowledge can attain (cf. Lear 1982, 162). Aristotle explains this connection in the following section:

Each question will be best investigated in this way-by setting up by an act of separation what is not separate, as the arithmetician and the geometer do. For a man qua man is one indivisible thing; and the arithmetician supposed one indivisible thing and then considered whether any attribute belongs to a man qua indivisible. But the geometer treats him neither qua man nor qua indivisible, but as a solid. For evidently the properties which would have belonged to him even if perchance he had not been indivisible, can belong to him even apart from these attributes. Thus, then, geometers speak correctly; they talk about existing things, and their subjects do exist; for being has two forms-it exists not only in complete reality but also materially.

Aristotele, Metaphysics XIII Book (M) trans. by Jonathan Barnes (1984), 1078a–1078a|1078b

Here Aristotle introduces a distinction that is essential to his view of *Mathematics*: a material entity has properties that *necessarily exist* – for example, those that are common to all *human beings* insofar as they are *human beings* – and those that also exist by chance and can therefore vary (cf. Nye 1990, 57). Aristotle understands *Mathematics* as the determination and investigation of *essential* and thus *universal properties*, which are *immovable* and *unchangeable*. *Mathematics* is the *deduction of truth* insofar as it carries out the investigation of these very properties.

Similar to Parmenides and Plato, Aristotle's image of *Mathematics* also carries the figure of *necessity* and *completeness* deep in its core (cf. *ibid.*). As Aristotle writes at the beginning of the section, (mathematical) investigation is not one kind of knowledge among many, but the *best possible kind*.

So let us note the following about Aristotle's ontological conception of *Mathematics* and the *truth* it produces. Firstly, mathematical objects exist in the form of unchanging, essential aspects of the material, physical world and *Mathematics* is thus the study of what cannot be otherwise (cf. Lear 1982, 163, 183).

In order to focus on Aristotle's methodological conception in the context of the *search for truth* from this ontological concept, I will at this point take a look at Aristotle's concept of the *sylogism*. He outlines the same concept in the *First* and *Second Analytics*, not referring exclusively to *Mathematical Knowledge*, but outlining the very rules that are also those of modern mathematical reasoning (cf.

Lear 1982, 162). So let us look at Aristotle's syllogism in order to understand how *people*, according to his image of (*Mathematical*) *thinking*, gain access to *necessary knowledge*. The following section provides an initial insight into Aristotle's idea of knowledge:

When the extreme terms are convertible, the middle term must be convertible with each of them. For if A is true of C because B is A and C is B, then if All C is A is convertible, All C is B, All A is C, and therefore all A is B, and All A is C, All B is A, and therefore all B is C.

Aristotele, Prior Analytics trans. by Jonathan Barnes (1984), 67b 27

Here Aristotle formulates the idea of *knowledge as a system of axioms* as indicated by Parmenides and Plato. He contends that there is a premise (an axiom), in this case "A is present at that at which B is present", and from this follows further necessary knowledge, "that C is present." Let us pursue this idea further by returning to Aristotle:

and when one's inference is derived only from the possible one cannot be said to have knowledge in the true sense of the word. When the conclusion is necessary there is nothing to prevent the middle term, by means of which the conclusion was proved from being necessary, for it is possible to infer the necessary from the not necessary, just as one may infer the true from the untrue.

Aristotele, Posterior Analytics trans. by Jonathan Barnes (1984), 1.6

Here Aristotle formulates the idea of an *axiom in which there is a knowledge that is unprovable* and requires no provability because it *necessarily* exists. *Provable knowledge* is derived from this *unprovable, necessary knowledge*. The strategic conception of *provability* is based on a specific role of the idea of *contradiction* in which *contradiction* is regarded as a symptom of *falsity* and is what makes a *proof* fail (cf. Nye 1990, 50). Aristotle further formulates the idea of *unprovable knowledge that does not require proof* along the lines of the category of *man*:

if then we have no higher perception of the demonstrable than knowledge, the result must be that we cannot know anything absolutely by means of demonstration, but only conditionally.

Aristotele, Posterior Analytics trans. by Jonathan Barnes (1984), 1.22

Aristotle here establishes the idea of *universal, human perception*, which encounters ‘the necessary bodies of knowledge’ that can be taken for granted. The general *truth* lies in perception and would be recognized with *reason*, and in such a way that from then onwards it constitutes *irrevocable knowledge* from which *evidence* of other knowledge can be provided. This idea links *reason* directly with *knowledge* and *knowledge* in turn with the idea of *provability*, which takes place strictly within the concept of the axiomatic system. For Aristotle, a proof is the demonstration of knowledge that exists independently of itself.

Aristotle departs from those elements in the philosophy of Parmenides and Plato that appear mystical or metaphysical, while retaining and intensifying their claim to knowledge of *the immovable*, the *unchangeable*, formulating it into a method that is explicitly identified with the category of *man* and the distribution of political power. To summarize, Aristotle’s image of *Mathematical thinking*, is captured in the following core claims¹¹:

- 1) *Mathematical knowledge* is knowledge about the material world that *necessarily* exists. In this sense, *Mathematical knowledge* is knowledge with an outstanding authority that is precisely established through the idea of necessity. So, as seen in Plato as well as Ellenberg, the special epistemic status of *Mathematics* is explained through the identification of *Mathematics* with *necessity*.
- 2) Mathematical knowledge has two forms: the *unprovable, necessary knowledge* (axioms) and the *provable knowledge*, which becomes provable through the *unprovable knowledge* or the axioms. So, there are two ways knowledge can have this special epistemic authority attributed to *Mathematics*: either it can qualify as an *axiom*, or it can qualify as *provable*.
- 3) *Unprovable knowledge* stems from a specific, universal part of perception that is discovered with *reason*. As in the work of Aristotele, Pinker too conflates universalism and reason with one another, which highlights another transhistorical aspect of the *Mathematics-Rationality-Human* continuum.

11 The respective points can be found as examples in the following secondary literature:

Re 1) Gillies 2019, 23/ Lear 1982, 164/Nye 1990, 461

Re 2) Lear 1982, 172/ Nye 1990, 58

Re 3) Lear 1982, 169, 183/Nye 1990, 57

Re 4) Lear 1982, 164/Nye 1990 1990, 58/Shulman 1996, 435

Re 5) Lear 1982, 172/Nye 1990, 172/

Re 6) Nye 1990, 58/Shulman 1996, 435

Re 7) Nye 1990, 43/Shulman 1996, 435

- 4) A *proof* is the demonstration of a *truth* that exists independently of that proof. A proof has authority insofar as it is a demonstration and not the originator of the knowledge in question. This is crucial because the proven knowledge has epistemic authority because the proof is understood not to construct the proven knowledge, but rather, to merely point to it in a sort of gesture extending beyond the proof as a method. Furthermore, this aspect showcases how ontological questions intersect with questions of epistemic authority, as the ontological status of the knowledge in question is decisive for the level of epistemic authority attributed to that knowledge.
- 5) The *contradiction* is a symptom of the *invalidity* of a proof or the *falsity* of a statement. Similar to Pinker or Parmenides, this postulate introduces a logic of binary into *Mathematics* and *Rationality* as images and methods of thinking.
- 6) Aristotle deepens the idea of the *closed nature* of questions and answers and thus deepens the logic of separability built into *Mathematics*. As such, meaningful questions and answers are precisely those that take place in the axiomatic system and in the logic of a separability in seclusion from one another.
- 7) Aristotle's concept of *proof* and *reason* are explicitly characterized in a political dimension. A human who moves validly within the axiomatic system, i.e., in accordance with its logics of thinking-being, is a person to whom epistemic and political authority is to accrue. This political dimension of the notions of proof and reason were also observable in Pinker's work and has thus lived transhistorical lives as well.

Parmenides, Plato, and Aristotle all differ from one another in their teachings and yet they can all justifiably be understood as founding figures and works of the axiomatic image of thinking, of *Mathematics* as an image of thinking-being. Their common core and the project they all pursue – albeit all differently – is that of a knowledge that is *immutable* and to which *infallible access* can be granted. Plato and Aristotle share an explicit construction of *Mathematics* in precisely this context in their understanding of *Mathematics* as a path to this *immutable, infallible knowledge*, which is particularly infallible because of the characteristic of *necessity* built into *Mathematical knowledge* and *Mathematical thinking*.

Aristotle establishes the role of *Mathematics* in the strongest and most concentrated way as the knowledge of 'a special claim to truth.' However, all three

works contribute to an identification of *Mathematics* with *necessity*, which is based specifically on the notion of axiomatic reasoning.

In both Aristotle and Plato, *Mathematics* is identified as 'a universally human perception' making the *Mathematics-Human* continuum a shared aspect of their understandings of *Mathematics*.

The traits of the *image of (Mathematical) thinking* shared between all three works can be summarized as follows:

- 1) They are guided by the notion of a search for *unchanging, universal truth* linked to the idea of *necessity*: the notion that there is *knowledge* that cannot be otherwise, and that this knowledge is *Mathematical knowledge* precisely because of the conflation of epistemic necessity and *Mathematics*.
- 2) *Mathematics* is construed as a sphere in which this rigorous claim to a *necessary truth* is considered to be fulfilled. Because of this attribution of *epistemic certainty*, a particular epistemic authority is granted to *Mathematics*.
- 3) The idea of *necessary truth* is conceptually interwoven with the axiomatic image of thinking. It is believed that certain knowledge is *necessarily true* without proof, and that further knowledge can be inferred with intellectual methods that grant it *epistemic necessity*. In the axiomatic image of thinking all knowledge is therefore *necessarily true knowledge*.
- 4) *Truth* is understood as a system that is connected within itself by relationships of *epistemic necessity* and is unalterably closed to the outside world and this brings a logic of *separability* into *Mathematics* as an image of thinking.
- 5) *Contradiction* is construed as an indicator of epistemic *falsity* thus establishing a logic of *binary* within *Mathematics*.
- 6) *Mathematical knowledge* is understood as the knowledge to which all humans have access, so that *Mathematics* becomes part of the definition of *being human* and the other way around, which establishes the *Mathematics-Human* continuum.
- 7) The thinking that produces *true knowledge* is called *reason* and *Mathematics* is understood as an especially strong and triumphant example of *reason*.

In this sense, Ancient Greek philosophy can be understood as the birth of *Mathematics* as an image of thinking. This points to the Western character of *Mathematics* and to the political dimension of the question of *Truth*, which is evident in the explicit interwovenness of *Mathematics* with a special claim to epistemic authority. To further trace the historical makings of *Mathematics* and the *Mathematics-Rationality-Human* continuum, I will now turn to the philosophy of En-

lightenment and its relation to *Mathematics*. This is not to denounce the existence of non-*Mathematics* forms of mathematical knowledge making – such as Indian, Babylonian, Chinese or Amerindian mathematical practice. But, because all mathematical systems in non-accordance with *Mathematics* and with the *Mathematics-Rationality-Human* Continuum, have been made to inhabit the place of ‘the other’ in relation to the universalized Westernized mathematical practices.

1.4 The Expansion of *Mathematics*

Rationality and the Human in the Philosophy of the Enlightenment

In my examination of the Enlightenment, I draw from the philosophies of René Descartes and Immanuel Kant. Both philosophers represent different philosophical traditions and yet are repeatedly referred to as central philosophers in the conception of *human reason* and also shape the conventional understanding of the *Enlightenment* period to a particular extent (cf. e.g. da Silva 2017, 6). I am interested in how they each develop their epistemic claims and practices and what role their understanding of *Mathematics* plays in their respective understanding of *thinking* and *reason*.

My consideration begins with Descartes, who is widely associated with his ‘method of universal doubt’ (cf. e.g. Tarek 2020, 25). This method requires doubting everything one believes in order to retain only that which can soundly withstand any doubt in order to arrive at ‘certain knowledge’ (cf. Brown 1980, 23). This methodological proposal reflects the fundamental claim of Descartes’ work, which Gilles Deleuze describes as ‘the claim of a complete beginning’ (cf. Deleuze 1992, 169) in which *nothing* in knowledge or belief is simply to be retained and *everything* is to be doubted and tested (cf. Tarek 2020, 25).

Descartes was active as a philosopher as well as a *Mathematician*, whereby his philosophical claim sought realization through his *Mathematics* (cf. Felgner 2020, 115). I am particularly interested in the connection between his philosophical and *Mathematical* work and the conception of *Mathematics* that he develops in the process. Descartes’ *Geometry* as his main *Mathematical* work, will only play a marginal role here, as Descartes establishes his core epistemic

claims, his methods, as well as his understanding of *Mathematics*, primarily in the *Meditations* and the *Rules*¹² (cf. Tarek 2020, 2).

In the beginning of the *Meditations*, Descartes describes the methodological idea of a doubt that is related to all believed knowledge, in which a kind of 'epistemic new beginning' is created. Everything that is considered knowledge within the universal doubt is thus supposed to be 'knowledge beyond doubt.' Universal doubt should identify what cannot be doubted and what in turn can be doubted and must therefore be proven. This is a similar distinction as that of axioms and knowledge, which are necessarily derivable from the axioms as we have witnessed in the works of Aristotle and Plato; thereby, establishing another transhistorical aspect to *Mathematics*.

The epistemic aim that Descartes wants to fulfill is described with the concept of *truth*, which is associated with the idea of 'non-doubtable knowledge' and with the concept of *provability*. *Proving* is the epistemic practice that establishes the status of the *non-doubtable*.

In the *Rules* Descartes expresses that the aim of his philosophy is to develop a method by which all humans can recognize *truth* as such and know everything about it (Rules, 71). A conception of *truth* as a system is implied here insofar as Descartes clearly assumes the closed nature of *true knowledge*: by understanding *truth* as a closed system through which *everything* can be known – again evoking separability and seclusion.

To develop this method, Descartes establishes two epistemic practices in the *Rules*: *intuition and deduction* (Rules, 17).

Descartes selects the epistemic methods that he declares to be *valid* according to his epistemic claim regarding the search for *non-doubtable truth*. He assumes that specific epistemic practices methodically exclude deception, i.e. that certain practices of producing knowledge necessarily fulfill the claim to *absolute truth* and others do not. Descartes identifies two epistemic practices as those that realize his epistemic aim for 'knowledge beyond doubt': *intuition* and *deduction*.

12 There is debate as to whether the method in the *Meditations* is the same as that in the *Rules* (cf. e.g. Tarek 2020, 27). I therefore refer to both works equally and verify all aspects that are relevant to my work on the basis of both works. All aspects that I define as "Descartes' image of thinking" can be found explicitly in both works and are also recognized in research on Descartes as central aspects of his work.

He goes on to write about *intuition* as a method:

By intuition I understand, not [...] the conception which an unclouded and attentive mind gives us so readily and distinctly that we are wholly freed from doubt about that which we understand. Or, what comes to the same thing, intuition is the undoubting conception of an unclouded and attentive mind, and springs from the light of reason alone; it is more certain than deduction itself, in that it; is simpler, though deduction, as we have noted above, cannot by us be erroneously conducted.

Descartes, Rules trans. by Elizabeth S. Haldane and G. R. T. Ross (2017), 22

Here Descartes describes *intuition* as even more reliable than *deduction* in that it provides more direct access to the *truth*. *Intuition* describes the perception of the indubitable character of a certain knowledge or a form of *indubitable* insight into the *indubitable* character of a specific knowledge.

The idea of *intuition* signifies a form of universalization of perception insofar as it is based on *innate ideas* that are inherent to *all people qua being human*. A specific way of thinking is thereby already implicitly linked to *human perception* in general. Descartes uses two geometric and thus mathematical examples of such knowledge, which can be recognized in its *indubitability* through *intuition*. Geometric knowledge appears here as an example of *the most certain knowledge*.

Descartes characterizes the method of deduction as follows:

[...] many things are known with certainty, though not by themselves evident, but only deduced from true and known principles by the continuous and uninterrupted action of a mind that has a clear vision of each step in the process. It is in a similar way that we know that the last link in a long chain is connected with the first [...].

Descartes, Rules trans. by Elizabeth S. Haldane and G. R. T. Ross (2017), 24–25

Here Descartes elaborates on the relationship between *intuition* and *deduction*. Deduction is *necessary* because not all *certain knowledge* is intuitively recognizable, but *intuition* forms the principles from which and with which further knowledge can be deduced. This gives *knowledge* from intuition the character of an axiom: it represents the knowledge that is already certain and can be used to produce further knowledge.

This also makes clear what has already been hinted at, primarily, that Descartes understands *truth* as a system, as is particularly clear in his image

of the chain. Accordingly, *truth as a system has* individual elements that are all connected to one another in a definable, recognizable way.

The concept of *intuition* comes from Descartes' *Rules* and is not used in the *Meditations*. In the *Meditations*, however, Descartes asserts a similar idea using the terms *clearly* and *distinctly* by establishing that everything 'seen clearly and distinctly' is to be recognized as *true* (cf. *Meditations*, 13–14, Felgner 2020, 115).

He makes this methodological proposal based on the consideration that those ideas that originate from our own imagination and only from our imagination must be *imperfect* and *incomplete*. *This is because* human beings, as *imperfect, fallible beings* cannot develop *perfect ideas*. However, if we nevertheless find perfect ideas in human beings, Descartes argues, they must be *innate*, God-given, *true* ideas (cf. Brown 1980, 27). These 'innate truths' are what is seen *clearly and distinctly*. Thus, a *true idea* to Descartes is true insofar as this idea has a specific form that is *unchangeable* and *eternal*. The identification of *immutability* and *eternity* with *truth* is clear here as what is *true* is precisely that which is not subject to change. *Truthfulness* does not depend on the physical occurrence of the idea or the thing that represents the idea.

Descartes establishes a notion of *provability* in this context. To *prove* that a triangle has certain properties is to see these properties *clearly* as those of the triangle, even though one knew nothing of them before the proof. According to Descartes, this process proves that the idea in question (here that of the triangle) contains properties that we have not added ourselves. This makes it a *true, innate idea*.

Descartes illustrates his rigorous epistemic claim of *eternal, complete truth* here along the lines of *Mathematics* and thus identifies certain *Mathematical Knowledge* as such *eternal, unchanging knowledge, which*, according to his vision, cognitive processes should strive for. *Mathematical knowledge thus* emerges as an exemplary fulfillment of Descartes' epistemic claim of 'unquestionable knowledge.'

In *Geometry*, Descartes lives out this philosophical claim in the sphere of *Mathematics*: His *geometry* strives to identify 'true geometrical ideas' and to create a geometry that operates exclusively with precisely these ideas (cf. Tarek 2020, 22). Descartes defines the *truthfulness* of geometric ideas in reference to another mathematical discipline by arguing that *truly geometric ideas* are those that can be expressed algebraically (cf. Felgner 2020, 118). For Descartes, *truthfulness* can thus be secured within *Mathematics* and through *Mathematics* itself. This again results in a special link between *Mathematics* and *Truth*.

The fact that Descartes repeatedly uses mathematical examples in the *Rules* and the *Meditations* and decides to implement his epistemic claim, developed in philosophy, in the sphere of *Mathematics* suggests that Descartes understands at least certain *Mathematical Knowledge* as a particularly successful example of ‘secure, eternal knowledge.’ It is precisely this stance that he puts into practice both in the *Meditations* and in the *Rules*:

For whether I am awake or asleep, two and three together always form five, and the square can never have more than four sides, and it does not seem possible that truths so clear and apparent can be suspected of any falsity [or uncertainty].

Descartes, Rules trans. by Elizabeth S. Haldane and G. R. T. Ross (2017), 394

Descartes distinguishes here between empirical knowledge as doubtful and apodictic knowledge (independent of experience), which is itself *transparent truth*. He cites two mathematical disciplines as examples of *certain, transparent truths* to which no imputation of *falsity* can be *meaningfully* attributed.

Mathematical knowledge appears here as an example of the category of the *most certain knowledge* and is specifically characterized by the fact that it cannot be meaningfully questioned, and the *truth* of the named *mathematical knowledge* is described as *plausible* and *necessary*.

In addition, the *certain knowledge* as which mathematical knowledge appears here is distinguished from the sphere of experience and “composite things.” *Mathematical knowledge*, which Descartes describes here, acquires precisely this character of *undoubted truth* through its *eternity* and *immutability*, which leads to independence from physical occurrence.

Also noteworthy is Descartes’ classification of “composite things” as objects about which knowledge is more uncertain. This remark follows his image of the chain and shows that Descartes sees his epistemic claim of establishing *absolute truths* fulfilled in a form of division. Thus, he here characterizes the consideration of the “individual parts” as the central and greatest prospect of *truth*. In this way, he understands a consideration of the *individual* to be more credible than that of the *coherent*.

Nevertheless, Descartes also applies the method of universal doubt, which is used in the *Meditations*, to *Mathematics*:

And, on the other hand, always when I direct my attention to things which I believe myself to perceive very clearly, I am so persuaded of their truth that

I let myself break out into words such as these: Let who will deceive me, He can never cause me to be nothing while I think that I am, or some day cause it to be true to say that I have never been, it being true now to say that I am, or that two and three make more or less than five, or any such thing in which I see a manifest contradiction.

Descartes, Rules trans. by Elizabeth S. Haldane and G. R. T. Ross (2017), 426

Here Descartes once again secures specific *Mathematical knowledge* against doubt: even divine omnipotence cannot make this knowledge false.

What is new here is the mention of *contradiction* as a criterion as the reason Descartes gives for the irrefutability of the *truth* of this knowledge as otherwise a *contradiction* would arise. *Contradiction* naturally appears here as an indicator of *falsity*.

In the further course of the *Meditations*, Descartes secures *mathematical knowledge* even more globally and explicitly against his own *methodological doubt*:

Even if not everything I have meditated on in the past few days were true, the existence of God in me would have to have at least the same degree of certainty as the truths of mathematics.

Meditations, 71

Descartes here summarizes the *knowledge* of God and the *knowledge* of *Mathematical truth* as the *knowledge* to which *complete certainty* belongs. Descartes thus locates *Mathematical knowledge* outside the realm of *meaningful doubt* and inside the realm of *knowledge beyond doubt*.

Descartes creates an image of thinking that has the aim to establish *incontrovertible truth* at its core. Throughout this endeavor he repeatedly identifies *Mathematical knowledge* as an example of this kind of *incontrovertible truth* in various works.

Based on my own reading and the prominent research on Descartes, I summarize his *image of (Mathematical) thinking* through the following core claims¹³:

13 The respective points can be found as examples in the following secondary literature:

Re 1) Rozemond 2008, 41/Tarek 2020, 5

Re 2) Rozemond 2008, 41/Tarek 2020, 5/Felgner 2020, 119

Re 3) Bos 2001, 6/ Brown 1980, 24/Felgner 2020, 118

Re 4) Tarek 2020, 4/Felgner 2020, 119

Re 5) Brown 1980, 26/Felgner 2020, 113

- 1) Descartes strives for a *truth* that is characterized by *immutability* and *universality*. This *truth* is thus independent of both *human beings* and their physical occurrence. The notions of *immutability* and *universality* as characteristics of truth mark another similarity to the works of Parmenides, Plato, and Aristotle as well as to Pinker and Brooks – showcasing a transhistorical life to the mutual conceptual making of *truth*, *immutability*, and *universality*.
- 2) He strives for a method that brings only the *truth* and everything from this *truth*.
- 3) Descartes understands *clarity* and *distinctness* as unambiguous indicators of *truth*, whereby he understands *Mathematical knowledge* as only such *irrefutably clear knowledge*.
- 4) Intuition and deduction are the two epistemic methods that Descartes understands to be the methodological realizers of finding immutable truths. The knowledge of intuition is constructed by Descartes as the most certain of all knowledge and further knowledge can be deduced from it. Truth thus appears for Descartes as a system, in which individual things and ideas can be put together and related to one another.
- 5) The *contradiction* appears as a certain indicator of *falsity*, which recalls the work of Parmenides, Plato, and Aristotle and the logic of the binary.

I now draw from the work of Immanuel Kant as a second voice of Enlightenment. His work can be read to a certain extent as a reaction to the dispute between rationalism and empiricism that flared up within modern philosophy (cf. Ruml 2022, 309). In light of this dispute, Kant strives to determine the limits and possibilities of *human cognition* once and for all. This project is implemented most clearly in his main work *Critique of Pure Reason*, to which my reading in this chapter also refers¹⁴.

In his *Critique of Pure Reason*, Kant establishes a strict distinction between different modes of cognition and poses the question of the possibility of certain modes of cognition and disciplines (cf. Hintikka 1967, 364). Two of Kant's distinctions are particularly fundamental. First, he distinguishes *a priori* knowledge as knowledge independent of experience from *a posteriori*

14 Before the *Critique*, Kant had already developed a theory of mathematics in his *Prize Essay*, which, appears further developed than in the *Critique* and is why I am working with the *Critique* here (cf. e.g. Shabel 2021, 2).

knowledge as knowledge from experience (cf. Slavkow 1976, 191)¹⁵. Second, he differentiates between *analytical* and *synthetic* judgments. Analytic judgments are those that are fed by the object in question itself, for example by naming partial aspects of the definition of the object¹⁶ (cf. Kitcher 1975, 26). Synthetic judgments, on the other hand, make use of the perception of the object in question and deduce a judgment from it; synthetic judgments cannot be explicitly inferred from the object alone (cf. Shabel 2021, 3, 7).

Kant classifies *Mathematical knowledge* as judgments that are synthetic and a priori. Along with his discussion of *Mathematical truth*, he therefore also discusses the possibility of synthetic a priori judgments in general (cf. Felgner 2020, 176).

In the context of differentiating distinctions between *synthetic* and *analytical* and *a priori* and *a posteriori*, Kant elaborates the concept of *Anschauung*:

Sensory perception is either pure perception (space and time) or empirical perception of that which is immediately presented as real in space and time through sensation. By determining the former, we can obtain a priori knowledge of objects (in mathematics) [...].

Critique of Pure Reason, 131 [my translation from German to English]

Kant describes two types of intuition. Firstly, an intuition in experience, whose judgments are thus a posteriori. And secondly, a *pure intuition* that takes place independently of experience. He understands the objects of *Mathematics* as those that can be understood through this *pure intuition*.

Let us take a closer look at Kant's conception of this *Mathematical* mode of cognition and its attributes:

[...] mathematical propositions are always judgments a priori and not empirical, because they involve necessity [...]. [...] I restrict my proposition to pure mathematics, whose concept already implies that it does not contain empirical, but merely pure knowledge a priori.

At first one might think that the proposition $7 + 5 = 12$ is a merely analytical proposition, which follows from the concept of a sum of seven and five

15 A philosophical-historical classification and extensive explanation of the apriori-aposteriori distinction can be found in Russell 2020.

16 A prominent example of an analytical judgment is "Bachelors are unmarried." This judgment refers precisely to the definition of "bachelors" and is therefore analytical. For more examples and explanations, see Russell 2020.

according to the law of contradiction. However, [...] [t]he arithmetical proposition is [...] synthetic [...].

Nor is any principle of pure geometry analytic. That the straight line between two points is the shortest is a synthetic proposition. [...]

Critique of Pure Reason, 38–40 [my translation from German to English]

Here Kant first clarifies that his investigations into *Mathematics* refer to *pure Mathematics*, i.e. those whose knowledge arises a priori (independent of experience).

In this context, he also establishes a form of epistemic hierarchy between a posteriori and a priori knowledge by attributing a *necessity* to a priori knowledge that knowledge from experience cannot have. He classifies *Mathematical Knowledge* as ‘necessary, a priori knowledge.’

Kant then uses the example of the equation $7 + 5 = 12$ to explain the synthetic character of *mathematical knowledge*. At first, he writes, the equation can be taken to be analytical and one might think that the concept of the number 12 contains the fact that it can be composed of 7 and 5. On closer inspection, however, he argues, it becomes clear that this is not actually the case, but rather that one must imagine the numbers in order to establish knowledge of the equation – one must make use of *intuition*. This means that all arithmetical judgments are synthetic judgments for Kant.

Kant also understands geometric judgments as synthetic. Although there are individual analytical principles in geometry, they only take on a mathematical character because they are “representable in contemplation.” Kant thus makes representability in (pure) intuition a necessary criterion of mathematical concepts, judgments, and objects.

The character of synthetic knowledge refers to the idea of *true knowledge* as a system whose connections to further knowledge must be developed.

He goes on to write about the reliability of *mathematical knowledge* and its significance:

[...] the mathematical, is in the old possession of reliability [...]. Moreover, when one is beyond the circle of experience, one is sure not to be refuted by experience. The attraction of extending one's knowledge is so great that one can only be stopped in one's progress by a clear contradiction which one encounters. This, however, can be avoided if one's deductions are made cautiously, without them remaining less deductions for that reason. Mathematics gives us a splendid example of how far we can go in a priori knowledge,

independently of experience.

Critique of Pure Reason, 33–34 [my translation from German to English]

First of all, Kant once again emphasizes the special degree of reliability of *mathematical knowledge*. This degree of reliability functions as an ideal for other disciplines; even if they make use of fundamentally different ways of knowing, they should strive for the degree of *epistemic certainty* that Kant ascribes to *Mathematics*.

This affirmation becomes particularly clear in the last sentence of the quoted excerpt: Kant establishes *Mathematics* here as the sphere in which the *epistemic certainty* to which he aspires is fulfilled. This gives it the character of a concept that shapes the epistemic practices of other disciplines and contexts.

The second aspect worth emphasizing here lies in the role that Kant assigns to the idea of *contradiction*: it appears as *the* indicator of the *falsity* of an epistemic practice.

Kant also explicitly discusses this degree of epistemic reliability with regard to *Mathematical axioms*:

The mathematical axioms (e.g. between two points there can only be a straight line) are even general a priori cognitions and are therefore rightly called principles [...]. But I cannot therefore say that I recognize this property of straight lines in general and in itself from principles, but only in pure intuition.

Critique of Pure Reason, 280 [my translation from German to English]

Kant describes *Mathematical axioms* here as findings of a particular general validity, which, however, must also be representable in *pure perception*. Further he writes:

But to determine a view a priori in space (shape), to divide time (duration), or merely to recognize the generality of the synthesis of one and the same in time and space, and the magnitude of a view in general (number) arising from it, is a matter of reason through the construction of concepts and is called mathematical.

Critique of Pure Reason, 568 [my translation from German to English]

Here Kant conceptually links *Mathematical knowledge* and the idea of pure perception with his concept of *construction*, which is also of central importance for

his understanding of *Mathematics*: Kant defines *Mathematics* here as the construction of concepts within ‘pure perception.’

Kant expands on this understanding of *Mathematics* and uses it to differentiate between *Mathematics* and *Philosophy*. Kant describes philosophical knowledge here as that which emerges from concepts, while mathematical knowledge consists in the construction of concepts (*Critique of Pure Reason*, 560–561).

Following this distinction, Kant clarifies his distinction between *empirical* and *pure intuition*: the construction of concepts, which *Mathematics* undertakes, is an activity in *pure intuition*. This *pure intuition* is such because it has a degree of *general validity* that *empirical intuition* does not have: Kant understands pure *Anschauung* as an abstract form of *Anschauung* that contains only the necessary properties of a particular concept (*Critique of Pure Reason*, 560–561). He understands this abstraction (“the general in the particular”) as the characteristic of *Mathematics* and its distinguishing feature from philosophy. What both disciplines have in common, however, is their character as a priori knowledge. He refers to this time and time again in the further course of the *Critique*, as in this section:

All knowledge of reason is now either from concepts or from the construction of concepts; the former is called philosophical, the latter mathematical.
Critique of Pure Reason, 651 [my translation from German to English]

For Kant, all knowledge of *reason* is therefore either philosophical or mathematical, whereby *Mathematics* constructs concepts and philosophy draws knowledge from them.

In the context of the construction of concepts, pure perception plays a central role, which Kant repeatedly explains in the course of the *Critique*:

Otherwise, we distinguish by appearances that which is essentially attached to the perception of the same, and is valid for every human sense in general, from that which is only accidental to it, in that it is not valid for the relation of sensuality in general [...]. And here the former cognition is called that which represents the object in itself, but the latter only the appearance of the same.
Critique of Pure Reason, 71–72 [my translation from German to English]

Here Kant emphasizes that *pure intuition* is the intuition that is accessible “to every human sense.” Kant thus creates the concept of the “human sense” along the

lines of the idea of pure *intuition* and *Mathematics* and defines the "human sense" as the availability of specific knowledge by showing that if a priori knowledge is the knowledge that 'all humans share,' then the disposition to access this knowledge is a necessary characteristic of *being human*. If *Mathematical Knowledge* is the knowledge that *all humans* can access at any time, then the availability of this knowledge is a necessary characteristic of *being human*.

The link between *Mathematical knowledge* and the concept of *the human* becomes increasingly clear in the course of the first *Critique* and is associated with a link between *Mathematics* and *Reason*:

Mathematics gives the most splendid example of pure reason happily extending itself without the aid of experience. [...] Hence pure reason hopes to be able to extend itself as happily and thoroughly in transcendental use as it has succeeded in doing in mathematical use, if it employs there chiefly the same method that has been of such apparent use here.

Critique of Pure Reason, 560 [my translation from German to English]

What has already been hinted at in other quoted passages becomes explicit as Kant establishes *mathematical knowledge* in its a priori certainty as an ideal and model for the use of *pure reason*.

By citing *Mathematics* as a prime example of the use of pure *reason*, he renders *Mathematics* a concept that fundamentally shapes the notion of *reason*. If *Mathematics* is the example of the successful use of pure *reason*, then the idea of *pure reason* is directed towards *Mathematics* through Kant's attempt to establish epistemic certainty as the fulfillment of pure reason as which *Mathematics* appears.

Kant's link becomes even clearer in the following section:

The very dignity of mathematics (this pride of human reason) rests on the fact that, since it gives reason the guidance to comprehend nature [...] far beyond all expectations of philosophy based on common experience, thereby itself gives occasion and encouragement to the use of reason extended beyond all experience [...].

Critique of Pure Reason, 380 [my translation from German to English]

Here Kant emphasizes that *Mathematics* is a particularly sublime way of knowing and thus also intensifies its conceptual connection to *human reason* and intensifies the *Mathematics-Human* continuum present in his work. Understand-

ing *Mathematics* as the "pride of human reason" means making *Mathematics* a defining concept for both *reason* as an image of thinking and for *the human*¹⁷ as an image of being.

Accordingly, Kant's image of (*Mathematical*) *thinking* can be summarized through the following core claims¹⁸:

- 1) *Mathematics* and the axiomatic method are defined by Kant by their *necessary validity*. The knowledge they produce is construed as fully *timeless* and *reliable knowledge*. Thus, Kant conflates *Mathematics* with epistemic necessity much like Plato, Aristotle, Descartes, and Ellenberg do.
- 2) For Kant, *Mathematics* is an ideal of *universal knowledge*. *Mathematics* is constructed by Kant as the sphere in which knowledge of *absolute epistemic reliability* exists to which *pure reason* per se and other disciplines (such as those of metaphysics) should aspire. Therefore, Kant's philosophy bears its very own *Mathematics-Thinking* continuum, making *Mathematics* a reference point for *thinking* more generally.
- 3) *Mathematical knowledge* is a priori knowledge and therefore independent of the physical world and individual experience. A priori knowledge is the knowledge that *humans* have at their disposal precisely because they are *human*.
- 4) *Mathematical knowledge* is synthetic knowledge because it makes use of *pure intuition* to derive knowledge. In this dimension, Kant's conception of *Mathematics* is based on the idea of *secure knowledge as a system* and is similar to the philosophies of Parmenides or Plato in this regard.

17 For a historical and power-critical positioning of the idea of *mathematics* as the "greatest achievement of human rationality", see Hottinger 2016, 13.

18 The respective points can be found as examples in the following secondary literature:
 Re 1) Felgner 2020, 183/Kröber 1976, 183/ Shabel 2021, 2, 5, 9/ Slavkov 1976, 192, 199/ Wolff-Metternich 1995, 31, 118
 Re 2) Kitcher 1975, 36/Shabel 2020, 5/ Slavkov 1976, 200
 Re 3) Hintikka 1967, 352/Kitcher 1975, 26/Slavkov 1976, 191/ Shabel 2021, 4 and Hintikka 1967, 374/ Kitcher 1975, 24, 25/Kröber 1976, 183/Slavkov 1976, 192/Wolff-Metternich 1995, 31
 Re 4) Hintikka 1967, 364/ Kitcher 1975, 36 /Peters 1964, 158/Slavkov 1976, 192, 199/Shabel 2021, 2, 7 and Felgner 2020, 177/Slavkov 1976, 192/Wolff-Metternich 1995, 31
 Re 5) Felgner 2020, 183/Hintikka 1967, 374/ Kitcher 1975, 24, 25/ Kröber 1976, 183/Slavkov 1976, 192
 Re 6) Shabel 2020, 7/Slavkov 1976, 195/Wolff-Metternich 1995, 18

- 5) For Kant, *mathematical knowledge* appears as *human knowledge* because *Mathematical concepts* are those concepts that are available to *all humans*. In this sense, mathematical knowledge becomes a defining characteristic of *reason* and of *being human* showcasing what I have called the *Mathematics-Rationality-Human* continuum.
- 6) Kant understands *contradiction* as an objective indicator of *falsity*.

Despite their very different theories and affiliations with fundamentally different schools of thought, Descartes and Kant do share some decisive qualities in their respective understanding of *Mathematics*. These shared aspects can be summarized through the following claims:

- 1) The claim of a *universal, necessary truth* is established and is a defining epistemic value for *Mathematics*.
- 2) The universalization of 'human knowledge' occurs through the notion of *Mathematics*. Both believe that there is knowledge that is accessible to *all human beings* because they are *human*, and that *Mathematical knowledge* constitutes such particularly *human knowledge*. Thus, they both actively partake in the construction of the *Mathematics-Human* continuum.
- 3) The *contradiction* continues to be treated as a reliable indicator of *false* or *unreliable knowledge*.
- 4) *Mathematics* appears, especially in Kant, but also in Descartes, as the sphere which produces knowledge as the goal of various ways of *using reason*. Mathematics is conceptualized as proof that *the human mind* can produce such knowledge with particular quality and authority.
- 5) *Reason* and *truth* are further explained in their conceptual context as the former is the path to the latter.
- 6) Kant and Descartes deepen the idea of *truth* as a system that is closed and in which individual bodies of knowledge are linked to one another.

Core aspects of the *image of (Mathematical) thinking* that we have traced in Parmenides, Plato, and Aristotle as well as in Pinker, Ellenberg, and Brooks are found in Descartes and Kant too. Above all, the notion of *necessary, universal knowledge* remains and finds its own formulation in each theory. and *Mathematics* is constructed as an exemplary figure for the production of *necessary, reliable knowledge*. *Mathematics* is thus not only one discipline or method, but rather it is an epistemic practice as well as a symbol of the possibility of fulfilling a concept of *truth* that is rigorously based on gaining epistemic authority.

1.5 A Transhistorical Existence

The Thinking-Being of the *Mathematics-Rationality-Human* Continuum

The contemporary and historical studies of this chapter establish a transhistorical existence of *Mathematics* as an Image of Thinking that relies on a distinctly Western notion of proving, which that notions of *Rationality* and *the Human*.

All three stages of this study – the contemporary scholarship, the Ancient Greek philosophies, and the philosophies of the Enlightenment – have established that *Mathematics* as an Image of Thinking is inextricably interwoven with *the Rational* and *the Human*. *Mathematics* shapes what it is *to think rationally* and this capacity to think, according to the Image of Thinking called *Rationality*, is used to construe what it is *to be human*. I understand this interwovenness of *Mathematics* with *Rationality* and *the Human* as the pivotal transhistorical characteristic of *Mathematics*.

The inextricable nature of the interwovenness of *Mathematics*, *Rationality*, and *the Human* is crucial and results in two findings that are decisive for the continuation of this thesis:

- 1) *Mathematics*, *Rationality*, and *the Human* are not separate notions because they only exist in relation to another. Thus, they build a transhistorical continuum, which I refer to as the *Mathematics-Rationality-Human* Continuum. This thesis therefore studies this continuum with special attention to the movements of *Mathematics* in the *Mathematics-Rationality-Human* Continuum.
- 2) The existence of the *Mathematics-Rationality-Human* Continuum shows that Images of Thinking do not move merely on an epistemic level because through said continuum they are always already related to the mode of being titled *the Human*. So, the *Mathematics-Rationality-Human* Continuum shows that *Thinking* and *Being* too, constitute a continuum rather than separate entities. To understand this *Thinking-Being* Continuum is to understand that an Image of Thinking is always an Image of Being too. To account for the *Thinking-Being* Continuum created by the *Mathematics-Rationality-Human* Continuum I will use the term *Image of Thinking-Being* in continuing this thesis. This variation emphasizes the inextricable interwovenness of *thinking* and *being* as notions and as practices. Furthermore, this variation continues to align with the work of Deleuze, who deliberately did not separate epistemic and ontological questions from one another

(e.g. Deleuze 1968, 169 f and 217 f). This also means that all three players of the continuum discussed above – *Mathematics*, *Rationality*, and *the Human* – are images of thinking-being.

Finally, the thinking-being shaped through the *Mathematics-Rationality-Human* Continuum relies on Western ideals and notions, creating a form of silent sovereignty of Western interpretations of thinking-being. This Western sovereignty is implied in the *Mathematics-Rationality-Human* Continuum and shall now be explored in chapter two of this thesis.

2. Epistemic Violence as a Violence on Subjectification

Violence on the Thinking-Being-Becoming Continuum

I had ventured outside the human community, landed beyond the moral universe, beyond the realm of predictable events and comprehensible actions, and I didn't know how to get back.

Susan Brison, Aftermath (2003), xv-xvi

2.1 Violence as a Continuum

Epistemic Violence and Other Forms of Violence

Chapter One has established *Mathematics* as an Image of Thinking-Being that emerges from the *Mathematics-Rationality-Human* Continuum. All three players of this continuum share the epistemic value and framework of universalism and the generalization of specifically Western images of thinking-being (cf. e.g. Wynter 2003, Fanon 2021, Braidotti 2020, – 2018).

This second chapter explores the role of *Mathematics* and the *Mathematics-Rationality-Human* Continuum in contemporary relations of power. The notion of *epistemic violence* guides this endeavor. As I established in the introduction to this thesis, I understand the notion of epistemic violence through the work of Sylvia Wynter and in close relation with the theoretical movement of New Humanism. In this understanding, epistemic violence at its core is a hegemonic exclusion from the notion of *the Human*. Considering the thinking-being of *the Human* is created and kept alive through the *Mathematics-Rationality-Human* Continuum, as we have witnessed in chapter one, understanding *the Human* as epistemically violent calls for an exploration of the entire continuum in rela-

tion to epistemic violence. In this endeavor I draw from feminist and decolonial work on the epistemic violence of *Rationality* and *the Human*. In what follows, I will explore a) how *Mathematics* might unfold epistemic violence and b) relate these findings on the epistemic violence of *Mathematics* back to the *Mathematics-Rationality-Human* Continuum.

I understand different forms of violence as building a continuum of violence. Epistemic violence is a distinct form of violence, but not one that can be separated from other forms of violence. Epistemic violence continuously unfolds its precisely through its interwovenness with other forms of violence. Throughout this chapter sexual violence will function as a case study to illustrate the interwovenness of epistemic violence with other forms of violence. I understand sexual violence as any violence enfolded within the realm of sexuality and thus as a form of violence that always already bears an epistemic dimension. The epistemic dimensions of sexual violence will be explored in this chapter through an exemplary case that shows how epistemic violence builds a continuum with other modes of violence. The exclusion from *the human* in both concept and practice is what I understand as the common denominator moving through all forms of violence. Violence is the practice that actualizes the exclusion from *the human*, which happens because of the conceptual exclusion from *the human*, which, also realizes this very exclusion at the same time. The exclusive conception of *the human* causing the *human*-centric world of violences is *the human* that is birthed by the *Mathematics-Rationality-Human* continuum.

Sexual violence is a violence that grows from within the world that the *Mathematics-Rationality-Human* continuum builds. Sexual violence, as I understand it, is a practice of excluding as a being from the realm of *the human*. This exclusion occurs along various dimensions, which will be explored. Firstly, living through sexual violence bears the potentiality to hinder the victim-survivor in their self-understanding as *human* and thus to alter the conditions of their participation in being and becoming *human*. But even before the aftermath of sexual violence – to lean on the words of Susan Brison here (Brison 2002) – the violence itself, I will argue, comes from a place of the exclusive human. Women are subjected to sexual violence especially often precisely because they are less-human than men in the world of the *Mathematics-Rationality-Human* continuum because their thinking-being is less accounted for in the continuum-based notion of *the human*. Women of color are subjected to even more sexual violence because their thinking-being is even less accounted for in *the human* birthed by the continuum. Autistic women too are subjected to sexual violence in especially high numbers because their thinking-being too is largely

unaccounted for and largely excluded from the continuum-based *human*. And it is these exclusions from *the human* that birth many floods of sexual violence in which sexual violation is a practice of being treated someone as *not-quite-human* – it is the practice of the conceptual exclusion from the human – the consequence of being unaccounted for.

The objective of this chapter is to explore the consequences of the *Mathematics-Rationality-Human* Continuum through my notion of epistemic violence. This endeavor entails examining the consequences and dimensions of epistemic violence and their interwovenness with other forms of violence. For this aspect of chapter two, I mainly rely on three terms that I understand as inextricably interwoven: meaning-making, sense-making, and subjectification. Meaning-making describes how the attribution of meaning is formed, while sense-making, as a term, centers sensing and feeling in order to establish that epistemic violence not only permeates the analytic, definitory attribution of meaning, but rather affects all areas of minds and bodies. Subjectification is employed to explore the depth of this shaping of sense-making. Black Studies scholars such as W.E.B. du Bois (1994) and Sylvia Wynter (2003) or sexual assault survivors such as Susan Brison (2002), have established that systems of sense-making and whether our experiences fit within these systems or not, shapes how simple or hard it is for us to understand ourselves as *human* – or as rational, as *thinking* – mathematically or otherwise. I employ the term subjectification to account for this experience – this systemic hardship in knowing oneself to be *human*. My study in this chapter asks how the *Mathematics-Rationality-Human* Continuum shapes these interwoven areas of meaning-making, sense-making, and subjectification.

This chapter moves at three levels- Firstly, I study the thinking-being produced and legitimated through the *Mathematics-Rationality-Human* Continuum. Secondly, I study how the continuum and the thinking-being it allows and disallows affects processes of meaning-making, sense-making, and subjectification. Thirdly, I further develop my notion of epistemic violence by relating it to the *Mathematics-Rationality-Human* Continuum.

From chapter one, we know that epistemic violence is not purely epistemic because the epistemic and the ontological build a continuum: So, I understand epistemic violence as a violence inflicted on thinking-being and a violence that shapes and limits possibilities for thinking-being. From chapter one, we also know that the *Mathematics-Rationality-Human* Continuum builds images of thinking-being. So, now, we need to understand the implications of these images of thinking-being formed through the continuum. The notion of epis-

temic violence guides this exploration into the politics of power built into and built through the *Mathematics-Rationality-Human* Continuum.

I understand explorations of epistemic violence as explorations of the intricacies of different forms of violence as I understand epistemic violence to build a continuum with other forms of violence. This relationality and continuum of violence of which epistemic violence is part, is examined throughout this chapter. Understanding epistemic violence as a violence enacted upon thinking-being – as a silencing of marginalized modes of thinking-being, emphasizes how epistemic violence moves in a world of interrelated continua.

I proceed in six steps:

First, I introduce the current state of research on patriarchal and colonial dimensions of *Mathematics* and relate these findings to my understanding of epistemic violence. Particularly central here is the discussion of the works of Denise Ferreira da Silva (2017), Bonnie Shulman (1996), and Sara N. Hottinger (2017).

Second, I explore varying dimensions of epistemic violence. I explore how epistemic violence affects meaning-making, sense-making, and subjectification by making use of illustrative case studies in each step.

Third, I examine the notion of *credibility* in relation to the *Mathematics-Rationality-Human* Continuum.

Fourth, I explore the politics of interpretation built by the *Mathematics-Rationality-Human* Continuum.

Fifth, I examine the relation of binarism to *Mathematics* and epistemic violence.

Sixth, I close the chapter with discussing of my findings on: a) specific ways in which *Mathematics* enfold epistemic violence and b) as part of a broader examination of the epistemic violence of the *Mathematics-Rationality-Human* Continuum.

2.2 The Depth of the Continuum

The *Man*-centric World is the *Mathematics*-centric World

Now that my historical reconstruction has established the many lives of the *Mathematics-Rationality-Human* continuum, it is time to listen in on what the lives of the continuum engender. What are the continua of violence caused by the continuum? What sorts of lives does *Mathematics* as an image of thinking-

being live in these worlds of violence fashioned by the *Mathematics-Rationality-Human* continuum?

My first endeavor of examining this will draw from the work of sociologist Sara Hottinger, philosopher Bonnie Shulman, and philosopher Denise Ferreira da Silva, who have all previously examined *Mathematics* in relation to colonial-patriarchal worlds of violence. I will explore their respective work in relation to my notion of the *Mathematics-Rationality-Human* continuum.

This endeavor is guided by my notion of epistemic violence as a violence enacted upon thinking-being, i.e., a violence that shuts down the more-than and a movement of limitation that hinders what Erin Manning calls *emergent creaturing*¹. Epistemic violence is a living body, and its heart is the exclusive *human* – the *human* birthed by the *Mathematics-Rationality-Human* continuum. This exclusive *human* is both a notion and a mode of thinking-being, which builds a continuum with other notions and modes as well as with other images of thinking-being, namely *Rationality* and *Mathematics*.

The examination that follows seeks to bring the work of Hottinger, Shulman, and da Silva in conversation with my understanding of epistemic violence and of the *Mathematics-Rationality-Human* continuum. This will provide a more concrete account of the other images of thinking-being that are entangled in the constant making and re-making of the *Mathematics-Rationality-Human* continuum. As such, this analysis creates an opening for further exploration of epistemic violence in its relationality to other forms of violence and in its lives and consequences. Furthermore, drawing from Hottinger, Shulman, and da Silva will establish three core aspects of thinking-being that enfold epistemic violence: *Rationality*, *Necessity*, *Binarity*.

In 2017 Hottinger published, her remarkable discursive analysis of how the notion of the *Mathematician* is constructed in Western discourse. However, what she finds exceeds a study of a representation of *Mathematicians* because she comes to study what she terms *Mathematical subjectivity*, i.e., a notion and a mode of subjectivity that references *Mathematics* as an image of thinking-being. Much like I do with my notion of the *Mathematics-Rationality-Human* continuum, Hottinger too emphasizes how subjectivity derived from *Mathematics* exists in relationality to other images of thinking-being:

1 The notion of emergent creaturing is established by Erin Manning in *For a Pragmatics of the Useless* as an expression for relationality that is not human, but more-than human or as she puts it the 'coming into relation' that does not hinder all that is in non-accordance with *the human* (Manning 2020, 63).

I trace the entangled relationship between the construction of mathematical subjectivity and the construction of Western rationality and subjectivity; these constructions both define what it means to be human and limit who is allowed to see themselves within that ideal.

Inventing the Mathematician, 47

Hottinger establishes how *Mathematical subjectivity* is an implicit point of reference for Western concepts of *Rationality* and *subjectivity*. Through the life of *Mathematics* within *Rationality* and *subjectivity*, *Mathematics* becomes part of 'what it means to be human.' This is precisely what my notion of the *Mathematics-Rationality-Human* continuum describes in its portrayal of *Mathematics* as an image of thinking-being and as a form of inhabiting subjectivity, which is mutually interwoven with *the Rational* and *the Human* as images of thinking-being and as modes of subjectivity. Hottinger too understands the interwovenness of *Mathematics* with *the Rational* and *the Human* in relation to power relations when she writes: "Those who are Othered in the West are also Othered (conceptualized as 'the other' to an alleged norm) in mathematics" (Hottinger 2017, 163). Here Hottinger asserts that *Mathematical subjectivity*, like *Rationality* and the *Human*, is interwoven with the question of who is 'the other.' and *Mathematics*, as an image of thinking-being, constructs who is 'the normal human' and who is not – it makes 'the other,' in concert with *Rationality* and *the Human* as images of thinking-being.

In her analysis of Othering constructed through *Mathematical subjectivity*, Hottinger centers *race*, *gender*, and *class*. as it is femininity, blackness, and non-bourgeois social classes that are excluded from the *Mathematical*, from *the Rational*, and *the Human*. The notion of *Rationality* is a central mediator in the *Mathematics-Human* continuum and bears many histories of colonial-patriarchal exclusion that have been brilliantly examined by scholars such as Sylvia Wynter (e.g. 1994, 2003, 2006) and Sandra Harding (e.g. 1982). Hottinger writes the following on the relation of *the feminine* and *the Rational*:

We, as a culture, simply cannot process the feminine in relation to mathematical rationality. [...] as a culture we understand reason, rationality, and mathematics and antithetical to the feminine.

Inventing the Mathematician, 46

Hottinger here further establishes *Mathematics* as a mode of *Rationality* that comes into existence precisely through and because of its exclusion of *feminine*

modes of thinking-being. Just like *reason* and *Rationality*, *Mathematical thinking* comes into itself as an image of thinking-being through its construction in opposition to *the feminine*. This is to say, *Mathematics* as an image of thinking-being moves with a binary conception of gender in its heart and bones and this binary conception exists through the hierarchized *Rationality-Emotionality* binary.

In my historical reconstruction of *Mathematics*, I have established that the logic of the binary and the logic of separability move through *Mathematics* deeply and characteristically. This is to say that *Mathematics* as a mode of thinking-being draws from existing dualisms – such as the *Rationality-Emotionality* dualism and from a general invocation to think within a logic of binary and a logic of separation. The logic of the binary thus fashions *Mathematics* and is fashioned and authorized my *Mathematics* at the same time.

Shulman too examines this mode of thinking and identifies it, as Hottinger does, with Western intellectual history:

Our Western theories are so dominated by the oppositions between mind/body, emotion/reason, thought/desire (and the linkages with rational masculinity and emotional bodily femininity), that we find it almost impossible to conceive of reality in any other terms.

What If We Change Our Axioms?, 432

Shulman thus establishes the normalization of hierarchized dualism as embedded so deeply into Western understandings of *thinking* that they automatically structure our sensing and meaning-making of the world and our very ways of living. She situates this inclination to dualism, to take up the logic of perceiving the world with notion of binarity in its political dimension:

Since the Sophists were Plato's political as well as philosophical rivals, the defeat had to be final, not merely a debate between rhetorical systems. Logic had to be defensible as reflective of a higher reality. It had to appear to be above and beyond any political agenda. Thus, it was necessary to assert the independent and prior reality of these Platonic Forms if the dialectical practice was to have final authority.

What If We Change Our Axioms?, 434–435

Shulman situates *axiomatic Mathematics* as having its origins in Ancient Greek philosophy and contextualizes it by reference to how the in the concept of 'a

knowledge with final authority' as we have witnessed it in Plato's construction of *Mathematics*, is intrinsically political because it implies a search for a final, untouchable knowledge. It is also intrinsically political, in the sense described by philosopher Isabelle Stengers as a question of authority (Stenger 2000, 102 f.). So, the 'epistemic certainty' conflated with *Mathematics* by Plato, Aristotle, Descartes, and Kant as well as Pinker and Ellenberg is to be understood as a struggle for epistemic authority – that is a struggle for political authority. Shulman further explores this in relation to the axiomatic method as an *image of (Mathematical) thinking*:

This view of mathematics as a deductive system is linked with the assumption that mathematics constitutes a body of infallible or absolute truths. [...] *Upapatti*, or the Indian proof, is viewed as a 'convincing' demonstration [...]. [...] the *Upapatti* are not about 'compelling assent' but rather are more concerned with communication than control [...].

This draws attention to the distinction between utility and verisimilitude (workability and truth) as the goal of knowledge-making. Workability is defined from within particular projects situated at a time and place. Truth is defined by standardized methods (obedience to predetermined criteria) which deny contingent and subjective intrusions [...].

What If We Change Our Axioms?, 436

A politicized understanding of the notion of *proof* helps us see how a distinct notion of *proving* arises in the context of the *Mathematics-Rationality-Human* continuum. A notion in which, as the conceptualization of *Mathematics* as a 'body of infallible truth' is upheld through a distinctly Western notion of *proving* that is understood as an intellectual method bringing about 'infallible knowledge.' The *Mathematics-Rationality-Human* continuum and the epistemic violence it births thus move with this distinct notion of *proving* as one of the modes of thinking-being that is made by and upholds the continuum-based world. This notion of *proving* and its interwovenness with the concept of *Mathematical necessity* thus have direct bearings upon questions of subjectivity – as the work of da Silva teaches us:

When considering the "Subject without properties" it is always helpful to recall [how it emerged] to describe the world in such a way as to make it possible to establish that the human mind can know the truth of things in it without the need for divine revelation? [...]

For Descartes locates efficient causality in the very movement of thought

that establishes *I think, therefore I am* as the ultimate ground for ontological and epistemological statements. He was not the first or the only one to make a case for replacing syllogistic logic with mathematical necessity; Galileo had done the same.

$$(\text{life}) \div 0 (\text{blackness}) = \infty - \infty \text{ or } \infty / \infty, 4-6$$

Da Silva speaks of the 'subject without properties' as a distinctly white and Eurocentric understanding of *the subject*. Such an understanding in which – the subject is supposedly 'neutral,' and *without properties*. She contextualizes this notion of subjectivity as an answer and a reaction to a conception of *the human* as other to the world and to truth that emerges when one seeks to both conceptualize *the human* as a 'subject without properties,' while still conceptualizing *the human* as 'having access to truth.' Resultingly, a distinct notion of *subjectivity* arises – one in which the notion of *Mathematical necessity* becomes the cornerstone for existence: the *proof* for being. Da Silva further examines this notion of Mathematical necessity and the lives it lives:

Both the scientific and ethical figurings of determinacy would enter into nineteenth-century scientific accounts of human difference, which produced the notions of racial and cultural difference. [...] Further, these procedures deploy the European/white mind as the universal gauge, since it alone shares a key quality with universal reason [...], namely, self-determination. In this way, this earlier moment of racial knowledge yielded indexes of human difference [...] that transformed economic differences resulting from conquest, colonization, settlement, and enslavement into presentations of [...] universal reason [...].

$$(\text{life}) \div 0 (\text{blackness}) = \infty - \infty \text{ or } \infty / \infty, 10$$

Da Silva understands *Mathematical necessity* to be part of the conceptual underpinnings of the idea of *determinacy* that shapes conceptualizations of 'human difference.' The notions of *Mathematical necessity* and *determinacy* birth the notion of *universal reason* that characterizes and universalizes the notion of *the human* as European/white. It is therefore distinctly the notion of *necessity* – a notion birthed through *Mathematics* as an image of thinking-being – that establishes this universalization. *Mathematics* is part of forming the universalization of the European/white human by instituting *necessity* as a notion that legitimizes and conceptually de-politicizes universalization. The universalization of one mode of being *human* is what brings about the world, in which some life *matters* more – possess more *value* – than another life:

Why don't black lives matter? [...]

Let me briefly elaborate on this by situating blackness in the Kantian design of the modern ethical scene of value. Here, as we know, the guiding ethical entity is humanity, which Kant describes as the sole existing things possessing dignity, that is, possessing intrinsic value. Among existing things, humanity [...] alone shares in the determining powers of universal reason, since it alone has free will, or self-determination. [...]

My point here is that the very arsenal designed to determine and to ascertain the truth of human difference already assumed Europeaness/whiteness as the universal measure, that is, as the bodily, mental, and societal actualization of universality.

$(life) \div 0 (blackness) = \infty - \infty$ or ∞ / ∞ , 11

Da Silva here establishes how we come to inhabit a world in which 'black lives don't matter.' *The human*, as conceptualized by Kant, is the only creature possessing intrinsic value. This value is ascribed only to this particular mode of being *human* through the notion of universal reason. It is therefore the *thinking* the being in question partakes in that decides the value ascribed to the life of that respective being and its status as a being. *Mathematics* shapes which *thinking* is the *universal thinking* – which *thinking* is the *thinking* that qualifies one as *human*, which makes one's life possess intrinsic value. As such, the *Mathematics-Rationality-Human* continuum governs whose lives are *human lives* and thus *lives of value*.

The work of da Silva bears crucial similarities to the work of Sylvia Wynter on the exclusivity of *the human*. Wynter speaks of the *Man*-centric world as the world that creates a universalized, but distinctly male and Western version of *the human*. This *Man*-centric world is the *Mathematics*-centric world too. Building on the work of da Silva, as we can derive that it is *Mathematics* that conceptually determines the universalized *human*. The notion of the *Mathematics-Rationality-Human* continuum aims to speak to this relation and to the relation of the *Man*-centric world as being the *Math*-centric world too.

Through thinking-with Hottinger, Shulman, and da Silva I identify three aspects of *Mathematics* as an epistemically violent image of thinking-being: a) the logic of *binary*, b) the notion of *necessity*, and c) the notion of *proving*. I will further explore each of these three aspects in its respective relation to *Mathematics* as an image for thinking-being.

The aim of this examination is twofold: First, to further make sense of *Mathematics* as a form of epistemic violence. Second, to situate epistemic violence as a form of violence that builds a continuum with other forms of violence.

2.3 Violence as a Continuum

Sense-Making, Meaning-Making, and Subjectification in the *Mathematics*-centric World

Before examining the three epistemically violent aspects to *Mathematics* I have just established, I will deepen my account of epistemic violence building a continuum with various other forms of violence. I understand epistemic violence to affect sense-making, meaning-making, and subjectification in a limiting manner that is in a manner that deepens the exclusion of marginalized positions and their thinking-beings.

Both sense-making and meaning-making are shaped by epistemic violence and actualize epistemic violence through the exclusions they carry out. I understand both notions in inextricable interwovenness with epistemic violence and *the human* as the epistemically violent exclusions from the human are woven in and carried out through normalized practices of sense-making and meaning-making. My notion of epistemic violence conceptually guides this chapter and will therefore take up the most space. However, sense-making and meaning-making are always being echoed whenever I utter the notion of epistemic violence because they are how the exclusions from *the human* – that I term epistemic violence – are continuously made, actualized, and transhistorically kept alive.

As I have established before I believe the exclusivity of the notion of *the human* to live at the very core of epistemic violence and to be the heartbeat of violence more generally. I will establish here that sense-making, meaning-making, and subjectification are interwoven with one another and live in a relationship of mutual construction with the exclusive *human*. Thereby, the limitations placed on the forms given to sense-making, meaning-making, and subjectification by the epistemic violence of the continuum, uphold the exclusivity of *the human*.

Let me further establish this account by recalling Wynter:

[...] we [the blacks] are the bearers of "human otherness" to the West's conception of "Man." If we are the bearers of "human otherness," it means that

the world of the human remains subordinated to the world of "Man."
Sylvia Wynter, PROUD FLESH INTER/VIEWS: SYLVIA WYNTER, 15

The Man is the universalized 'genre of being human.' It is the thinking-being of *the human* that is brought to life and kept alive by the *Mathematics-Rationality-Human* continuum. And as Wynter writes this exclusive image of thinking-beings call the *human* construes black lives as the ones 'other to the human.'

In other parts of her work Wynter establishes that the universalized *human* is not only white, but also *male* and *bourgeois* as *the human* universalizes the very distinct lives and the thinking-beings, of those with the most power historically (Wynter 2006 B).

As I have briefly established in the beginning of this chapter, I understand there to be a relation of *the human* to sexual violence constituted by many lives. This is one of the many consequences of what Wynter describes as the exclusivity of *the human* and as da Silva established – over whose lives possess value. It is *the human* that governs whose bodies and whose sexualities are of 'intrinsic value' as well as whose sexual bodies and bodyings are human enough to remain unscathed and unviolated. It determines the degree to which one's thinking-being participates in the thinking-being of *the human* that decides one's vulnerability to sexual violence. Furthermore, once a person has lived through sexual violence, they will be estranged from the realm of *the human* precisely because of their survival and the violence they have lived through:

Ten years ago, a few months after I had survived a nearly fatal sexual assault and attempted murder in the south of France, I sat down at my computer to write about it for the first time and all I could come up with was a list of paradoxes. Things had stopped making sense. [...] I turned to philosophy for meaning and consolation and could find neither. Had my reasoning broken down? Or was it the breakdown of reason? I couldn't explain what had happened to me. [...] I had ventured outside the human community, landed beyond the moral universe, beyond the realm of predictable events and comprehensible actions, and I didn't know how to get back.

Aftermath, Susan Brison, ix-x

Susan Brison describes the afterlife of her survival of rape as one in which she '*had ventured outside the human community*'. She arrives at this feeling, this conclusion of her non-humanness after having detailed how her writing and her thinking consist of *contractions* since surviving the assault whereby it is her

thinking – in particular her *thinking* in contradictions – that excludes her from being *human*. As we have witnessed in the historical reconstruction of *Mathematics*, contradiction is constructed as the ultimate irrationality and the ultimate signifier of error, and of falsity. This concept of ‘the contradiction as a signifier of error’ is authorized through *Mathematics* as an image of thinking-being and through the notion of *Mathematical proving*. So, Brison describes thinking and writing in contradictions and feeling that ‘her reason broke down.’ As such, she considers her own non-humanness to be a consequence of the feeling of ‘a breakdown of reason’ because in the world authored by the *Mathematics-Rationality-Human* continuum, it is the participation in reason, and in this particular thinking that qualifies one as human. Brison’s survival, however, makes her inhabit a thinking-being in non-accordance with the thinking-being of *reason*. Her survival makes her inhabit a thinking-being that is excluded from *the human*.

As she can no longer sense herself as *human*, she cannot attribute meaning to her experience by the modes of thinking she had previously known and cannot inhabit a ‘human subjectivity’. As a result, these interwoven layers of epistemic violence shape her sense-making, meaning-making, and subjectification – the *non-humanness* – she faces.

So – as Hottinger established – there is an exclusive subjectivity, one that is device for determining *how human* one is. When a person is degraded or violated, the violence is thus not necessarily an ascription of the status of ‘an object,’ but might also take the shape of a subjectivity or a subjectification that is simultaneously rendered exclusive. Cultural and literary theorist Saidiya Hartman examines *subjectivity* in a similar vein when writing on enslavement:

I argue that the barbarism of slavery did not express itself singularly in the condition of the slave as object but also in the forms of subjectivity and circumscribed humanity imputed to the enslaved. [...]

The enduring legacy of slavery was readily discernable in the travestied liberation, castigated agency, and blameworthiness of the free individual.

Saidiya V. Hartman, Scenes of Subjection, 5–7

Here Hartman establishes the notion of *the subject* as an integral aspect of enslavement as the restricted participation of enslaved people in *the human* is integral to their enslavement. *The human* is a *subjectivity* that is demanded while it is restricted through the *Mathematics-Rationality-Human* continuum and of thinking-being.

So, epistemic violence moves to create an exclusion from *the human* and as a shared denominator of different forms of violence. Epistemic as well as other forms of violence share the infliction of this exclusion from *the human* through interwoven layers of sense-making, meaning-making, and subjectification.

I will now further explore *Mathematics* as a form of epistemic violence in relation to other modes of violence by examining each of the previously established epistemically violent aspects of Mathematics in their own subchapter.

2.4 The Hegemony of Rationality

Epistemic Dimensions of Sexual Violence

This section further explicates how the notion of *epistemic certainty*, as established by *Mathematics*, is as a form of epistemic violence. In this endeavor, I establish how *Mathematics*, as an image of thinking-being, fashions notions of *Rationality* and *credibility*. These notions of *Rationality* and *credibility* are a) established through the notion of epistemic certainty authorized by Mathematics as an image of thinking-being and are b) built to discredit victim-survivors of sexual violence. This section will thus further establish *Mathematics* as a form of epistemic violence and showcase violence as a continuum by examining the relationship of sexual violence and the *Mathematics-Rationality-Human* continuum with regards to *Rationality* and *Credibility*.

In doing so, I do not aim to produce a comprehensive examination of the epistemic dimensions of sexual violence. Rather, I take up a case study of sexual violence as a in order to make the lifeworld and socio-political consequences of epistemically violent notions of *Rationality* and *Credibility* tangible. Furthermore, this case study serves as an initial exploration of the interconnectedness of forms of epistemic violence with other forms of violence. To do so, I first locate the question of *credibility* in the context of sexual violence and from there move on to *Mathematics*.

Testimonies of sexual assault, whether they take place in the media or in person, are accompanied by questions of *credibility*. This could recently be observed in the media in the accusations against the German band Rammstein²:

2 Content Note for descriptions of sexual violence:

The German band Rammstein, internationally known for many decades, faced various severe allegations of sexual assault in the summer of 2023. In particular, lead singer Till Lindemann has been reported by many women to have drugged and sexually abused

With every testimony from a woman, hundreds of questions, assessments and calls were raised around the issue of her *credibility*. Being *credible* usually exists as a demand that is as unspecific as it is persistent. Those affected must study this obscure criterion as they must decipher it and fulfill it. These attempts to fulfill credibility have different levels. They have an intrinsic level: a need to believe oneself, to trust one's own perception and naming – in short, to experience oneself as *credible*. There is also an extrinsic level: a need to be believed, to have one's own experience not denied but taken seriously, to react to it and act on it – in short, to be experienced as *credible*. Both of these levels are interwoven and can exist simultaneously or individually. Susan Brison, for example, describes how she did not experience any questioning of her story thanks to evidence that was perceived as unambiguous (Brison 2017). However, this does not spare her the ongoing struggle to take her own experience seriously and to perceive herself as *credible* and *rational* (Brison 2003, 2017). In the time after her rape, Brison experiences herself as outside of the *human* and outside of the *rational* (Brison 2003, ix). Her perception of what she has experienced and continues to experience after the crime seem to lie outside of what her life consisted of before. I assume that there is a close connection between the idea of *credibility* and that of *Rationality* as both concepts form norms that shape the experiences and expressions of victims.

When aspects of our expression or experience lie outside of the idea of *credibility*, it does not necessarily mean that an experience of violence is denied as such. This denial does take place, and it takes place to a specific extent in the context of sexual violence (Brison 2017). However, this direct denial is not the only way to consign people, modes of expression or worlds of experience to a supposed 'outside of credibility.' Exclusion from the idea of *credibility* can also take the form of conceptualizing certain aspects of one's own experience or expression as *implausible*. Brison, for example, experiences continual devaluations of her philosophical work on sexual violence in which *rape* is understood by her philosophical peers as a biographical element specific to her. This

them – the sexual abuse often being especially brutal and physically harmful and leading women to awake from a state of unconsciousness due to heavy bleeding.

When an increasing number of women came forth, many fans as well as a wider public denounced the accounts of the women who had come forth or would withdraw from the conversation by saying they would 'wait for proof.' Till Lindemann and Rammstein faced various forms of feminist resistance but ended up successfully touring that same summer as well as the summer after, in 2024.

is the only existence that is conceded to *rape*. It is explicitly not understood as a philosophically relevant topic. Instead, Brison is summoned by superiors and encouraged to turn her attention back to the "real questions of philosophy" following the completion of her personal coping with *Aftermath*. I also see a question of *credibility* in this experience of Brison as Brison is believed to have been raped but is not believed when she says that *rape* is a structural problem or that it is of philosophical relevance or that she knows how to assess this topic in all its dimensions. Even here, then, there is an exclusion from the idea of *credibility* that affects Brison specifically in her marginalization as a *raped woman*.

However, the question of *credibility* often also relates to the violence itself. People who report experiences of sexual violence often experience one of two reactions, or a mixture of both, in and out of court in which their naming of the violence is seen as an *exaggeration* or their story is not doubted, but they are denied the right to tell it, or they are accused of a conscious or unconscious form of lying, whereby the story as such is denied. Both of these strategies, as well as Brison's experience, which takes place in the context of the recognition of rape, reflect exclusions of *credibility*.

In her essay *Men explain things to me*, Rebeca Solnit writes about a conversation in which her professional expertise as an author is not acknowledged. She recounts and negotiates the experience and finds herself at the end of the essay in a description of court proceedings on sexual violence (Solnit 2019, 11). In an epilogue, she describes how she was initially surprised to have written about rape in her processing of this conversation. However, she quickly realized that the core theme of her essay is the question of *credibility* and that it is precisely this idea of *credibility* that connects the annoying party conversation with the courtroom as patriarchal criteria of *credibility* are produced and reproduced in both situations (Solnit 2019, 11). And, according to Solnit, *credibility* is ultimately a question of survival (Solnit 2019, 28 f.). This dimension of survival also has many dimensions. Survival can be about access to protection and resources or also about one's own survival – the attempt to feel *human* again after experiencing violence and to inhabit a lifeworld again that does not just feel *outside* of hegemonic norms.

The implicit and explicit demands for the *credibility* of modes of expression, ways of life, narratives, and names imply *credibility* as a form of superior authority and in doing so, implicitly or explicitly, refer to *rationality* as a concept, *Credibility* is assumed to be something that can be clearly assessed and can be fulfilled equally by all. In doing so, reflection on the fact that criteria of *credibil-*

ity are established and maintained by society and conceptually include socio-political exclusions is preempted.

The concept of *credibility*, I argue, is conceptually intertwined with the *rationality-emotionality-binarity* because *emotionality* serves as one of the most prominent criteria for *non-credibility*. Another criterion of credibility is lack of *contradiction*. Narratives that show *contradictions* or expressions that are understood as *emotional* serve as prominent criteria, in the context of testimonies about sexual violence as well as in other cases, for conceptual exclusion from the idea of *credibility*. In this sense, *rationality* appears implicitly in the demands for *credibility*. Both concepts, are conceptualized in their essence through their opposition to *emotion* and *contradiction* and thus order, organize, include and exclude (Jones 2002, Harding 2009, Shulman 1996, Nye 1990). Moreover, both concepts assume the possibility and desirability of a *neutral point of view* without subjecting the criterion of neutrality itself to scrutiny. In the search for *Rationality* and *credibility* lies a search for *unambiguity*, which I propose to look at by considering the concept of *proof* as a constitutive idea of *Rationality* and *credibility*. The demand for *proof* is also a prominent reaction to testimonies of sexual violence and as such it is similar to the ideas of *credibility* and *Rationality*, as it is also about realizing an ideal of *determinability*.

Such a concept of *proof* suggests a conceptual interweaving with *Mathematics* and pose the following questions: what conceptual connections exist between the concept of proof in *Mathematics* and that non-mathematical concept of proof that becomes effective, for example, in the media, personal and legal settings as well as in political disputes regarding sexual violence?

As an initial insight into these entanglements, let us first consider the rhetorical effect and political efficacy of the demand for evidence in response to testimonies of sexual violence. These demands for evidence are closely interwoven with two central narratives. The first is that there is a substantial probability that the narrative is untrue and thereby fundamental doubt is correct. Secondly, there is a possibility of *evidence* that actually creates *clarity* about the specific case and thus also about the fundamental use of the term sexual violence.

The first of these narratives is essentially rooted in patriarchal social structures. That incline us to believe as we grow up or have a preference with for seeing sexual violence as major exceptions, so-called isolated cases, or as something that is supposedly far removed from modern Western culture. This preference is personally, politically and epistemically relevant and it results in said fundamental doubt, especially in the light of empirical data that impressively

demonstrates the rarity of false statements (see e.g. Leithead 2021, Kay 2018, NSVRC 2012). The second narrative refers to the epistemic, political and personal need that the demand for evidence seeks to fulfill: a need for *unambiguity* and ‘seclusion of knowledge.’ This desire for unambiguous knowledge, according to my argument, exists for the respective case and also explicitly beyond it. The question of whether a testimony of sexual violence can be *proven* requires criteria (*criteria of proof*) about the *correctness* and *incorrectness* of the application of the term ‘sexual violence.’ If a specific narrative is classified as *proven* or *disproven* in the media, legally, or personally, this shapes a certain understanding of *sexual violence* as a whole.

The notion of *proof* demands *unambiguity*, *neutrality* and *closure*. Thus, assuming that sexual violence can be *proven* means assuming a *politically neutral* concept of *proof*, *sexual violence*, *sexuality* and *violence*. And it is this credo and this power-political search for a *neutral*, *universal* perspective that is reproduced in *Mathematics*. The concept of proof in *mathematics* forms a conceptual basis for non-mathematical concepts of proof, which are interwoven into the very same power-political search for interpretative sovereignty which *mathematics* exerts.

The concept of *Mathematical proof* secures the socio-political idea – the possibility, desirability and necessity of a closed, unambiguous, and universal knowledge. The *Mathematical proof* is implicit reference in non-mathematical concepts of *proof*, such as those used in the context of sexual violence³. I also see this conceptual interweaving of the idea of *Mathematical proof* in the concepts of *credibility* and *Rationality*; both of these terms cultivate an existence as epistemic ideals as well as rhetorical and political figures. The efficacy of rationality and credibility can only exist against the basic collective assumption that *total knowledge* (unambiguous, complete, and universal) can be produced by *humans* and that the production of such knowledge is desirable – even necessary. My core argument here is to point out that both of these basic premises are fundamentally secured by *Mathematics* as a concept. In this sense, *Rationality*, *credibility* and concepts of proof implicitly refer to *Mathematics* as they are committed to those ideals of knowledge and basic methodological ideas that *Mathematics* is considered to fulfill.

The notion or demand of *credibility* as faced by victim-survivors of sexual violence is a form of epistemic violence. It is a notion built on excluding those

3 This analysis evokes feminist discourse on evidence that cannot be recaptured here but is crucially shaped by the voices of Francis and Smith 2021, Childs and Ellison 2000, Bryden and Lengnick 1997 or Hunter 2000.

who have faced sexual violence and its survival. It does so by excluding those who are less-*human* or non-*human* according to the standards set by the continuum-based *human* – the *human* grounded in the *Mathematics-Rationality-Human* continuum. This epistemically violent notion of *credibility* restricts access to legal and social resources and further restricts one from being experienced as *human*. Resultingly, this exclusive notion of *credibility* is birthed by the exclusive *human* and further establishes the exclusive *human*: exclusive *credibility* partakes in the continuous making of the exclusive *human* i.e., the *Mathematics-centric human*.

I have established here that this exclusive *credibility* – *human credibility* is established through a *Mathematics-centric Rationality* and through the notion of *proving* birthed by *Mathematics* as an image of thinking-being. Both *credibility* and *Rationality* conceptually reference the *Mathematics-centric* notion of *proof* and are conceptually authorized by their interwovenness with the idea of *proof*. This conceptual interwovenness is especially explicit when victim-survivors of sexual violence are evoked to provide proof of what happened to them in order to be understood as *credible* in their accounts. However, this same interwovenness of *proof* with *credibility* and *Rationality* is prevalent in a multitude of ways. Victim-survivors live the ‘contradiction as falsity’ – logic in the context of sexual violence, as they are regularly attributed ‘contradiction’ or ‘contradictory behavior’ as a means of allegedly showing them as non-*credible*, non-*Rational* – and thus non-*human*. This figure of ‘contradiction as falsity’ is one of the instances showing how exclusive notions of *credibility* and *Rationality* are rooted in an axiomatic idea of *proof* as well as in *Mathematics*.

The world grounded in the *Mathematics-Rationality-Human* continuum births the axiomatic proof and exclusive credibility; both are symbols of the continuum-based metrics as well as actors in upholding the bodies of the *Mathematics-Rationality-Human* continuum and the epistemic violence of the continuum.

2.5 Struggles for Interpretative Sovereignty Necessity as Dominance

As I have established in my reconstruction of *Mathematics* in chapter one, the notion of *epistemic necessity*, of ‘necessarily true knowledge’ is established in a conceptually continuous relationship with *Mathematics* – more concretely – with the figure of *Mathematical necessity*. As Shulman and Stengers demon-

strate, the notion of 'epistemic certainty' built into the notion of *necessity* is a question of power because it is a question of epistemic authority, of interpretative sovereignty, and of narrative power. The notion of *necessity* is construed as a mode of thinking-being and a quality of specific forms of knowledge. The knowledge to which *necessity* is attributed is the knowledge that gains distinct epistemic authority. Thus, I explore the notion of *necessity* as a) being established through *Mathematics* and b) enfolded epistemic violence in the form of fashioning an interpretative sovereignty that limits and silences marginalized narratives, accounts, and thinking-beings. In each case of all four of my explorations of *Mathematics* as epistemic violence, I will draw from sexual violence as a case study.

I understand the epistemic control enacted through the notion of *necessity* as a form of epistemic violence in the sense that it is an attempt to control narratives and epistemes that move in accordance with the *Mathematics-Rationality-Human* continuum. As such, *Mathematics* is the image of thinking-being that births and is implied by those notions of necessity that foster epistemic control.

I will begin by examining the notions of epistemic control and dominance as forms of epistemic power. In my consideration of sexual violence, I highlighted demands for *proof* and *credibility*. These conceptions are as fundamental as they are inaccurate and are therein a tool for exercising epistemic dominance as they claim sole and total dominion over processes of naming, narrating, interpreting, signifying, and evaluating. Kate Manne describes forms of such control and dominance on an epistemic level as integral components of sexual violence, its normalization, and thematization. Manne characterizes the control over the naming and non-naming of an act as a patriarchal, male-dominated exercise of control that has an unsettling effect on sexual violence (Manne 2018, 4 f.). This uncertainty extends throughout the existence of sexual violence – in its systemic components as well as in very specific cases. According to Manne, the classic narrative of sexual and domestic violence is that it is a mistake or an escalation, but not *sexual violence* (Manne 2018, 7).

The implication here is that violence – especially patriarchal forms of violence – form a very specific, particular category of action, i.e., something that rarely or never occurs and that *cannot simply be asserted*. The paradox lies in the fact that concepts of *sexual violence* and *domestic violence* are placed outside the norm, while at the same time those very forms of violence are continually normalized and thus conceptualized precisely as the norm. The naming of violence is thus de-normalized while the violence itself is explicitly normalized. This

paradox is one that secures power in rendering even the act of naming *domestic violence* or *sexual violence* *implausible* in principle. This is due to the fact that according to prevailing conceptual networks, these forms of violence are *eternally different* – meaning they take place in *a different place*, in *a different time*, or take place at the hands of *other people* (Manne 2017, 34). This supposed demarcation also conceptualizes the apparent unambiguity of the term *sexual violence*.

Cases and issues of sexual and sexualized violence are thus understood in binary terms. It is sexual violence, or it is *not* sexual violence. The result is the appearance of unambiguity and binarity. This view makes it impossible to discuss what is considered as sexual violence, nor what is considered as the sexual norm or “abnormal.” Instead of a common process of interpretation and understanding, questions of sexual violence become a question of *being right and wrong*, which exists legally, politically, personally and epistemically as all these dimensions are closely interwoven and intrinsically related to each other.

My argument is that this way of looking at and treating sexual violence follows the axiomatic logic that Shulman describes and problematizes. This thematization represents a transfer of the axiomatic way of thinking to the topic of sexual violence as an epistemic system that distinguishes between *true* and *false* through the criterion of *contradiction* is imagined. The central epistemic ideal of the axiomatic method is *necessity* – the *inevitability* of knowledge. Interwoven with these ideals of *necessity* and *inescapability* are the concepts of *universalism* and *neutrality*.

At the core of all these ideas is what Shulman calls the desire for epistemic control – understood as being able to force someone to say or not to say something (Shulman 1996, Nye 1990). It is the desire for epistemic dominance in a very literal sense whereby one is able to control what is said and not said and how it is interpreted and not interpreted. The ideas of *necessity*, *inevitability*, *universalism*, and *neutrality* are to be understood in t as tools for exercising such epistemic control. They imagine and conceptualize that ‘epistemic univocity’ that must be assumed in order to enable, legitimize, normalize, and even affirm forms of epistemic control and dominance. The normalization of the search for and exercise of epistemic control is a central element of epistemic power protection as it enables invisibility of these dominating relations of power and thus a (largely) unhindered continuation of power and violence.

Mathematics serves as a central conceptual safeguard and source of legitimization of the practices that seek and have epistemic control. *Mathematics* exists implicitly as an image of thinking in all those epistemic practices that fundamentally serve the production of epistemic dominance. *Mathematics*

secures the idea of the possibility and desirability of epistemic control and produces an imaginary of legitimate epistemic control by creating methodological and epistemic ideals that supposedly legitimize the claim to epistemic dominance. The notion of legitimacy, even desirability, of epistemic dominance feeds ideas of *rationality/irrationality*, *credibility/incredibility* and their political and personal consequences as those narratives, persons or modes of expression that become legible as *irrationality* or *untrustworthiness* become objects of epistemic dominance and are themselves excluded from this form of control.

Mathematics as an image of thinking produces standards for the exercise of epistemic control as it legitimizes and affirms epistemic dominance as *scientific* or *progressive* (e.g. Pinker 2018). However, the good of epistemic control remains exclusive to existing power relations. *Mathematics* is Western and patriarchal in its core project of producing and affirming epistemic coercion, and it is Western and patriarchal as to whom these forms of exercising power accrue.

The particular normalization of epistemic control, which emanates from *Mathematics*, makes it a central player in processes of epistemic power and itself a carrier of epistemic violence. *Mathematics* exists as the ultimate conceptual safeguard in the production and reproduction of epistemic dominance. This safeguarding of interpretative sovereignty through epistemic dominance takes place in four dimensions: 1) *Mathematics* forms a point of reference for every other concept of proof; 2) *Mathematics* forms a point of reference and conceptualizes the legitimization of struggles for epistemic control; 3) *Mathematics* functions as a supposed *proof* of the possibility and desirability of a certain kind of truth, a *neutral* kind of knowledge; and 4) *Mathematics* provides a specific image of what *knowledge* should look like in order to be considered as such.

Mathematics as an image of thinking-being is part of endeavors of epistemic control as they come into existence through the notion of *necessity* birthed by *Mathematics*. This *Mathematical necessity*, as established in chapter one, is part of *the Rational* and *the Human* too; the knowledge derived through *necessity* is the knowledge construed as the most valuable knowledge of *human thinking* thus making *necessity* into a conceptual cornerstone for the *Mathematics-Rationality-Human* continuum.

2.6 The Logic of the Binary as Oppression

Epistemic Hegemony

I now examine the logic of *binary* that moves continually with the logic of *separability* and hierarchized dualisms. As established in chapter one, the understanding of *binary* conceptions and modalities of thinking based on binary conceptions, such as the practice of the 'indirect proof', are integral to *Mathematics*. The *Mathematics-Rationality-Human* continuum thrives off of and establishes binary modalities of thinking and a continuous infatuation with dualism whereby *Mathematics* as an image of thinking-being relies on and authorizes and produces binary modalities of thinking. *Rationality* comes into itself only through its construction as the opposite of *Emotionality*. And so too is *the Human*, made an allegedly closed category in opposition to notions such as *animal* or *nature*.

These inclinations to hierarchized dualism and to binary modalities of thinking are a form of epistemic violence that continue the exclusion from *the human* of every thinking-being in non-accordance with the *Mathematics-Rationality-Human* continuum.

I connect several existing decolonial and feminist problematizations of binarity and dualism situate *Mathematics* relation to these conceptions (e.g. Plumwood 1993A, B). I start with *thinking-in-binaries* – a concept that is characterized by two epistemic tendencies and ideals: a tendency to think within and through existing binary concepts (dualisms) –that is, to use them as one's epistemic horizon; and a tendency to assume fundamental epistemic duality (*true* – *false*, *credible* – *untrustworthy*, etc.).

First, I characterize and problematize thinking-in-binaries on the basis of six aspects that I understand as constituting the epistemic stance of *Mathematics* and as intrinsically power-securing. Subsequently, I shed light on how *Mathematics*, as an image of thinking, secures these six power-securing effects of *thinking-in-binaries*. In doing so, I focus primarily on the specific role and relevance of *Mathematics* as a conceptual safeguard and legitimization of *thinking-in-binaries*. The conclusion of this chapter indicates the effects of *thinking-in-binaries* for processes of subjectivation.

Let us first look at *thinking-in-binaries* understood as a basic epistemic attitude that structurally permeates the socio-political life of the Western world. It can be found and is maintained for example, in and by institutions, interactions, individuals and media representations. *Thinking-in-binaries* is characterized by the fact that existing dualisms, such as the *rationality-emotionality*

dualism or the *nature-culture dualism*, function as an unquestioned epistemic basis and are while being reproduced by *thinking-in-binaries*. Moreover, *thinking-in-binaries* assumes, implicitly or explicitly, an epistemic duality – it assumes a fundamentally existing *true* or *false*, a *credible* or *untrustworthy*, or a *scientific* or *non-scientific*.

I propose that the following six aspects be noted as potential epistemically power-securing effects of *thinking-in-binaries*.

- 1) In establishing an epistemic duality (*true – false*), the conceptual basis for practices and attempts at epistemic dominance and control is constituted.
- 2) *Thinking-in-binaries* establishes the epistemic expectation of the *closedness* of categories as the norm. Bivalence thus becomes a fundamental norm a simplification of *thinking*-, and thereby the hegemonic immobility of concepts of violence are established and maintained.
- 3) *Thinking-in-binaries* favors and is based on the prediction of existing hierarchized dualisms, such as the *rationality-emotionality dualism* or the *nature-culture dualism*. In this way, central patriarchal and colonial conceptions are actively kept alive and maintained in their epistemic and socio-political relevance.
- 4) *Thinking-in-binaries* forms a central epistemic basis for hegemonic norm-setting and the forms of othering that result from it.
- 5) *Thinking-in-binaries* forms *objects* and *subjects*. It constitutes those who look and those who know as well as those who are looked at and known about. This is accompanied by forms of epistemic objectification, which reproduce these conceptual foundations and legitimize other forms of objectification.
- 6) *Thinking-in-binaries* shapes hegemonic modes and concepts of *credibility* that are informed by the stigmatization of *contradiction* and the denial of an *in-between*.

I will summarize each of these aspects as a dimension as epistemic violence. Firstly, the establishment of an epistemic duality, for example through a binary conception of *truth/falsity*, *lie/truth*, *credibility/incredibility*, already contains attempts to claim epistemic authority (Stengers 2000, 102 f.). It is precisely the binary character of these conceptions that enables what Shulman calls epistemic dominance i.e., *getting someone to say something*. Such a practice requires an epistemic binary as well as a way to claim the side established by such as *epistemically superior* (*true*, *credible*, *proven*, etc.). The establishment of an epistemic norm grounded in the value of binarity informs the epistemic frame-

work against the background of which a struggle for *epistemic winning and losing* is possible as it is what ensures that there is an epistemic sense of *winning and losing*. c. In this dimension, a fundamental establishment of epistemic bivalence as a norm is the central conceptual foundation upon which struggles for epistemic authority take place. Epistemic bivalence establishes the playing field on which ground practices of epistemic dominance and control can – even must – take place.

Secondly, the epistemic claim and the epistemic norm of the *seclusion of categories* bears a three-fold form of epistemic violence.

On the one hand, bivalence is elevated as a fundamental epistemic norm as the fundamental expectation of an *either/or is created*. This shapes epistemic practices as well as fundamental social images, for example of *gender* or *sexuality*. For, central basic structures of knowledge and coexistence, such as having two values becomes the norm: *either man or woman, either heterosexual or homosexual, either rational or emotional, either true or false, either ... or ...* This normalization and universalization of binarity marginalizes and unsettles equivalencies and spaces in between. It creates a compulsion to "choose a side." The epistemic safeguarding of power here is twofold. Firstly, identities and groups, which contest binarity are systematically made insecure, for example bisexual people through a binary understanding of *sexuality* and trans, intersex and non-binary people through a binary understanding of *gender*. Secondly, the *either/or* norm establishes a conceptual framework that makes the exercise of epistemic dominance possible in the first place. This is because practices of epistemic dominance require a conceptual network of bivalence – a *true* and a *false*, a *credible* and an *untrustworthy*, a *rational* and an *emotional*.

Thirdly, the idea of the *closure of categories* characterizes a fundamental tendency to think *in isolation*. If the closedness of *categories* represents the epistemic and social norm, then thinking in contextually becomes systematically more difficult. The norm of *closedness* reproduces the idea one should speak in terms of *individual cases* instead of systems and resultingly *individual closedness* emerges as a norm for thinking and political and personal interpretation. In accordance with this *habit of thinking in terms of closedness*, it is also more logical, for example, to assume the existence of *individual cases rather than systems at the root of violence*. Due to the established habit of *closure created by this norm, thinking in contexts* is decisively less obvious than *thinking in isolation*.

Fourthly, the expectation of seclusion serves as a structural shield against a *dense reality* of marginalized lifeworlds. Elsa Dorlin, in her book *Self-Defense*, (2020) describes an epistemic difference between the rulers and the oppressed.

According to Dorlin, the rulers have no *dense reality* other than their own and for them, there is no tangibility, no experience of not being *the norm* themselves. What Dorlin describes is impressively demonstrated in media and social discourses on *sexual violence* as in questions of *sexual violence*, definitions are used without being understood as contingent expressions of their socio-historical origins. The term *sexual violence* is *flattened and* becomes *two-fold*. *Either it exists or it does not exist*. This denies and refuses profound insights into these forms of violence and ongoing patriarchal and colonial understandings of the term are codified and, in a sense, naturalized. This dynamic, I argue, is fed by the fundamental expectation of the *closed nature of categories* in which epistemic and social norms lead to a suppression of interrogations of concepts and categorizations that are critical of power relations, such as *sexual violence*.

Fifthly, *thinking-in-binaries* gives authority to existing binary concepts (*dualisms*) and keeps them alive and meaningful. In Western structures of power, for example, dualisms exist that are inextricably linked to the production and reproduction of patriarchal, colonial, and racist power relations, such as the *rationality-emotionality dualism* or the *nature-culture dualism* (Plumwood 1993, 43). *Thinking-in-binaries*, as a fundamental, general, and collective habit of thinking and interpreting favors and maintains precisely such dualisms.

Sixthly, *thinking-in-binaries* is closely linked to othering and hegemonic norm-setting. The structure of thinking and practice of interpretation of *either/or* calls for thinking and interpreting within the framework of binary concepts. These binary concepts are usually hierarchized in so far as they are understood as either *superior* or *an inferior to each other*. This hierarchization is closely linked to a form of norm setting in which the *superior* points to what is considered as *normal* and the *inferior* as *deviant*. *Thinking-in-binaries* as a basic social and epistemic order calls for an understanding of the *self* and the *other* as distinct from one another and thereby favors those hegemonically shaped norms.

Seventhly, *thinking-in-binaries* forms a binary distinction between *objects* and *subjects on the basis of*: an *either-or structure*, in which there are those who *look* and *know* and those who are *looked at* and *known about*. This epistemic power relation ignites and is founded along existing power relations and produces and reproduces them (Haslanger 2002, 209 f.).

Eighthly, *thinking-in-binarity* produces and reproduces hegemonic concepts of *credibility* in two ways. First, collective, Western ideas of *credibility* stigmatize *contradiction* by understanding it as an indicator of untrustworthiness. This takes away crucial spaces of expression that are typical, for example,

for the expressions of traumatized people or negotiations of socio-politically complex cases of violence. Secondly, an in-between is denied by categorizing statements, narratives, and narrative styles as *credible* or *untrustworthy*. There is no room for *hearing* and *being heard* without these judgments.

I will now further examine how *Mathematics* as an image of thinking-being births and authorizes *thinking-in-binarities*. First, I consider each of the six aspects again in order to show separately how *mathematics* participates in establishing and securing the power of the specific aspects of thinking-in-binarities. I then go on to discuss the specific role and relevance of *Mathematics* for *thinking-in-binarities*.

To begin, *Mathematics* characterizes its methodological approach and justifies its special epistemic authority precisely by reference to epistemic bivalence as a criterion of the *certainty* of the knowledge produced. As such, the axiomatic method and the rules of deductive reasoning⁴ are based on and reproduce epistemic bivalence. Accordingly, the central epistemic ideal of *mathematics* lies in the production of *incontrovertible truths*. This fundamental ideal is fed by the idea of a *truth* and a *falsity* with nothing in between. Concrete proof is also based on this epistemic bivalence, in that the rule of the "excluded third" is used for proof. Moreover, *Mathematics* is also characterized by a specific attitude in relation to the epistemic norm of having two values as this norm it is both understood as inescapable and treated as the reason for the special epistemic authority of *mathematics* (Shulman 1996).

In this sense, epistemic bivalence is indispensably interwoven with the idea of producing *compelling truth*, which makes the epistemic structure at the core of the *either-or* compulsion possible in the first place.

Secondly, *mathematics* takes the *closedness of categories* as the norm in its understanding of axioms. An axiom should be a *truth that is compelling in itself* and as such the axiom should have an inner closedness, which is what renders it epistemically usable and utilizable in the sense of *mathematics* (Shulman 1996). The criterion of *closure* is thus the criterion for epistemic participation within the framework of *mathematics*. It is precisely this dynamic that is also transferred to socio-political processes as forms and performances of closure are

4 Deductive reasoning seeks to establish *necessarily true* statements by establishing statements (axioms) that count as *necessarily true* and to then derive further statements from these axioms in ways recognized as *logically necessary*. For more detailed accounts on deductive reasoning see Dutilh Novaes 2021, Shulman 1996, Nye 1990.

required from modes of expression, concepts, etc. in order to qualify for epistemic participation, (Shulman 1996).

Thirdly, the role of *mathematics* in the preservation of patriarchal and colonial dualisms is less direct, but no less influential. Dualisms are characterized by a) the construction of the absence of an *in-between* or *beyond* and b) by an implicit or explicit hierarchization between individual dualisms. *Mathematics* exhibits both of these criteria by organizing itself along the two dualisms of *true/false* and of *contradictory/free of contradiction*. This organization appears as a *normality*, and even, an *imperative normality* (Shulman 1996, Nye 1990). The fundamental structure to secure power of dualisms is thus produced, reproduced, normalized and authorized by *mathematics*.

Fourthly, the axioms of *mathematics* can be understood as a form of standardization. Axioms constitute *the incontrovertible*, *the unquestionable* and *the unquestionable* – they constitute *norms* (Shulman 1996, da Silva 2017, Hottinger 2017). In *Mathematics*, this norm-setting is inextricably interwoven with the figure and ideal of *necessity*. Axioms are allowed to take on the role of norm-setting because they are conceived as *necessarily existing*. This conceptual interweaving of *norm* and *necessity*, I argue, inscribes itself into socio-political relations. *Mathematics* produces, normalizes, and naturalizes this interweaving and thus creates and shapes lifeworlds and political realities.

Fifthly, the division into *objects* and *subjects* is inscribed in *Mathematics* itself, insofar as binarity is evident in the conceptual frameworks of *mathematical knowledge production*. *Mathematical concepts*, *formulas*, *equations*, and *questions* are often described, treated, and understood as "mathematical objects." In this imagery, *mathematicians* are the *subjects of mathematical knowledge*, and the *mathematical objects* are the objects to be known. It is this clear *subject-object division* that is a central component of the establishment of epistemic authority and the authorization of *Mathematics*, and it is this clear division that reinforces the *sense of certainty* that surrounds *mathematics*. As such, in the methodological logics of axiomatics as well as in that the fundamental epistemic bivalence manifests itself, in the concrete form of this *subject-object division*.

Sixthly, I have previously demonstrated that a figure of *credibility* exists in the Western worlds and that this *credibility works to secure power* along the lines of identification with *credibility* and *non-contradiction* and the refusal of an *in-between* or *beyond*. *Mathematics* establishes both of these criteria as central characteristics of *correct and reliable thinking* and in this sense plays a decisive role in the construction of this figure of *credibility*. Furthermore, in the axiomatic method, *contradiction* serves as a central indicator of *falsity* (Shulman

1996, Nye 1990) and it is precisely this conceptual proximity of *contradiction* and *falsity/credibility* that occurs in socio-political contexts and negotiations. The collapsing of the *in-between* or *beyond* arises from the fundamental epistemic bivalence of *Mathematics* as in its world there is a *truth* and a *falsity* and nothing that cannot be categorized by reference to one of these two terms.

Thinking-in-binarities, as well as other hegemonic modes of thinking and being, are socially established in many ways through many interwoven concepts. In this sense, I consider *mathematics* to be one of many "players", but also a "player" with specific and particularly serious relevance to the production and reproduction of hegemonic *thinking-in-binarities*. *Mathematics* establishes itself as a discipline and way of thinking that demonstrates the possibility and desirability of a *necessary truth*. *Mathematics* thus exists as a central and final safeguard for universalist claims and normalized, binary modes of thought as such.

For example, *Mathematics* as a modality of thinking permeates the basic structures of analytic philosophy and classical philosophical logic (Mangraviti 2023, Nye 1990): This interweaving suggests that *mathematics* can exist as an explicit or implicit reference in the constitution of other fields and ways of thinking. Similar entanglements can also be observed in socio-political and legal uses of the concept of *proof through reference* to the figure of *Mathematical proof* through implementation of its epistemic ideals and methodological modes of operation in contexts other than *Mathematics*.

Thinking-in-binarities assigns the roles of *being an object* and *being a subject* constituted by hegemonic power relations. This dynamic is to be understood as a form of epistemic safeguarding of power. Shaped by existing power structures and grown to maintain them, safeguarding has a further dimension of bringing about 'a crisis of subjectivity' – in which people are often only granted very limited access to prevailing ideas and practices of *subjectivity*⁵ in line with their marginalization. *Thinking-in-binarities* as a whole reproduces crisis-ridden subjectivity by creating epistemic, social and political worlds in which an understanding of oneself and others as a *subject* is dependent on how well one moves in accordance with the *Mathematics-Rationality-Human* continuum and its modalities for thinking-being.

5 In alignment with the work of Saidiya Hartman, my notion of *subjectivity* is interwoven the notion of *the human* and understood as a potential perpetrator of violence (Hartman 1997).

2.7 The Thinking-Being of Epistemic Violence

The *Mathematics-Rationality-Human* Continuum

This chapter has established that the *Mathematics-Rationality-Human* Continuum creates systems of meaning-making, sense-making, and subjectification that continuously reproduce the existence of the continuum. I understand these movements of the continuum as epistemic violence – as forms of violence that shape and limit thinking-being according to colonial-patriarchal relations of power.

There are three decisive findings in this chapter.

- 1) The *Mathematics-Rationality-Human* Continuum lies at the heart of epistemic violence as the continuum produces exclusive notions and practices of what it is *to think* and of what it is *to be human*. These exclusive notions of *thinking* and *being* are themselves a form of epistemic violence that begins at the level of notions – the level of the epistemic – and from there it permeates all other spheres, and it permeates and shapes thinking-being itself by fashioning images of thinking-being according to hegemonic standards.
- 2) There are four distinct and interwoven ways through which *Mathematics* enfold epistemic violence. All four aspects far exceed *Mathematics* but are fundamentally created, legitimated, and upheld through *Mathematics: Binarism, Universalism, Proving, epistemic Necessity*.
- 3) The epistemic violence of the *Mathematics-Rationality-Human* Continuum is at the core of its world. This claim follows in connecting the findings of chapter one and two. Chapter one showed the transhistorical existence of the continuum and chapter two showed its violence. Connecting these two findings establishes that the *Mathematics-Rationality-Human* Continuum is an endeavor of world-making because it moves transhistorically to shape and limit thinking-being.

In conclusion, this second chapter established the interwovenness of epistemic violence with other forms of violence and it established the crucial role that the *Mathematics-Rationality-Human* Continuum plays in continuously reproducing the continua of violence. If we want to make visible the many violences of the *Man-Math*-centric world, we need mathematical modes of disobedience and mathematical modes of resistance so that our revolutions, our re-makings of the world account for the role *Mathematics* played and plays in (re)creating the world as it is now in which the *Man-Math* centric version of the world is hege-

monic. Chapter three and chapter four will respond to how this critical knowledge can be used for mathematical re-makings.

3. Mathematical Disobedience

Connectivity, Sense-Making, and Political Subjectivities

Our toes, our noses
Take hold on the loam,
Acquire the air.
Sylvia Plath, Mushrooms (1967), 34

3.1 Epistemic Disobedience against *Mathematics*

A Subversion of Sense-Making

The first two chapters of this thesis have established it's the epistemically violent role of *Mathematics* in the *Mathematics-Rationality-Human* Continuum. The last two chapters of this thesis are responses to my findings on the *Mathematics-Rationality-Human* Continuum as a continuum of violence.

Both chapter three and chapter four work to re-make the continuum; however, they differ in their approach and in their temporalities. This chapter explores forms of mathematical disobedience, i.e., forms of disobedience to the *Mathematics-Rationality-Human* Continuum, that can still be related to the bodies of meaning formed by the continuum. So, chapter three moves at the temporality of what I call future 1 – a future that is close to the now, the contemporary, because it directly connects to contemporary bodies of meaning-making, sense-making, and subjectification. *Mathematical disobedience* therefore keeps *Mathematics* and the *Mathematics-Rationality-Human* Continuum as a reference point while moving to subvert the continuum by making it less epistemically violent. So, chapter three proposes politically strategic modes of *Mathematical disobedience* while chapter four puts forth an intervention and field of epistemic resistance by seeking radical difference in the realm of mathematical practice.

Mathematical disobedience seeks to reference *Mathematics* and to subvert aspects of its hegemonic politics precisely by doing so. As such, it is a disobedient appropriation of *Mathematics* and draws on modes of subversion that are aware

of *Mathematics* as an image of thinking-being. I explore *Mathematical disobedience* by seeking to uncover disobedience to each of the following seven aspects of *Mathematical* epistemic violence¹:

- 1) The establishment of the *Mathematical-Human* Continuum through the interweaving of *Mathematical Subjectivity* and *Human Subjectivity*;
- 2) The conceptual making of *Mathematics* as *white* and *masculine*, and along with this, the ongoing imprinting of the figure of the *Mathematician* as a *white* and *male* mode of being and of thinking;
- 3) The existence of *Mathematics* as a hegemonic and normalized mode of communication;
- 4) The role *Mathematics* plays in construing and legitimizing universalist ideals and images of thinking-being;
- 5) The functionality of *Mathematics* as a hegemonic norm for forms of expression in political, personal and theoretical spheres;
- 6) The manner in which *Mathematics* stabilizes the hegemonic lives of *Rationality* and the *Human* through its role in the *Mathematics-Rationality-Human* Continuum; and
- 7) The role of *Mathematics* in the continuous reproduction of hegemonic binaries and in the legitimization of forms of *thinking-in-binaries*.

Each of these hegemonic dimensions of *Mathematics* and the *Mathematics-Rationality-Human* Continuum is examined in its own sub-chapter through exploration of potential forms of *Mathematical disobedience*. to each of the hegemonic lives of *Mathematics*. I will propose possibilities for *Mathematical disobedience* and then assess the potentialities of the proposed forms of *Mathematical disobedience*. These endeavors draw from existing work on epistemic disobedience and bring it into conversation with *Mathematics*. These endeavors of *Mathematical disobedience* share that they do not aim to overthrow the *Mathematics-Rationality-Human* Continuum, but rather, aim to disobediently appropriate the logics of the continuum and to do so precisely because they strategically

1 I understand these seven aspects to be particularly central to my investigations from chapters one and two. However, these aspects are by no means an exhaustive list of the hegemonic dimensions of *Mathematics*, nor are they an exhaustive list of possible starting points for forms of rebellion. Rather, I sketch out proposals along these seven aspects with the explicit wish that they provide grounds for a more comprehensive discourse on forms of rebellion against *Mathematics*.

connect to the bodies and logics of the continuum. Each version of *Mathematical Disobedience* is introduced by means of an example of the respective practice of *Mathematical Disobedience*. From each example I then deduce a more general characterization and definition of the respective mode of *Mathematical Disobedience* in order to then take note of the possibilities and potentialities of the respective form of *Mathematical Disobedience*.

Important to note is that I do not understand this endeavor to move in opposition to the approaches of chapter four. Rather, I understand resistance too, as a continuum moved and shaped by different poles. Therefore, chapter three moves with the logic of strategically connect the hegemonic bodies of meaning, while chapter four will be a movement of resistance guided by a different logic – one that does not of reference the continuum.

3.2 A Disobedient Appropriation Subverting Mathematical Subjectivity

As I have established in my reconstruction of the *Mathematics-Rationality-Human* continuum *Mathematical Subjectivity* in Hottinger's sense is a form of *subjectivity* that comes into existence through *Mathematics* and shapes *the human* as an image of thinking-being. Here I explore possible forms of *Mathematical disobedience* towards *Mathematical subjectivity* that is conceptually continuous with *human subjectivity*.

Hottinger develops the concept of *Mathematical subjectivity* in order to draw attention to a specific conception of subjectivity, which explicitly refers to the spheres of *the Mathematical* and is interwoven with specifically Western ideals and conceptions of subjectivity in general (Hottinger 2017, 6). *The West understands itself in relation to Mathematics*, Hottinger writes, meaning that Western understandings of subjectivity and of being human are conceptually interwoven with a specifically Western idea of mathematical activity – *Mathematics* (Hottinger 2017, 12). Resultingly, *Mathematics* constructs a conceptual continuum on the basis of an exclusive conception of *the human*² (Hottinger 2017, 12). In addition, *Mathematics* informs, legitimizes and normalizes the exclusions of *the human* by interweaving *Mathematical subjectivity* with *Rationality* and *the human* thus establishing specifically Western and patriarchal modes and criteria for all three of these concepts, such as *universalism* and *individualism* (Hottinger

2 See also the explanations in chapter one of this thesis.

2017, 12). This *Mathematical subjectivity*, according to Hottinger, produces and reproduces patriarchal and colonial forms of exclusion by conceptually placing them in opposition to *blackness* and *femininity* (Hottinger 2017, 8–10).

Hottinger orients herself using works that operate in the field of *Mathematics* without engaging the conceptual opposition between *Blackness* versus *Mathematical subjectivity* nor of *femininity* versus *Mathematical subjectivity*. Hottinger discusses the work of Danica McKellar as an attempt to intervene in the hermeneutic structure that produces *femininity* and *Mathematics* as *mutually exclusive*. McKellar, herself an actress and an academically successful mathematician³, wrote middle-school mathematics textbooks that center engaging those who identify as *feminine* with the idea of *femininity* in *Mathematics*. The covers of McKellar textbooks feature herself in playful poses and smiling into the camera. By centering her image, using bright colors and playful fonts, and inclusion in the titles of some subchapters on the book that reference article-titles of magazine covers, these covers lean on the aesthetics of ‘girl magazines’ rather than on those common for (mathematics textbooks). Her titles are equally playful and speak to those identifying as *girls*: “Math doesn’t suck – How to survive middle school math without losing your mind or breaking a nail” or “Kiss My Math: Showing Algebra who’s Boss.” Throughout McKellar’s books, all the characters engaging in Mathematics –explaining it, enjoying it, and excelling at it – are girls. Hottinger rightfully points out how this is indeed rare since the most common middle school textbooks offer clearly gendered imbalances in that they favor narratives in which boys are ‘the one mathematically capable’ (Hottinger 2017, 25–38). McKellar’s chapters each open with a story that features a scenario commonly associated with *femininity*, which goes on to introduce *Mathematical knowledge* through this story.

Through these practices McKellar quite literally re-writes what a mathematics textbook is, looks like, how it moves, and who it portrays. This re-writing, Hottinger argues, boils down to McKellar intervening into the framework that makes *Mathematics*, *Mathematical practice* and *knowledge* masculine-coded, and masculine dominated. McKellar herself describes her vision as follows, “My method is to write books that look more like teen magazines than math books and say, look at how girly math can be. It doesn’t have a gender line. It’s for you, too. Math is going to make you—it’s going to make you smarter; you’re

3 McKellar coauthored a groundbreaking mathematical physics theorem that bears her name. For more information and a more detailed and nuanced discussion of her work see Hottinger 2017, *The Discursive Construction of Gendered Subjectivities*.

going to feel more confident because you know how to handle a challenge and really go for it and then become more popular because of it" (McKellar 2008b, quoted in Hottinger 2017).

Look at how girly math can be is another way of saying: *Mathematical Subjectivity* is not inherently masculine and by extension, neither is subjectivity in general, nor is being-human. By insisting on Mathematics as *always potentially feminine*, McKellar queers the *masculinity* moving through *Mathematical Subjectivity* and all forms of subjectivity implicitly referring to *Mathematical Subjectivity*. Furthermore, McKellar *It's for you too* is a direct call to those who have been estranged from *Mathematics* precisely because of its conceptual entanglement with *masculinity*. She concludes by linking the intellectual empowerment that *Mathematical Practice* can be to a general sense of confidence.

Like Hottinger, I too understand McKellar's insistence on 'girly Math' as a practical and conceptual intervention into the masculinity moving through Mathematics. And much like McKellar notes herself, this goes deeper than engaging girls in Math – it is an attempt to engage girls with a confidence that has been conceptually and historically constructed as not-theirs to inhabit. And yet, here is McKellar, committing to the idea that girls can inhabit *Mathematics*, confidence, and *femininity* all at once. This might seem trivial, but in societal structures built to estrange girls from *Mathematics* and from their own sense of intellect, I do not believe it is trivial. McKellar published four 'girly Math books', – all of which became New York Times bestsellers, and goes to show there are people in the market for exactly the feminine-Math-intervention that McKellar is staging.

Another example that moves horizontally through *Mathematical Subjectivity* is a book I stumbled upon in the endeavor of writing my Bachelor Thesis in (Feminist) Philosophy of Mathematics entitled, *How to free your inner Mathematician – Notes on Math and Life* by Susan D'Agostino (year). D'Agostino's book is a mathematics workbook that, much like McKellar's work, approaches its reader with playfulness, accessibility, and empowerment. However, it differs its commitment to do so in so far as D'Agostino's book is marketed towards adults.

D'Agostino introduces mathematical theorems, and notions by giving metaphorical meaning to mathematical topics, offering playful exercises, sketches, and humor. In her introduction to the book, she tells the story of her own mathematical practice. She explains that she had felt estranged from the field, intimidated even, while she has always remained highly compelled to actively engage with *Mathematics* herself (D'Agostino 2020, 1 f.). She explains how she needed to engage with *Mathematics* intuitively and playfully and

how she needed to reassure herself that she can struggle with and through her *Mathematical practice* without understanding this intellectual struggle as any sort of incapability or failure. Her book stresses the role of intuition and playfulness and understands *Mathematics* as an intellectual adventure that might help coping with life and moving through the messiness that is living. D'Agostino frequently turns the theorems or questions she is discussing into metaphors for 'life advice.' Thus, making *Mathematics* into something, touchable, feelable, into something for which – much like life – people might have an intuition.

Both McKellar and D'Agostino change aspects of the conceptual make-up of *Mathematical Subjectivity*. McKellar queers the construction of *Mathematical Subjectivity* by showing *Femininity* as mutually exclusive with it. D'Agostino queers the harshness, the linearity, the seriousness that is commonly part of *Mathematical Subjectivity*. Both of these queerings result in *Mathematical Subjectivity* being made accessible through different modes for people who are likely to have been excluded by the conventional meaning of *Mathematical Subjectivity*.

Drawing from these considerations, I propose to define the subversion of *Mathematical Subjectivity* as any practice that changes aspects of the exclusionary criteria and dimensions of *Mathematical Subjectivity* and thus enlarges conceptual, practical, and emotional access to *Mathematical Subjectivity*. This establishes two criteria for epistemically disobedient appropriations of *Mathematical Subjectivity*: A) the practice in question queers at least one exclusionary aspect of *Mathematical Subjectivity*; B) people, contexts, modes otherwise excluded from *Mathematical Subjectivity* are given (at least on the level of the conceptual) a place in the realm of *Mathematical Subjectivity*.

These subversive acts move not solely using the *logic of addition* but also move to queer the very meaning of *Mathematical Subjectivity*. Furthermore, practices like these showcase the politics of *Mathematical Subjectivity*. Both McKellar and D'Agostino link *Mathematical Practice* to a more general sense of confidence. I believe this linkage can be very emotionally real precisely because of the hermeneutical structures surrounding, entrenching, and making *Mathematical Subjectivity*. This is because due to the Western entanglements of *Mathematics*, *Rationality*, and *Being-Human*, one very literally becomes *more human* when practicing *Mathematics*. Therefore, a disobedient mode of moving through these entanglements utilizes them to form practices that enlarge the conceptual and emotional access to the generally highly exclusive notion

of *the Human*. Subverting *Mathematical Subjectivity* does this by utilizing the conceptual entanglements of *Mathematical Subjectivity* and *Human Subjectivity*.

Personally, I believe practices like these to move on a strategic, preliminary level, since I am convinced that *the Human* is violent beyond repair. However, that does not mean that there are no cracks, leaks, and termite tunnels to move through and this is what subversions of *Mathematical Subjectivity* aim to do; they move to make termite tunnels that disobediently enlarge *the Mathematical*, *the Rational*, and *the Human*.

Considering this definition and the works of McKellar and D'Agostino, allows me to point out four possibilities to engage in subversion of *Mathematical Subjectivity*. This list lays no claim to completeness but rather outlines four possible ways of disobediently appropriating *Mathematical Subjectivity*.

- A) Queering Binaries that underlie *Mathematical Subjectivity* can be engaged to subvert dualisms and images of thinking-being. Examples of such underlying binaries could be the conceptual opposition of *Femininity* versus *Mathematical Subjectivity*, *Femininity*⁴ versus *Intellectuality* more generally, or binary concepts such as the *Emotionality-Rationality* dualism.
- B) Subversions moving in this mode find ways to disrupt, disturb, question, and queer such binaries through their appropriation of *Mathematical Subjectivity*. Both McKellar's and D'Agostino's work can be taken up as examples. McKellar queers the *Femininity/Mathematics-Binary* and the *Femininity/Intellectuality-Binary* and D'Agostino moves to queer the traditional *Rationality/Emotionality-Binary* by focusing on emotion and intuition in her modes of introducing *Mathematics*. This mode of practicing and teaching *Mathematics* bears potential to subvert some of the binaries underlying *Mathematics* as a modality of thinking-being.
- C) Subversion of *Mathematical Subjectivity* can be engaged by pluralizing forms of access and modes of studying *Mathematics*. One element of *Mathematical Subjectivity* is the restrictiveness of what is taken to be *Mathematical Practice*. Drastically pluralizing what is understood as *Mathematical Practice* or *Mathematical Study* thus subverts *Mathematical Subjectivity* by queering the restrictive modes it inhabits. This entails pluralizing the bodyings of

4 I employ the notion of femininity similar to how Hélène Cixous employs the notion of womanhood – as a figure of radical difference, minoritized due to its immensity and always bearing the potentiality to rediscover its immensities (Cixous 1976, Cixous and Clément 1986).

Mathematical Practice (*How do bodies look that do 'Math?'*), the methods and modes of study, and the existing options to engage in *Mathematical Practice*. Both McKellar and D'Agostino take part in this in emphasizing playfulness and in making visible intellectual struggle in *Mathematical Practice*.

- D) Pluralizing images of *Mathematical Practice*, such as is done with the textbooks, subverts and leads to pluralization of representations of *Mathematical Practice*. Thus, intervening into the discursive landscape that makes *Mathematical Subjectivity* as outlined above.
- E) Pluralizing images of *Mathematicians* is a mode of subversion that also moves at the level of representation in emphasizing the (contemporary and historical) variety of *Mathematicians*. Because as Hottinger has shown, *women Mathematicians* as well as *Black Mathematician* did and do exist but are hardly ever portrayed in conventional books on the history of *Mathematics* (Hottinger 2017, 49 f.). This, as Hottinger also shows, is one of many discursive movements that makes *Mathematical Subjectivity* an exclusive notion and institution. Portrayals of *women Mathematicians* and *Black Mathematician* can thus engage in much more than “just stating that there are women and Black people who are *Mathematicians*.” Rather, specific portrayals can be a mode to engage in the queering of binaries underlying *Mathematical Subjectivity*, e.g. the portrait of Émilie du Châtelet disturbs the *Femininity/Mathematics-Binary*. (Hottinger 2017, 109).

I believe there are different potentialities that are shared by all of these modes of subverting *Mathematical Subjectivity*:

- A) They engage unruly utilizations of the dominant positioning of *Mathematical Subjectivity*, specifically of its entanglement with *the Human* and *the Rational*. This shows that *Mathematical Subjectivity* can be appropriated by and opened up to those historically and contemporarily relegated to the outskirts. This can be a strategic move of empowerment and even of representation – a chewing at the corners of *the Human* so that this violently exclusive notion is enlarged slightly.
- B) Partaking in movements that queer subjectivity and being-human enables critiques of *the Human*, of neoliberal subjectivity. Moreover, movements to queer these notions, confront the exclusionary make-up of *the Human*. Since *Mathematical Subjectivity* is such an integral stabilizer of the Human and of Western and neoliberal modes of Subjectivity, subverting *Mathemat-*

ical Subjectivity is a mode of partaking in this movement to re-construct, de-construct and chew up *the Human* and *the Subject*.

- C) Queering *Mathematics* is queering *Mathematical Subjectivity*. *Mathematical Subjectivity* and *Mathematics* are, as I have shown in both Chapter One and Two of this work, deeply interwoven – they are integral to one another. Thus, queerly subverting *Mathematical Subjectivity* is a mode of queering *Mathematics*.

Movements to subvert *Mathematical Subjectivity* share that they consider the hegemonic make-up and the hermeneutical landscape interwoven with *Mathematical Subjectivity* and ? and thus move to disobediently utilize this exact hermeneutical landscape. Subversions of *Mathematical Subjectivity* use movements of queering *Mathematical Subjectivity* to chew tunnels into *the Rational* and *the Human*.

3.3 Disobedient Symbolism

Transforming Images of *Mathematic*

Mathematics as an image of thinking-being is continuously made and kept alive. One of the countless ways this happens is through representations of those who practice Mathematics. While this might seem like a matter of representation only, I do not believe this to be the case. *Masculinity* and *whiteness* exist as categories of gender and race, but also as modalities of thinking-being and both layers are interwoven. So, this is why the systemic dominance of *whiteness* and *masculinity* in portraiture of *Mathematicians* is part of *Mathematics* as an image of thinking-being. This dominance manifests *whiteness* and *masculinity* as modalities of thinking associated with and authorized through *Mathematics* and it signals exactly whose mode of thinking-being *Mathematics* is and is not. This move is then reproduced with *Mathematics*, *the Rational* and *the Human* too.

In her discourse analysis Hottinger relates the construction of *Mathematical Subjectivity* to portraits of *Mathematicians*. Her analysis on the systemic exclusion of women mathematicians and black mathematicians from books on the history of mathematics reveals one of many symptoms of the *Mathematics-Rationality-Human* continuum and how these exclusionary manners of portrayal are one of a multitude of ways of the exclusivity of *the human* works.

As Hottinger (2017) shows, one of countless strands of the construction of exclusive, normative *Mathematical Subjectivity*, lies in the portraiture of *Mathe-*

maticians (Hottinger 2017, 89 f.). I propose the notion of *disobedient symbolism* to account for a) potentialities and possibilities of deliberately queering portraiture of mathematicians and b) to make visible how the question of representation in the context of portraits of Mathematicians is about more-than 'representation' in a superficial sense. While I am all about arguing for more portraits of *Black Mathematicians* and *woman Mathematicians*, I am also arguing that such choices are not only making visible the existence of Black people and woman as *Mathematicians*. Rather, I believe that *Blackness* and *Femininity* and their systemic exclusion from *Mathematics* and *Mathematical Subjectivity* are so integral to Mathematics that portraying *Blackness* and *Femininity* in the context of *Mathematics* is a form of queering and troubling the very notion of *Mathematics*. Such conceptual troubling via portraiture can be understood by drawing from Hottinger's analysis of the portrait of Émilie du Châtelet in contrast to the portrait of Isaac Newton⁵.

The portrait of Newton is commonly featured in any conventional book on 'the history of *Mathematics*', while du Châtelet's portrait is usually mentioned in text, but never⁶ visually featured. Hottinger understands this to be the case precisely because the portrait of du Châtelet is in deep and visible non-accordance with *Mathematical Subjectivity*. This non-accordance consists of du Châtelet being a woman; however, it also goes deeper. The portrait of du Châtelet features various aspects that are in non-accordance with *Mathematical Subjectivity* and with Western, Masculine notions of *Intellectuality* more generally (Hottinger 2017, 97 f., 107 f.). Du Châtelet wears clothing deeply conceptualized as *feminine*. Her dress is extravagant and eye catching and features lace, vibrant colors, and sequins (Hottinger 2017, 107 f.). Her expression in the portrait is soft, she looks like she is daydreaming while smiling towards the recipient of the portrait. As such, the air of seriousness integral to Western and Masculine modes of *Intellectuality* is completely lacking from this portrait (see *ibid.*). Rather, the portrait of du Châtelet moves with a playfulness – she looks dreamy, plays with a divider, and has different books in front of her, –one of them even featuring a floral cover. Hottinger argues that these aspects of the portrait form the non-accordance of the portrait with *Mathematical Subjectivity*. Furthermore, she argues this as the reason the portrait is hardly

5 The portrait of Émilie du Châtelet can be found in Hottinger 2017, 109. The portrait of Isaac Newton can be found in Hottinger 2017, 107.

6 This 'never' goes for the popular, conventional books of 'the History of Mathematics.' For more details in this see Hottinger 2017, 89.

ever featured, even if written descriptions of du Châtelet's work are commonly featured.

Contrasting this portrait of du Châtelet with the portrait of Newton makes it almost seem revolutionary. The comparison highlights how deeply the portrait of du Châtelet insists on its non-accordance with *Mathematical Subjectivity* as well as dominant notions of Intellectuality. The portrait of Newton hardly features any color, nor does it feature any books, tools, or items. His clothing is dark and plain, and he is looking away from the recipient of the portrait with a stern, serious expression. As Hottinger argues, this imagery is symbolic of Western and patriarchal notions of *Mathematical Intellectuality* as well as *Intellectuality* more generally.

I believe that Hottinger's analysis shows how portraiture of *Mathematicians* can seriously trouble and queer *Mathematics* as a hegemonic notion of meaning-making for troubling symbolism and imagery integral to Western and patriarchal modes is likely to make the legs that *Mathematics* is standing on tremble. I believe such troubling of integral imagery is integral to bringing up more radical questions and revolutions concerning *Mathematics*. Afterall, such troubling imagery is one way to a) chew on Western and patriarchal dominance in the context of *Mathematics* and b) to bring up questions concerning *what is considered Mathematics and what is not*. As such, if people can be inspired to seriously ask these questions, they only need to take a few more steps to realize the violent exclusions prominent in *Mathematics*, in *Intellectuality*, in *Humanness*.

Drawing from these considerations, I propose a definition for *Disobedient Symbolism of Mathematics* understood as any Imagery/Representation that subverts expectations brought up by *Mathematics*. These practices of *disobedient symbolism of Mathematics* commit to queering dominant imagery of *Mathematicians/Mathematics/Mathematical Subjectivity*⁷ in their commitments to showing how *Mathematical Practice* has always already been more-than the dominant frameworks of *Mathematics* and *Intellectuality* suggest. For du Châtelet, and her beautiful dresses, did do daydreamy *Mathematics* alongside, though, and with many other beings and modes of doing *Mathematics* in nonaccordance with *Mathematics*.

This definition allows me to note three core criteria for *Disobedient Symbolism of Mathematics*.

7 *Mathematics* shapes *Mathematical Subjectivity* and with that the figure of the *Mathematician*.

- A) They subvert expectations/criteria surrounding *Mathematicians/Mathematical Practice*.
- B) They are committed to showing *what has always been there* – making visible the existence of various mode of being more than and showing the modes of *Mathematical Practice* and *Mathematical Subjectivity* that move in non-accordance with *Mathematics*.
- C) Pluralizing imagery of *Mathematicians* and *Mathematical Practice* makes available more accessibility and modes of representation regarding who gets to see themselves within *Mathematics*.

Broadening these considerations, I believe there are (at least) six types of possibilities to practice such *Disobedient Symbolism of Mathematics*:

- A) By pluralizing images of *Mathematical practice* and making visible various modes and formats of *Mathematical practice* that subvert the dominance of specific modes of *Mathematical practice*;
- B) By pluralizing images of *Mathematicians* and making visible various subjectivities and social roles accorded to the role of Mathematician and thus enlarging the notion of *the Mathematician*;
- C) By pluralizing the modes of portraying *Mathematicians*, for example, queering and breaking with classical formats of portraiture that focus on *individuals*⁸, focuses on queering *Mathematics* by queering the format of *the portrait*;
- D) By de-individualizing imagery of *Mathematical Practice* and *Mathematicians* we go beyond portraiture to deconstruct the individualism common in Western and patriarchal notions of (*Mathematical*) *Intellectuality*, e.g. by symbolizing and visually representing collective modes of *Mathematical practice* and *Intellectual Practice*⁹;
- E) finding symbolism and imagery, which emphasize aspects of *Mathematical practice* commonly excluded from visibility: such as collectivity, diverse

8 I do not believe that people are individuals. I refer to the term as a concept. For closer considerations see Manning 2013 and Manning 2020.

9 In the Undercommons Moten and Harney propose to re-write intellectual history by understanding intellectual practice as collective practice – famously pinpointed by Moten's words "study is what you do with other people." See Moten and Harney 2013 for a more detailed account.

See Nana and Kather 2024 for an example of collective intellectual practice.

- bodys, playfulness, and intuition, commits to making visible modes of Mathematical practice that move in non-accordance with *Mathematics*; and
- F) Queering/Breaking with particular stereotypes on *Mathematicians/Mathematical practice/Mathematic* helps us discover and make visible imagery and symbolism that breaks with exclusive stereotypes of (*Mathematical*) *Intellectual Practice*.

Drawing from these considerations, I believe there are six core potentialities of *Disobedient Symbolism of Mathematics*:

- A) Through engagement of visibility of various modes of *being-a-Mathematician* and *practicing as Mathematicians* the dominance of Western and patriarchal (*Mathematical*) modes can be subverted;
- B) exclusionary imagery of *Mathematicians* can be counter-acted as well as exclusionary images and notions of *Intellectuality* and *Humanness*;
- C) Conceptually queering concepts of *Mathematical Practice* and *Being-Mathematician* can make visible the effects modes of being, which are more-than those recognized by *Mathematical Practice* and queering concepts of *Mathematical Practice* and *Being-a-Mathematician* can trouble the hegemonic aspects and dimensions moving through these notions;
- D) It can subvert expectations surrounding *Mathematical Practice* and *Being-a-Mathematician*. as *Mathematics* as a hegemonic meaning-maker and stabilizer of power thrives off of the persistence of exclusionary and rigid stereotypes surrounding *Mathematical Practice* and *Being-Mathematician* (such as the stereotypes of girls* and women* being inherently less 'mathematically capable' or the idea that *Mathematics* is always practiced alone by solitary geniuses), by subverting the exact expectations arising from these stereotypes;
- E) It can bring about questioning of common understandings of *Mathematics*, *Mathematical Practice*, *Mathematicians* as it calls these notions into question by making visible the modes of being more-than Western and patriarchal modes of (*Mathematical*) Thought, which makes have visible that they have never been "all that there is"; and
- F) Enlarging access to self-understandings as *Mathematician*, *Intellectual*, *Human*: can enlarge representation, symbolism, and imagery, that participates in the making and re-making of notions of *Mathematician*, *Intellectual*, *Human*; and thus, can enlarge access to self-understandings as *Mathematician*, *Intellectual*, *Human*.

These possibilities and potentialities have in common that they move through modes of *Mathematical Disobedience* on the level of imagery and symbolism. They attempt to subversively utilize how masculinity and whiteness are both a gender/race as well as a modality of thinking-being. These modes of disobedience engage with the power of visuals. They do so by subverting the visual identity and make-up of *Mathematics* in order to chew tunnels right through the body of the continuum – right through the bodies of *the Mathematical*, *the Rational*, and *the Human*.

3.4 Disobedient Connections

Mathematics as Disobedient Communication

In chapters one and two I have demonstrated the entanglement of *Mathematics* with the epistemic value of *being right* and epistemic practice of creating *forceful knowledge*, i.e., knowledge that moves in the logic of *winning-or-losing* and determines itself to *epistemically win*. This mode of *epistemic winning-or-losing* creates the epistemic ideal that forms *forceful knowledge* – knowledge that comes out as the *epistemic winner*. As I have shown, *Mathematics* is one of the frameworks applied to a) conceptualize the goal of *forceful knowledge* as desirable and possible, b) to normalize and even naturalize the ideal of epistemic force and epistemic winning-or-losing. It is this normalization of epistemic force within and through *Mathematics* as a notion and a practice that I focus on here as I propose a form of epistemic disobedience that is rooted in subverting the normalization of *epistemic force* in and through *Mathematics*.

Shulmans analysis of *Upapatti* and *Axiomatic Proofs* can help to understand the core of this endeavor of disobedience. With her brief analysis of *Upapatti*, Shulman shows that there are indeed mathematical practices, whose workings are not fueled by endeavors of wanting to be right or wanting to be epistemically forceful. Rather, Shulman writes, *Upapatti*, is a practice of mathematical proving in which proof is a communicative endeavor and tool. *Upapatti* is applied to convey and to communicate ideas, notions, and processes of thought. The focus of this chapter is inspired by precisely this focus on mathematical practice as a form of communication in which *communication* refers to smaller-scale, inter-personal communication.

What moves this chapter is the idea of reshaping *Mathematics* and its practices into forms of communication. My claim is that such endeavors are form of disobedient applications that reclaim *Mathematics* as they take up *Mathematics*

as a framework but subvert one of its core aspects. My claim is that reshaping *Mathematics* as a form of communication is a practice of epistemic disobedience that through which *Mathematics* works against the grain of its hegemonic structures.

This practice of engaging *Mathematics* as disobedient communication revolves around a) using *Mathematics* for the sake of communicating something (politics, notions, feelings, and thoughts) and b) around forming modes of *Mathematics* that de-center the logic of dominance and the dynamic of *winning-or-losing*. Thus, the following criteria can be understood to characterize practices of *Mathematics as Disobedient Communication*:

- A) *Mathematical practices and notions thereof*, such as proving, equations, or calculations are applied, taken up, or utilized to communicate a notion, an idea, a feeling, or a thought;
- B) *Mathematics* as notion and practice is largely taken up and remains in place, but the focus on epistemic dominance built into *Mathematics* and normalized through *Mathematics* undergoes subversion as the logic of dominance authority, and the dynamic of *winning-or-losing* are decentered in *Mathematics*;
- C) The notion and practice of *Mathematics as Disobedient Communication* begins with a commitment to both find and invent potentialities of *Mathematics that build and benefit non-hierarchical goals of communication*. I believe mathematical practice facilitates wide-ranging tools of expression; however, in much *Mathematical Practice*, these tools of expression are applied as tools of epistemic domination. Exploring which of these practices intrinsically incorporate domination into their structure and which tools of expression might be applied in non-hierarchical, non-dominant modes is one of many tasks necessary to attempt subversion of *Mathematics*;
- D) They focus on mutual understanding in *Mathematical Practice* that is sought out and created; which means committing to a mode of communication that drastically de-centers any mode of hierarchy. The goal is to create mutual understanding of whatever the parties involved aim to communicate/communicate about. In *Mathematics as Disobedient Communication* the focus is to explore ways to bring about such mutual understanding through *Mathematical Practice*; and
- E) They center collectivity by focusing on communication *with* others, that seeks to create collective modes through, with, and within *Mathematics*.

Drawing from these criteria I propose six types of possibilities of *Mathematics* as Disobedient Communication. As always, this list lays no claim to completeness but rather aims to further consider and develop the subversive potential of re-appropriating *Mathematics* as a form of communication.

- A) Political communication, i.e., using *Mathematical Practices* or modes of expression to articulate political aims, structures, or thoughts, can be drawn from *Mathematics*. A striking example for such a practice can be found in da Silva's Essay $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$: *On Matter Beyond the Equation of Value*. Da Silva establishes the equation $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$ as an expression of Blackness and as a force of resistance – as *a matter beyond the equation of value* (da Silva 2017, 1).
- B) The equation she forms communicates precisely this *beyondness*.
- C) As such, utilizing *Mathematics* for political expression bears the potential to form and enlarge modes of communication, political notions, and to draw attention to the political character and structure of *Mathematics*.
- D) Drawing from *Mathematics* forms mode of intellectual communication that establish and enlarge modes for communicating ideas, thoughts, notions and facilitates *intellectual togetherness*. This mode of *Mathematics* as disobedient communication draws from Upapatti as a mode of proving and seeks to center practices of intellectual communication in *Mathematics*.
- E) *Mathematics* can be used to make communication and visibility of systemic dynamics and political structures. This usage is another more specific mode of drawing from Mathematics for political communication. For example, the way Erin Manning (2020) makes use of the notion of *counting* in, *For a Pragmatics of the Useless*, can be understood as an example of this form of *Mathematics* as disobedient communication. Manning refers to *counting* and *countability* as cases of *whiteness* and *neurotypicality* at play (Manning 2020, 7 f.). Her affiliation between counting, *whiteness*, and *neurotypicality* helps a) to make sense of *whiteness* and *neurotypicality* as logics, as modes of thinking, and of modes of being and b) sheds light on *Mathematics* as an image of thinking-being interwoven with structures of power.
- F) Drawing from *Mathematics* for emotional communication utilizes *Mathematical practices* or modes of expression to express emotion. This could take the form of creating equations or proofs that affect oneself and possibly others in a certain way or that bear the potential to express and cause emotions by giving space to such affects.

- G) Utilizing *Mathematics* as metaphorical communication draws from *Mathematics* to create metaphors that communicate a feeling, a notion, a logic, a system, or an idea.
- H) Drawing from *Mathematics* to communicate notions through forms of symbolism, models, images, or imaginations, makes use of *Mathematical Practices* or *Mathematical Notions* to form modes that convey a notion or an idea for the sake of communications.

These possibilities have in common that they keep *Mathematics* in place as a general framework but draw from it for the sake of forming and inventing modes of communication that are not rooted in a logic of dominance or in a dynamic of epistemic winning-or-losing.

Practices of *Mathematics as Disobedient Communication* bear (at least) the following six potentialities:

- A) They can subvert the logics of dominance and dynamics of *Winning-or-Losing* in *Mathematics* and epistemic practices more generally thus making *Mathematical Practices* and *Mathematical Notions* into modes of expression that center based on the core epistemic ideal of communication and subvert the entanglements of *Mathematics* and (epistemic) dominance;
- B) Drawing from *Mathematics* to establish, find, and invent modes of communication enlarges the available modes of communication. Forming practices of *Mathematics as communication* even bears the potential to subvert exclusive notions of communication, e.g. centering verbal modes or moving in favor of *neurotypicality*¹⁰.
- C) Centering communication in *Mathematical Practice* is a way to challenge individualism in *Mathematics* and epistemic practice through the assertion of collectivity in *Mathematical Practice*. Thus, re-evaluating and re-shaping the implicit individualism moving through many common understandings of *Mathematical Practices* and knowledge production more generally;
- D) Making visible and enhancing collectivity in *Mathematics* by centering communication and thus modes of collectivity not only questions common individualistic notions but also forms a movement in and of itself – a movement towards *Mathematical Practice* as a communal, collective practice;

10 For detailed accounts on *neurotypicality* as thinking that norms see Manning 2016 and Manning 2020.

- E) Forming modes of being an “intellectual with”, i.e., modes of intellectuality that center a togetherness in both rooting intellectual practice in togetherness and striving for togetherness through intellectual modes, in and through Mathematics. As Fred Moten and Stephano Harney (Moten and Harney 2013) make clear, such a subversion changes intellectual history because it changes the very meaning of *intellectuality*. I understand *Mathematics as Disobedient Communication* as part of such a movement. *Mathematics* as communication strives towards epistemic modes and practices that facilitate and give rise and space to intellectual togetherness. The “with” in *intellectual with* stresses how epistemic modes of an *intellectual with* aim to find, invent, and practice intellectual modes that do not center hierarchy and that do not rely on intellectualizing *about* something or someone, but *with* something or someone thereby forming intellectuality in and through relation; and
- F) Making known invisible or underrepresented aspects of *Mathematics* as aspects of *Mathematical Practice* that tend to be widely invisibilized in *Mathematics* as a notion, as an image of thinking-being and in the epistemic ideals it becomes entangled with, that focus on the communication. Thus, forming *Mathematical Practice* that centers communication and de-centers domination makes visible some of the disobedient potentialities already in place in *Mathematics*.

These aforementioned possibilities and potentialities center around and draw upon *Mathematics* as potential means of communication. As such they effectively connect to *Mathematics* as a mode of thinking-being but subverting the focus thereof away from a dynamic of *winning-or-losing* and aim to change the element of epistemic force constructed through the continuum.

3.5 Disobedient Expression

Mathematics as a Form of Expression

One of the core elements of *Mathematics* as an image of thinking-being is the conceptual making of *Mathematics* as a ‘politically neutral’ sphere of knowledge. As Stengers (2007) has shown more generally, and as I have shown for the case of *Mathematics*, it is precisely this conceptual making of *neutrality* that is intensely political. Therefore, attempts to subvert *Mathematics* find an incredibly relevant point of departure in re-considering and re-framing the conceptual

relationship of *politics* and *Mathematics*. One of many possible ways to engage in such is to make use of practices and notions connected to *Mathematics* in order to render it a form of political expression, i.e., of expression of political structures, notions, or struggles.

A striking example of this form of disobedience and expression can be found in da Silva's (2017) paper titled $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$: *On Matter Beyond the Equation of Value*. Da Silva establishes the equation $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$ as a mode of decolonial expression and showcases how Blackness exceeds Western notions of *value*. The excess and beyondness of Blackness is expressed through " $\infty - \infty \text{ or } \infty / \infty$ " as the equations' outcome. Da Silva both makes visible the politics of *Mathematics* and turns the *Mathematical Mode* of the equation into an expression of colonial and anti-Black structures of power. By articulating the logic of anti-Black systems, da Silva re-makes *Mathematics* as a mode of political expression.

I suggest drawing from her work in considering the possibility of *Mathematics* as political expression more broadly. In doing so, *Mathematics* as a political expression would require applying modes/practices/notions of *Mathematics* to express political systems, notions, thoughts, struggles, modes of resistance that are *more-than x*. This practice can be considered a form of epistemic disobedience because it subverts hegemonic epistemic practice and creates forms of resistant and deliberate nonobedience to epistemically violent worlds. Subverting *Mathematics* in this manner also facilitates political subjectivity that understands feeling, knowing, and their movements in their political dimension.

An epistemic practice meets the criteria for *Mathematics* as political expression, when the following three conditions apply:

- A) *Mathematical* notions, practices or concepts are used for political expression;
- B) The chosen aspect/aspects of *Mathematics* are applied to either express dynamics of hegemonic systems and/or modes of resistance and forms of more-than always already there; and
- C) The practice in question centers expression in the sense that it moves in a mode of non-necessity in which the primary goal is to express and not to force, – not even to convince.

Drawing from da Silva's work and these characterizations, I believe there are at least five possible modes *Mathematics as Political Expression* can be applied:

- A) *Mathematical practices/notions/concepts* can be used to express modes of resistance; for example, one possible mode of *Mathematics as Political Expression* consists of re-applying *Mathematics* for the expression of forms of resistance. Da Silva's equation $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$ might be understood as the expression of Blackness as a mode of resistance; This mode produces two important effects that constitute valuable forms of epistemic disobedience: a) *Mathematics as Expression of Resistance* conceptually entangles *politics* and *Mathematics*, which effectively questions and subverts the alleged binary between the two; and b) *Mathematics as Expression of Resistance* establishes new ranges and formats of political expression by unlocking and making visible the potential of modes of *Mathematics* for expression of forms of resistance;

Mathematical practices/notions/concepts are used to express the modes of being more-than, which are already present as it centers the visibility of the non-hegemonic modes of being and thought. This might take the form of equations, calculations, or proofs that form symbols that make visible such modes of being more than. I engage in such a form of expression in my paper entitled *1+1equals1 and 1+1equals0 and 1+1equals1000000000*, in which I argue that these three equations are entangled with one another when they are applied to describe the hegemonic politics of credibility present in discourses on sexual violence. The *1+1equals1000000000* expresses the modes of more-than that exceed the hegemonic system of credibility established and formed under conditions of epistemic oppression (symbolized by the simultaneity of *1+1equals1* and *1+1equals0*).

Mathematics as expression of modes of more-than, bears two core epistemically disobedient qualities: a) it subverts and changes *Mathematical Practice* by shifting the focus to the symbolic powers of *Mathematical modes*; and b) it unlocks new formats that express modes of more-than inside and beyond hegemonic structures of power by making visible the potential of *Mathematics* to realize these forms of political expression;

- B) It uses *Mathematical practices/notions/concepts* to express feelings/emotions/worlds of life. This could take the form of using calculations or equations symbolically or metaphorically to showcase, to make emotions and worlds of life touchable and feelable, like my simultaneous usage of *1+1equals1* and *1+1equals0*, which forms a way to grasp the ambivalence and disorientation that is produced by patriarchal systems of credibility.

Mathematics as expression of emotional worlds of life bears three main qualities through which it is epistemically disobedient: a) it subverts the alleged bi-

nary between *emotion* and *Mathematics* and between *emotion* and *rationality* by entangling *Mathematics* and *emotion*; b) it disobeys the notion of *Mathematics* as intellectually pure and other-worldly by situating it as expression of worlds of life and thus part of worlds of life and part of experiences lived and breathed; and c) it enlarges possible modes that can express feelings and worlds of life through its application of *Mathematics* for this goal;

- C) Using *Mathematical practices/notions/concepts* facilitates visions for living otherwise through *Mathematical modes* by centering *Mathematics* as a form of creative political practice in which understanding and applying practices, notions, ideas from within *Mathematics* are used to facilitate a Utopian Vision and to facilitate imagination.

Epistemic disobedience is produced through how *Mathematics, as practice for (political) Imagination*, queers *Mathematics* as an image of thinking-being by queering the alleged binary between *Mathematics* and politics. Forming and seeking ways *Mathematics* itself can be or inform creative practices, practices of imagination, and visions centers the forms of creativity, intuition, and imagination that already exist within *Mathematics*. *Mathematics as practice for (political) Imagination* carves out new spaces and makes visible intersections of political subjectivity and expression by enlarging modes and spaces of practicing *Mathematics through imagination*. In understanding oneself as possessing qualities for *Mathematical practice* and for political practice available self-imagery and self-conceptualization are informed by collective hermeneutical structures due to the relation between *Mathematical subjectivity* and *political subjectivity* (see Hottinger 2017). By shifting these exact concepts and by disobeying them – new forms and spaces of and for *Mathematical* and *political subjectivity* can be formed.

- D) Using *Mathematical practices/notions/concepts* expresses autobiographies. This suggestion moves very closely to the vision of applying *Mathematics* for the expression of worlds or lives. I understand autobiographical expression here as any form or any kind of fragment of such worlds of life and as any form of expression centered around finding modes through which to communicate one's lived experience. Such forms of expression should be considered modes of political expression because politics, systems, structures, and the notions moving through them shape the form and size of the experiences we live and breathe through.

Seeking and forming *Mathematics* as a mode for autobiographical expression centers *Mathematics* in its communicative qualities and potentialities as equations, numbers, calculations, and notions can be turned into forms

of expression and used to communicate autobiographical realities. Such practices bear the potential to drastically queer the conceptual proximity of *Mathematics* and *epistemic neutrality* because *Mathematics as autobiographical* expression politicizes *Mathematics* and forms a conceptual proximity between *Mathematics* and personal lives. This also disobeys the demands of conventional notions of *epistemic purity*¹¹ built into *Mathematics*. Approaching *Mathematics* having the potential to bear modes of autobiographical expression opens new ways of being *Mathematically active* as well as new modes of political expression by effectively facilitating different and more and more spacious modes of *political subjectivity* as well as *Mathematical subjectivity*.

These five sketches share the core idea of approaching *Mathematics* as a potential format for political expression thus actively disobeying the conceptual make up of *Mathematics as politically neutral*. In light of this, I believe there are (at least) eight potentialities of this form of *Mathematical disobedience*:

- A) Approaching *Mathematics* as political expression and drawing from *Mathematics* to invent different modes of political expression enlarges what can be understood as *political expression* and enlarges the possible modes of forming *political expression*. Thus, it engages in a quest for minor gestures such as pulling and chewing on the structures of rigid exclusionary modes of political expression. Enlarging modes is always a subversion of the dominant and universalized modes of being as well as a carving of new spaces and modes that give way and space to perspectives and modes that have been historically excluded;
- B) *Mathematics as disobedient expression* centers the communicative qualities and potentialities of *Mathematics*; thereby de-centering epistemic goals rooted in a binary logic of *true versus false*, which bely notions of *epistemic winning* and *epistemic losing*. *Mathematics as disobedient expression* explicitly refrains from attempts to *be right*, and centers modes of communicative practice already present in *Mathematics* as well the formation of new modes of *Mathematical practice* that center communication;
- C) Forming and understanding *Mathematics* as political expression de-centers the true-false-binary and bears the potential to question and subvert other

11 With 'epistemic purity' I refer to the notion of 'pure mathematics' and more generally to the idea of epistemic processes being (potentially) 'untouched by the world.'

binary conceptions as well: When the core of the practice of Mathematics is making political structures touchable, feelable this implies that binarism, as a logic, as well as concrete hegemonic binary conceptions¹² can and will be considered and re-considered;

- D) The potential to express violence exists along two dimensions as a) *Mathematics as disobedient expression* might express forms of violence reproduced or facilitated by *Mathematics* and b) *Mathematics* might facilitate modes of expressing forms of violence, e.g., in da Silva's usage of an equation to express the systemic invalidation of Black life;
- E) *Mathematics* already bears its own modes of more-than being in its non-Mathematical strokes there are already practices, notions, and modes that move subversively through *Mathematics*. *Mathematics* as disobedient expression centers thus can modes of more-than being, always already there or always already as well as forms of resistance, touchable, feelable, tastable;
- F) *Mathematics* as an image of thinking-being is conceptually entangled with *necessity* as an epistemic ideal. *Epistemic necessity* in its wide-ranging normalization, even naturalization is a product of hegemonic hermeneutical structures. Approaching *Mathematics* as a mode of expression aimed at communication de-centers this notion of necessity, effectively showing and forming modes of expression that are not structured by the notion of *epistemic necessity*.
- G) Approaching *Mathematics* in its potential for political expression politicizes *Mathematics* and subverts the alleged *political neutrality* of *Mathematics* thus making visible its political dimensions. We can draw from da Silva's work to grasp this better. da Silva forms the equation $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$ to show how modes and logics established through the notion of *Mathematical necessity* facilitate logics and systems of anti-Black racism. Thus, da Silva showcases the entanglement of *Mathematics* with anti-Black politics. I believe this is the general potential of *Mathematics as disobedient expression* to make visible political structures moving within and through *Mathematics*; and
- H) Re-appropriating *Mathematics* to form expression of worlds of live feelings and political structures opens space for *Mathematics* to cause emotion as

12 For more detailed accounts on binary notions and their entanglement with hegemonic structures of power see e.g. Merchant 2000, Alexander 2013, and Plumwood 1993 A, – 1993 B.

well as to express emotion. Such practices move *Mathematics* in a proximity to *emotion*, queering the *emotionality-rationality-binary* conventionally underlying *Mathematics*¹³ and *making visible its emotional dimension*.

These sketches of possibilities and potentialities revolve around the notion of approaching *Mathematics* as a possible form of political expression in order to fashion and endeavor of epistemic disobedience. Such practices target the hegemonic claim to ‘political neutrality’ established through *Mathematics* and the *Mathematics-Rationality-Human* continuum. There are two core effects of these forms of epistemic disobedience: a) they subvert the epistemic ideal of political neutrality built into and through *the Mathematical*, *the Rational*, and *the Human* and b) they build forms of expression that disobey conventional parameters for political expression.

Mathematics as disobedient expression actively disobeys the epistemic practices in accordance with the *Mathematics-Rationality-Human* continuum and partakes in movements that carve out more as well as wider spaces for political expression and therefore for political subjectivity¹⁴.

3.6 Disobedient Necessity

Mathematics as a Political Strategy of Meaning-Making

In chapter two, I established how the epistemic ideal and mode of *necessity* is a) a vital component of the epistemic dominance enfolded through the *Mathematics-Rationality-Human* continuum and b) a notion that is conceptually made up through implicit and explicit references to *Mathematics* as an image of thinking-being. *Mathematics* here takes on the role of allegedly *proving* the desirability, possibility, and superiority of the striving for *epistemic necessity*. Both Shulman and da Silva establish that this notion of *necessity* is inextricably interwoven with dominance because *necessity* is conceptually built through its justification of *dominance*.

13 On the relationship between *Mathematics* with the *emotionality-rationality-binary* see Hottinger 2017, Burton 2008, and Shulman 1996.

14 I understand political expression and political subjectivity to be intertwined as they mutually fashion one another.

However, modes of *necessity* can be and often are used strategically, e.g. to accomplish short-term and hands-on feminist goals such as amendments to law.

In her paper, *On the Cost of Socially Relevant Philosophy*, Kristie Dotson engages with the idea of *trap writing*: a mode of writing arguments, that “trap” the receivers of the text. Trap writing is thus a mode of argumentation that forms a path that renders it *impossible* or *unreasonable* to not agree (Dotson 2019, – 2012 B). Thus, such trap writing is a practice of *Necessity* as it works with and through the notion to engages the idea of *Necessity* to be understood as *convincing*, as *believable*, and as *credible*. In her paper, Dotson reflects on the strategic usage of such trap writing, detailing how a paper that she wrote in the mode of trap writing gained considerably large uptake (Dotson 2019). She specifically contemplates the mode of trap writing in the context of writing philosophy that aims at enacting social change by stating how this mode of writing makes strategic sense to her as a Black Feminist Philosopher (Dotson 2012 A).

I believe Dotson’s thoughts and her strategic engagement with trap writing is reflective of arguments directed towards feminist or anti-racist goals, which engage with the notion of *Necessity* and form arguments with and through practices that form and perform *epistemic Necessity*. The branch of Analytic Feminist Philosophy is a philosophy-based example of this. Generally speaking, there is a lot of trap writing in the branch of Feminist Philosophy. Specifically, trap writing that aims to trap people into committing to practices or thoughts, which might help to slightly reduce systemic sexism and other structural forms of exclusion (see e.g. Bratu 2024 or Schulz 2024).

Non-philosophical examples of these strategic engagements with *Necessity* is feminist content created on social media¹⁵ that heavily relies on a rhetoric of *logic*, *science*, and *data* to “back up” feminist claims, which are argued, to “water-proof” the argument, and thus the feminism itself and thereby to trap people into feminist considerations by not giving them “a rational mode to disagree.”

These strategies are in alignment with reference *Mathematics as Mathematics* is the image of thinking-being that these modes refer to. As such, sleeping with *necessity* means sleeping with the logic of $1 + 1 = 2$.

15 Instagram accounts that can be understood as exemplary of these forms of feminist content are ‘josischreibt_’, ‘magdalenaeml’ or ‘_vanessasiel’. The success of these forms of content are indicated through the numbers of followers, likes, and the amount of positive engagement they receive.

$1 + 1 = 2$ is the structure of all the modes detailed above, which argue that *this is a given and so is this and this adds up to feminist practice. You cannot argue with this. Do you want to disagree? Then, you might as well say $1+1$ is not 2. You cannot expect to be taken seriously then.*

This is the logic of disobedient usages of *necessity*. As always, there are nuances, but I do believe that this is their baseline. These modes work because they play with the entanglement of *Mathematics*, *Rationality*, and *Humanism*. This is a forceful mode of meaning-making that works through the exclusion of counter-politics.

I believe the politics of these strategic engagements with *necessity* are immensely complex and therefore it is important to note a few core considerations.

- 1) These modes of argumentation tend to be immensely successful in the sense that they generate wide uptake, wide validation, and consideration. This is because they fit with the dominant hermeneutical bodies in place – they perform the scripts of believability through their involvement with *Necessity*.
- 2) These modes of argumentation reproduce hegemonic modes as the logic of *necessity* is the logic of whiteness, the logic of masculinity, the logic of the binary, and the logic of coloniality¹⁶. When fooling around with *necessity* one fools around with all of the logics thus creating stark dissonance and, possibly, hypocrisy.
- 3) These modes are not solely a reproduction of these logics as they do subvert *necessity* by putting it to anti-hegemonic rather than to hegemonic use. Also, these modes might enlarge access to the modes and practices of *necessity* thus subverting their exclusiveness.
- 4) Still, while point three is important to acknowledge, what is not subverted through these modes of disobedient *necessity* is their involvement with *necessity* and *dominance*. Engaging with *necessity* is engaging in struggles for *dominance* – not by striving for nondominant modes– but by appropriating *dominance* for one's own struggle. There can be extremely good reason to do so, and my comments are not written with any judgement. Rather, I think there needs to be clarity that moving with modes of *necessity* is a form of striving for *dominance* and *domination*.

16 For more detailed accounts on these multiple hegemonic dimensions see da Silva 2017, Nye 1990, and Shulman 1996.

Personally, I am a firm believer that decolonial feminists can and sometimes should have affairs with *Necessity* –but never partnerships. An affair is an involvement that comes from a place of exigency and from a place of urgency. Affairs can be quite dirty (in Elsa Dorlins sense of the word¹⁷) for they do not align with deeper needs. A partnership is an involvement, which is hopefully and possibly very different in nature as it is a deliberate, deep commitment that arises from places of political, personal, emotional, and theoretical fulfillment.

I do not think any radical decolonial and feminist struggles should be seeking partnerships with *necessity*. But we might end up having strategic affairs with *necessity*. Some amongst us, like Dotson for example, might enjoy these affairs, which makes sense in lots of ways¹⁸, while others, like me, might feel a little dirty in these encounters. This makes as much sense as the enjoyment does and most times it is likely to be a little bit of both. However, I believe we should always realize the deeply hegemonic bodies of *necessity* at work. Thus, I arrive at my conclusion – no partnerships with *necessity*!

But also, affairs with *necessity* might be necessary (how ironic!) and might also be enjoyable and empowering.

Drawing from these considerations, I propose the following definition for *Disobedient necessity*: the formation of disobedient modes of *necessity* means putting *Mathematical necessity* to strategic use to subvert, change, and question violent structures of power. For these modes of *necessity* to be genuinely disobedient, however, I believe hegemonic bodies of *necessity* need to be made visible, known, and continuously negotiated and reflected upon.

This leads me to suggest the following criteria of *Disobedient necessity*.

- A) *Disobedient Necessity* applies practices and notions of (*Mathematical*) *necessity* to change/question/subvert hegemonic structures.
- B) Applying and claiming *necessity* happens in modes of strategic and critical playfulness – a little like playing with fire, knowing that a) it is warm (good!)

17 Through her notion 'Dirty Care' Dorlin defines 'dirty' actions, situations or behaviors that are primarily rooted in fear and attempts for self-preservation against violence (Dorlin 2017, 133 f.).

18 It makes sense on the level of intellectual and political self-empowerment, self-discovery as well as for strategic reasons and practices of self-preservation in the context of academic philosophy. For Dotson's personal and detailed reflections see Dotson 2012 A.

and b) it's fire (danger!). This is to say, the genuine social, political, and personal spaces and utopias we are moving ourselves towards should lie far beyond, inbetween, or underneath *necessity* as awareness of the hegemonic structure of Necessity is always there and always part of the *strategic play*.

There are six possibilities of *Doing Disobedient Necessity* that I want to highlight.

- A) Its strategic use for argumentation arises from its use of modes and practices of *Necessity* to form arguments that withhold and fit the hermeneutical structures in place.
- B) Claiming *being-convincing*, *being-credible*, *being-believable*, *being-rational*, and *being-human* is a strategic appropriation of *necessity* and appropriating *necessity* against the grain can subvert what is understood as *being-convincing*, *being-credible*, *being-believable*, *being-rational*, and *being-human*.
- C) (Self-)Empowerment can occur through *necessity*. Given that the notion and practice of *necessity* is made *valuable* due to the hermeneutical and political structures in place, the appropriation of *necessity* can be immensely empowering – intellectually, politically, and personally. Being able to move in modes of *necessity* is likely to feel intellectually empowering because of the hermeneutical structures and bodies of *necessity in place*. This empowerment can be deliberately engaged for purposes of political, personal, theoretical, and intellectual empowerment.
- D) Making use of *necessity* to change institutional structures (e.g. amendments of the law) can be a promising strategy to make institutional systems less widely violent and exclusionary by appealing to the very logic they stand on, i.e., the hegemonic logic of *necessity*.
- E) Appealing to and using *necessity* to make visible and name forms of violence can be a mode through which one insists on widely normalized forms of *violence* being named as *violence*. For example, proposing an official definition of patriarchal forms of violence such as sexual assault or stalking and meticulously applying them to singular cases is a strategy that moves with *necessity* as its guiding force. These kinds of strategies can be and have previously been of great importance in making visible violence and the normalization of thereof, and in appealing to wide audiences with this quest.
- F) In making use of *necessity* to enlarge access to *Mathematical Subjectivity* or other modes of *Intellectual Subjectivity*, one moves closely with *necessity* as a strategy of empowerment as claiming and reappropriating modes of *neces-*

sity is a mode through which *Mathematical Subjectivity* and *Intellectual Subjectivity* can be claimed.

I believe there are three core potentialities to all these modes of *Disobedient Necessity*.

- A) They can form strategic modes of (intellectual, political, etc.) participation, e.g., participation in discursive structures, modes, and practices. In hooking up with *Necessity*, these forms of participation can make visible violence and bear the potential to help bring about beneficial (non-radical)¹⁹ changes.
- B) Appeals to *necessity* can engage subversion of hegemonic modes and the potentiality of chewing termite tunnels and broadening concepts.
- C) They can open up possibilities for Identification, Subjectification and Empowerment as potentialities of disobedient appropriation of the entanglements of *necessity*, with *the Rational*, and with *the Human*.

These modes of *Mathematical disobedience* share that they strategically and critically engage with *necessity* thus making the dominant force of this notion a force for disobedience: This version of *Mathematical disobedience* is an attempt to turn the mode and notion of *necessity* against the scripts of the *Mathematics-Rationality-Human* continuum, which continuously re-enforce the *Mathematics*-centric world and the continuum-based scripts.

3.7 Disobedience against Thinking-in-Binary Non-binary *Mathematics*

One of the core elements of *Mathematics* as an image of thinking-being is *the logic of the binary*: a two-value-system that only bears the options *true* or *false* with no in-between – a logic of separability and of binary concepts, modes, and dualisms. The fundamental *logic of the binary* is exemplified by the popularity of indirect proofs in *Mathematics* as well as in philosophical logic in which indirect proofs prove something to be *true* by proving it is *not false*. Such modes of proving directly rely on a true-false-binary and utilize this bi-valent conception to

19 With 'beneficial (non-radical) change' I refer to societal changes that move on the level of making visible and de-normalizing violence, but not on the level of re-writing images of thoughts or modes of thinking and being.

demonstrate alleged *epistemic certainty* and irrefutable validity of *Mathematics* and of *proof*.

However, not all practices within *Mathematics* operate based on this fundamental binary. For example, philosophical logic bears multivalent systems of logic and *Mathematics* bears what Franci Mangraviti refers to as *Inconsistent Mathematics* (Mangraviti 2023 A, – 2023 B). By inconsistent *Mathematics* Mangraviti refers to modes of *Mathematics* that do not rely on a true-false-binary or on other modes of thought infatuated with binarism (Mangraviti 2023 B). Mangraviti proposes *queer incomath* as an emancipatory intervention into classical *Mathematics* (Mangraviti 2023 B, 298 f.). *Queer Incomath* as it is proposed by Mangraviti, is an outstanding example of epistemic disobedience in relation to *Mathematics*. Relating her work to feminist critiques of logic established by Val Plumwood, she showcases the validity of Plumwood's claims for *Mathematics* and uses them to then propose forms of *Mathematical Practice* that queer the logic of the binary moving through classical *Mathematics*. Queer Incomath radically disobeys binarism and thus engages in a type of mathematical disobedience that centers modes in which binarism can be disobeyed. These epistemic practices thus move in nonbinary modes as modes that subvert and counteract all modes of violence and hegemonic supremacy that are ever so present in modes of *thinking-in-binarism*²⁰.

Mathematical disobedience against binarism keeps the framework of *Mathematics* while subverting binarism by a) ridding *Mathematical Practice* of the *true-false-binary* and practices directly based on this binary (such as indirect proofs) and by b) developing and applying non-binary *Mathematical practices*. The following three criteria further characterize mathematical disobedience against binarism:

- A) Creating and applying non-binary *Mathematical Practices*, like proofs that do not require a two-value-system;
- B) Refusing the use of *Mathematical Practices* that rely on binarism, like the true-false-binary; and
- C) Otherwise keeping the framework of *Mathematics* mostly intact.

This points to four possible modes of mathematical disobedience against binarism.

20 For more detailed accounts see Mangraviti 2024, da Silva 2017, Alexander 2013, Shulman 1996, and Plumwood 1993 B.

- A) Centering *Mathematics* without indirect proofs by practicing non-binary modes of proving that already exist and by forming new modes of proving that do not rely on the true-false binary. Refusing indirect proofs and centering other modes of proving disobeys the logic of the binary in its most fundamental form by refuting the notion of the two-value system – of *either true or false without any in-between*. The popularity of indirect proofs is a telling example and a particularly fundamental example of *the logic of the binary within Mathematics*. Thus, one deeply powerful mode of Mathematical disobedience against binarism lies in any attempt to un-do and re-do the normalization of indirect proofs. These modes can range from refusal of indirect proving to the invention of new modes of proving. Mangraviti's *queer incomath* is a powerful example of *Mathematical disobedience against binarism*. Her concept of *queer incomath* foregrounds a focus on the beyonds and in-betweens that can be practiced and known and felt and touched when indirect proofs are refused and give way to *inconsistent Mathematical practice* (Mangraviti 2023 B).

At the core of this mode lies the identification of indirect proofs as a re-production of binary modes in their hegemonic dimension and thus the productive refusal of indirect proofs comes from turning away from indirect proofs toward other modes of proving.

- B) *Engaging Mathematical Practice* focused on practices not reliant on *the logic of the binary* is a similar move to de-centering indirect proofs, but rather than focusing solely or primarily on reproducing the normality and popularity of indirect proofs, it suggests centering a) an identification of other notions, modes, practices, as well as proofs within *Mathematics* that are not reliant on the true-false-binary or on a different binary; and b) adopting a broader approach to de-centering and re-doing. In its essence this approach, like the one I sketched out before, disobeys the *Mathematical Modes* reliant on binarism. However, by practicing and forming alternative ones, it thus, also refuses them.
- C) Centering the invention of *Mathematical Proofs* beyond binarism puts focus on the invention of modes of proving that do not feature modes of binarism rather than beginning with the identification of specific forms of the production and reproduction of binarism within *Mathematics*. It thus queers and redoes what it means to prove within *Mathematics* – subverting *proving* both as notion and practice by un-doing the binarism normalized within and through conventional *Mathematical proofs*.

D) Inventing and Developing *Mathematical Practice* not in need of the true-false-binary, much like the approach sketched out in C), aims to re-do *Mathematical Practice* by centering the invention and formation of modes beyond binarism. Like mode C), the focus lies not on the identification of binarism within Mathematics or on the non-binary modes already present in *Mathematics*. Rather, the focus is the invention and the (collective) creation of non-binary modes of *Mathematical Practice*, which effectively disobeys the element of binarism conventionally present within *Mathematics*.

I believe there are three core potentialities that of Mathematical Disobedience against Binarism:

- A) Subverting *Credibility* by means of subverting *Mathematics* keeps the credibility of Mathematics alive while de-linking *Mathematics* and *Mathematical Credibility* from Binarism. *Mathematical Credibility* is conceptually interwoven with binarism, particularly the *true-false-binary*. Thus, keeping the general framework of *Mathematics* alive but ridding *Mathematical Practice* of Binarism bears the potential to queer and render non-binary (*Mathematical Credibility*).
- B) Making visible existing non-binary modes of *Mathematical Practice* and epistemic practice, which are on the verge of *Mathematics* that we can see, know, and practice in order to shift them more towards its center.
- C) Subverting practices and notions of *proof* by de-centering Binarism queers what it means to *prove*, shifting the focus towards less hierarchical, rigid modes.

Mathematical disobedience against binarism directly relates to questions of *proving*. What it means to *prove* is a highly political question. This political dimension can be exemplified by considering how the notion of *proof* is present whenever accounts of sexual violence come forth²¹. *Mathematics* informs calls for *proving*, notions of *proof*, which much like *Mathematics* more generally, too

21 There is an impactful and wide-ranging feminist discourse on the invocations on victim-survivors to prove sexual violence as well as on the very notions of proof and evidence in this context. The most important works in this field include the following: Bryden & Lengnick, 1997; Childs & Ellison, 2000; Leslie & Smith, 2021; Hunter, 2000/ Kinports, 2000; Mack & Roach Anleu, 2000; Nicolson, 2000; Raitt, 2000.

move through and within *the logic of the binary* (Freedman, 2023; Mangraviti, 2023; Nye, 1990; Shulman 1996). Affirming inconsistency and refusing binary modes of *proving*, such as indirect *proofs*, therefore subverts practices and notions within *Mathematics* that are deeply interwoven with political discourses and personal worlds of life.

Disobeying binarism is a mode of decolonial and feminist disobedience because patriarchal and colonial structures of power are actively upheld by the true-false-binary, other binary concepts, as well as a general inclination towards binary modes and concepts. Thus, these conventional hierarchical binaries form exclusions that we can make visible, question, and re-do by disobeying binarism. *Mathematical disobedience against binarism* is of fundamental importance for epistemic disobedience against binarism more generally precisely because *Mathematics* deeply informs the normalization, legitimization, and idealization of binary epistemic modes.

Mathematical disobedience against binarism makes space for notions, modes and practices in *Mathematics* – as well as beyond *Mathematics* that disobey binarism and open up epistemic modes and modes of subjectivity that are not reliant on *the logic of the binary*. These endeavors of disobedience strategically connect to the *Mathematics-Rationality-Human* continuum to then chew away at the *logic of binary* built into continuum-based scripts.

3.8 Disobedience against Universalism

Seeing and Learning Mathematics in a Plural Sense

One of the core characteristics of *Mathematics* as an image of thinking-being is the inclination to think that this mode of mathematical practice is ‘the only *Mathematics*.’ The epistemic values and practices implied by *Mathematics* are distinctly Western and patriarchal but are hardly ever communicated in their situatedness. This dynamic universalizes *Mathematics* by claiming or implying that it is the only possible mathematical practice.

However, as both Shulman and Hottinger discuss, there are modes of mathematical practice, mathematical conceptualization, and epistemic values beyond those of the distinctly Western modes established through *Mathematics* (da Silva 2017, Hottinger 2017, Shulman 1996). Hottinger shines light on the importance of making visible, teaching, and knowing non-Western modes of mathematics as to this day *Mathematics* is actively universalized and taught as *the only Mathematics* – even to people who might already be familiar

with mathematical modes beyond Western *Mathematics* (Hottinger 2017, 125 f.). These students are asked to un-learn their non-Western mathematical modes so that their understanding of mathematical practice can fit within the Western, universalist notion of *Mathematics*. This is an epistemicide of mathematical knowledge as existing mathematical knowledge is actively erased and un-taught in light of the hegemonic norm that mathematical practice ought to be *Mathematics*.

There are attempts to build different forms of mathematical practice and different mathematics into school curricula (Hottinger 2017, 125 f.). I am in alignment with Hottinger's analysis, which states that while the attempts of so called *Ethnomathematics* are important, they are also in danger of reinforcing Western epistemic norms. All too often, these attempts still feature *Mathematics* as the form of mathematics that is singularly taught for the most part, and different mathematics are only introduced through a general nod to their existence. This effectively reinforces *Mathematics* as the norm and others all mathematics not rooted in Western epistemic values (Hottinger 2017, 157 f.).

So where does this leave us? Once more I feel reminded of my terminology in earlier parts of this work – that: attempts by *Ethnomathematics* tend to move with *the hope of addition* – the hope to add many different mathematics to *Mathematics*. But as long as the universalism built into *Mathematics* is not targeted itself, these attempts move with the constant danger of reinforcing that exact universalism, of only adding non-Western mathematical modes without restructuring the curricula themselves nor *Mathematics* in the necessary ways. So, what I argue would be necessary is to move towards pluralistic notions of mathematics and to train ourselves and others to think of mathematics in the plural. Therefore, we are in need of disobedience against universalism – both in general and specifically, regarding *Mathematics*. Such forms of disobedience against universalism center the deconstruction of Universalism of *Mathematics* and aim to learn, practice, and make visible different mathematics – a mathematics in the plural and with wide open spaces for diverging epistemic values, modes and practices. The following six criteria can be taken to define *Disobedience against Universalism* with regards to *Mathematics*:

- A) The general framework of *Mathematics* is kept alive, but the element of universalism in *Mathematics* is targeted in order to enable a pluralistic gaze and the visualization and learning of various mathematics.
- B) The universalism built into *Mathematics* is subverted, deconstructed, or questioned.

- C) Mathematical pluralism is introduced and practiced as multiplicities of mathematical practices are made visible, made to be learned and touched and felt and practiced and known.
- D) Non-Western mathematical practices are made visible.
- E) Differences in mathematical practices are made visible in non-hierarchical ways, i.e., without any ranking order or any true-versus-false-binary.
- F) Non-*Mathematics* mathematics are made more accessible, visible, practice-able.

There are seven possible ways to pursue such mathematical Disobedience against Universalism I will highlight here:

- A) Teaching non-Western mathematical practices in educational spaces, as the example of Ethnomathematics shows, is not without its pitfalls and can only unfold decolonial potential when *Mathematics* is deconstructed in its role as the norm in mathematics. However, taking up this task is of high importance for two core reasons: a) educational systems and institutions very deeply shape what is conceptualized as education, intellectuality, and “mathematics”; and b) as both Day and Hottinger very eloquently make clear, institutionalized mathematical practice shapes lives and opportunities for education, jobs, and all kinds of material wealth and institutional belonging (Day 1997, Hottinger 2017). Therefore, deconstructing the dominance *Mathematics* has over institutionalized mathematical practices and systems of job opportunities is of incredibly high importance to a) counter-acting mathematical epistemicide, b) make use of academic institutions to deconstruct the universalization of *Mathematics*, c) enact institutional validation and recognition of forms of mathematical practice, and d) counter-act Western and patriarchal mechanisms of exclusion built into educational systems and notions structuring job opportunities. Insisting on the existence and visibility of various modes of mathematical practice bring to bear two aspects of epistemic disobedience: a) subversion of the universalization of *Mathematics* and the universalism built into *Mathematics* and b) making non-*Mathematics* mathematical practices visible, learn-able, touch-able.
- B) Addressing, problematizing, and questioning the Universalism in *Mathematics* and the universalization of *Mathematics* makes it visible, as a mode of Western violence and counter-acts the universalization taking place: *Mathematics* is conventionally implied to be the only form of mathematical prac-

tice and to possess epistemic qualities like *neutrality* and *universality*. These conceptualizations, however, are applied to *Mathematics* in by means of distinctly Western epistemic qualities and values, which erases the visibility of the situatedness of *Mathematics*.

- C) Forming and establishing pluralistic notions of mathematics by approaching mathematical practice with a genuine sense of pluralism counter-acts the universalization of *Mathematics* and gives way to non-Western modes of mathematics being taught without engaging epistemic othering.
- D) Re-learning epistemic values in order and to restructure epistemic and political systems, requires changes in epistemic practice through engagement of different modes of mathematical practice, different forms of proofing, and application of different notions of *what it is to proof*.
- E) Creating and practicing forms of de-centering *Mathematics*, i.e., forming modes to change and deconstruct the role of *Mathematics* as a central reference point for Western epistemic practice as well as for mathematical practice, aims to address or subvert *Mathematics* in this role of reference point. *Mathematics* as a Western epistemic institution is conceptually built as a point of reference for *rationality*, *intellectuality*, and *being-human*. As I have demonstrated in chapter one and two these conceptual entanglements are brought into existence through universalism, which serves as a common thread – moving through these notions (*Mathematics*, *Rationality*, *Humanism*).
- F) Addressing dangers of “mathematical Othering” requires making visible, problematizing, and questioning dynamics of teaching, which still feature *Mathematics* as the mathematical norm. Directly addressing these dynamics helps recognize and disarm them and is a form of making visible and deconstructing the element of universalism in *Mathematics*.
- G) Not all practices, modes, and notions within *Mathematics* imply universalist notions. Therefore, one possible mode of combating universalism in *Mathematics* is centering and forming *Mathematical practice* that does not feature universalist implications.

These possible practices share a commitment to undoing the universalization of *Mathematics* and the universalism built into *Mathematics*. There are eight potentialities of such practices I will highlight here.

- A) Part of the conceptual make-up of *Mathematics* are the epistemic values such as *neutrality* or *objectivity*, which are closely linked to and informed by

universalism. Forming modes of subverting and questioning the element of universalism within *Mathematics* bears the potential to de-center the role these and other universalist notions play in Mathematics – in its conceptualization as well as in its practice.

- B) Establishing and learning non-*Mathematics* mathematics confronts and counter-acts the universalism and universalization of *Mathematics* and makes it possible to establish different mathematics as mathematical practice and knowledge; thereby, de-throning the dominance of *Mathematics* over the term ‘mathematics.’
- C) Epistemic Othering is any practice that explicitly or implicitly regards *epistemic modes as other to the norm* when they do not fit with epistemic modes normalized in Western patriarchy. Regarding all these epistemic modes as “other” re-enforces the normalization of hegemonic and conventional modes. Epistemic othering is a systematic occurrence, a product of the normalization of certain epistemic modes and the exclusion of other epistemic modes.

When the universalization and normalization of *Mathematics* is made visible and different forms of mathematics are more widely practiced, established, known, and recognized – opportunities to unlearn epistemic othering with regards to mathematical practices are formed. As a result, epistemic othering can become visible – and as such, can be confronted and un-learned.

- D) Forming and learning pluralistic notions of mathematics i.e., learning that multiple, even conflicting forms of mathematical practice can coexist without there necessarily being a *wrong* and a *right*, a *better* or *worse*. Pluralism here is not a movement towards despotism but rather towards questions of situatedness and of suitability. As such, approaching mathematical practices or epistemic practices more generally in a mode of pluralism is first and foremost a movement that counter-acts the binary of *true-false, good-bad*. It is not an undoing of these categories, but rather a chance to define them and to get to know their inbetweens and beyonds.
- E) Questioning *Mathematical universalism* and other forms of universalism makes visible the universalism within *Mathematics* and opens up opportunities to question universalism as an epistemic value, which is necessary to counter-act the universalization of *Mathematics* as *the only mathematics*.
- F) Making visible (mathematical) Universalism as Western, i.e., that universalism and universalization of specifically situated epistemic modes are distinctly Western and *white* modes that work to enact and uphold their

own supremacy. Confronting universalism within *Mathematics* implies to making visible what is being excluded through this universalism, namely non-hegemonic modes of mathematical practice. Making visible and understanding how colonial exclusions of knowledge and colonial epistemicide are consequences of and legitimized through universalism means understanding universalism in its capacity as a tool to uphold systems of *white* and Western supremacy.

- G) Subverting (*Mathematical*) Universalism by keeping the general framework of *Mathematics*, but de-centering and questioning elements of universalism are ways in which said universalism and universalization can be counter-acted and subverted.
- H) Forming epistemically disobedient mathematical practices with regards to universalism leads to developing pluralistic stances with regards to mathematical practice, e.g., practicing different mathematics.

Disobedience against Mathematical Universalism is a form of epistemic disobedience that centers modes of disobeying the universalization of *Mathematics* as well as the universalism built into *Mathematics*. When exclusionary and specifically situated epistemic modes are universalized they enfold exclusionary dimensions. This universalism thus affects possibilities and impossibilities for (political) subjectivity. The *Mathematics-Rationality-Human* continuum ensures that exclusions from *the Mathematical* are exclusions from *the Human* and the other way around. Confronting the universalism and universalization built through the continuum is a practice that a) shows and inhabits the inbetweens and beyonds of these notions that are always and were already there and b) carves out spaces for various and new (political) subjectivities.

3.9 Possibilities and Impossibilities of *Mathematical Disobedience*

In this chapter I explored forms of epistemic disobedience in relation to *Mathematics* and to the *Mathematics-Rationality-Human* Continuum, while also attempting to subvert some of their violent dynamics. This mode of disobedience bears the strategic element of connectivity to the world as it is. As such, rather than moving with different worlds in mind *Mathematical Disobedience* is grounded in the world of *Mathematics* and thus upholds a connection to hegemonic epistemic structures.

Working with *Mathematics* connects practices of epistemic disobedience practiced to existing bodies of meaning-making, sense-making, and subjectification and effectively assures that the disobedience practiced can be recognized as *meaningful* as it is taken up through contemporary bodies of meaning-making. However, it is this same connectivity to the hegemonic body of meaning-making, sense-making, and subjectification that runs the risk of reproducing central aspects of the patriarchal and colonial structures of power, we are so eager to move against and beyond. This is an unresolvable conflict integral to epistemic disobedience as I understand it here.

Mathematical Disobedience bears with this conflict – knowing it to be unresolvable and moving with this in mind to form strategic endeavors of disobedience. I proposed seven potential forms of Mathematical Disobedience: 1) disobedient appropriation, 2) disobedient symbolism, 3) disobedient communication, 4) disobedient expression, 5) disobedient necessity, 6) disobedience against binarism, and 7) disobedience against universalism.

Mathematical Disobedience is disobedience practiced against epistemic violence. Epistemic resistance is a vast spectrum featuring many modes – all of them deeply necessary in their own right. I make use of the distinction between *Epistemic Disobedience* and *epistemic wildness*, not to mark two mutually exclusive categories, but rather to point to two polarizing points within the spectrum of epistemic resistance. *Epistemic Disobedience* is a movement that counter-acts epistemic violence, whereas *epistemic wildness* moves beyond it. *Epistemic Disobedience* bears connectivity to contemporary bodies of meaning, whereas *epistemic wildness* bears connectivity to visions, movements, gestures, and modes that exceed the world as it is now.

Mathematical Disobedience and *Epistemic Disobedience* are limited because they still references violent modes and the continuum. Simultaneously, there is the vibrant possibility of connectivity and subversion – of finding modes of epistemic resistance that are linked to present bodies of meaning. The impossibilities of *Mathematical Disobedience* as well as other modes of *Epistemic Disobedience* include the impossibility of the radical centering of beyondness and inbetweenness and the impossibility of visions, modes, and movements that exceed the *Mathematics-Rationality-Human* Continuum.

Thus, our next movements will dance more closely to the other pole of the lovely and extensive spectrum of epistemic resistance – to the pole of *epistemic wildness*.

4. Wild Mathematics

Epistemic Wildness as Resistant World-making

We shall by morning
Inherit the earth.
Our foot's in the door.
Sylvia Plath, Mushrooms (1967), 34

4.1 Wild Mathematics as an Image of Thinking-Being for Rebirthing Worlds

This final chapter aims to be a beginning gesture, in moving toward the collective creation of *wild mathematics*: an image of thinking-being – as well as – a mode of thinking-being committed to re-birthing worlds.

I propose *wildness* as a guiding term for this endeavor in order to a) re-do the *order-wildness* binary that is so heavily and violently employed by colonial-patriarchal worlds and b) to name the vibrant messiness that is always already there and exceeds the *Mathematics-Rationality-Human* Continuum. Thus, what underlies my proposal of *wild mathematics* is a more general proposal of *epistemic wildness*: of a re-making of thinking-being that does not reference the continuum – a re-making of thinking-being that commits to the messiness of new worlds. New worlds are messy because it is precisely the continuum and its scripts i.e., the *Mathematics*-centric metric, which creates what we learn to recognize as order. To exceed the continuum and *Mathematics*-centric scripts, is to enter into messy complexity and wild potentiality. I propose epistemic wildness as a figure of resistance that aims to exceed rather than to reference what it resists – namely the *Mathematics-Rationality-Human* continuum and *Math-Man*-centric scripts.

The main objective of this chapter is to form a first proposal for *wild mathematics* as an image of thinking-being. I move through this endeavor by exploring six texts that I consider to be acts of epistemic resistance as well as theories

on epistemic resistance. My intellectual movements in this chapter are guided by three principles 1) thinking-with rather than ‘thinking about,’ 2) to learn-from rather than to ‘learn about,’ and 3) a commitment to intellectual debt – to always being indebted and in debt when thinking (and being). These three principles aim to re-do forms of hierarchy that are recognized as part of intellectuality in accordance with the continuum. In this sense, *wild mathematics* forms a movement beyond that of a counter-hegemonic strategy.

Each of my six explorations will generate insights about and characteristics of *wild mathematics* so that at the end of this chapter we will have created a proposal of what *wild mathematics* could be. These explorations are taken up in the form of what I call chapter-essays, which mix the genre of the essay with a conventional book chapter in non-complete, wild attempt to find a form that accounts for the intellectual movements of a thinking-with.

Exploration 1 with Audre Lorde *Mathematics as Distillation of Experience*

My first exploration is a reading of Audre Lorde’s essay (1985) *Poetry is not a Luxury*. This reading will form a movement of thinking-with Lorde’s understanding of poetry to help inform a notion and the practice of *wild mathematics* – a movement through which Lorde’s thought fills this notion with content. This chapter-essay provides a movement and an invitation to movement. My notions and propositions for *wild mathematics* are deliberately incomplete for they form an invitation, a starting point, and a framework; they are here to spark light and feeling – and to inspire collective creations and versions of *wild mathematics* and *epistemic wildness* more generally.

I move through this endeavor in four stages. First, I introduce Lorde’s core themes, terms, and thoughts in her essay *Poetry is not a Luxury*. Here I showcase and relate them to the question of epistemic resistance and epistemic wildness. Second, I take on the question of what Lorde’s propositions could mean for a notion and practice of *wild mathematics*. This part focuses on making *wild mathematics* realizable through and with Lorde’s notion of *poetry as a distillation of experience*. Third, I briefly propose possible ways to experiment with *mathematical practice as distillation of experience*. Fourth, I conclude with a comprehensive summary of characteristics of and inspirations for *wild mathematics* drawn from Lorde’s notion and practice of poetry.

So, let me *think-into* Lorde’s essay to begin this endeavor:

The title of the essay, *Poetry is not a luxury*, can be taken as the central point she is making and as an orientation for reading this short yet dense essay. Furthermore, with the line: *It is a vital necessity of our existence* (Lorde 2017, 8), Lorde is addressing *women* in their marginalization as *women* (Lorde 2017, 8). Her core argument is that there is a form of poetry that forms language, which is integral to survival and change and it is in precisely this sense that poetry is a necessity of survival and not a luxury (Lorde 2017, 10). To deepen our understanding of this thought is to understand the quality of the revolutionary power of poetry proposed by Lorde:

That distillation of experience from which true poetry springs births thought as dream births concept, as feeling births idea, as knowledge births (precedes) understanding.

Poetry is not a Luxury, 7

To Lorde poetry is *distillation of experience*; it is a practice that indulges in how life *feels*. And it is precisely this centering of feeling and feelings that forms the qualities Lorde considers forces of survival and change:

Sometimes we drug ourselves with dreams of new ideas. [...] But there are no new ideas still waiting in the wings to save us as women, as human. There are only old and forgotten ones, new combinations, extrapolations and recognitions from within ourselves, along with the renewed courage to try them out.

Poetry is not a luxury, 10

Lorde attributes the centering of thought, of thinking, of ideas to 'the white fathers' (Lorde 2017, 8) and thus to structures composed by colonial patriarchy. Most essential here is her plea to not get caught up in the fantasy that we are in need of 'new ideas' for survival and change. According to Lorde, we are in need of feeling the existing ideas differently – feeling them anew and remembering and recomposing what is there and has always been. The claim that in feeling(s) there lies revolutionary practice, and power lies at the core of Lorde's essay and of the notion and practice of poetry she puts forth:

For within structures defined by profit, by linear power, by institutional dehumanization, our feelings were not meant to survive. Kept around as unavoidable adjuncts or pleasant pastimes, feelings were meant to kneel to thought as we were meant to kneel to men. But women have survived. As poets.

Poetry is not a luxury, 11

Feeling is what has been conceptualized and shown through practice to be *the thing that's always less* and *the practice that is always lacking* – the thing inferior to *thought*. The script that evokes us to 'think rather than feel' is authored by the *Mathematics-Rationality-Human* continuum and by its logic of the binary as the alleged inferiority of feeling is conceptually birthed by the *Rationality-Emotionality* dualism and politically birthed by how dangerous feeling is to the *Mathematics-Man*-centric world.

Poetry for Lorde is a practice of feeling – of deepening, exploring, and expressing feelings in order to form language for what has had no language before:

And where that language does not yet exist, it is our poetry which helps to fashion it.

Poetry is not a luxury, 9

Lorde's intense advocacy for a practice of feeling is embedded into her warning to not let the glorification of thought fashioned by colonial-patriarchal worlds fashioned by the continuum take over. She speaks precisely of *living as a situation to be experienced and interacted with* rather than *living as a problem to be solved* (Lorde 2017, 8). What Lorde describes here as problem solving is a mode of thinking-being birthed by the *whiteness* and the *masculinity* of the *Mathematics*-centric world; the mode of problem solving and its universalization is birthed by the *Mathematics-Rationality-Human* continuum.

Poetry for Lorde is the practice that makes living into a situation, a practice, and an event to be experienced and interacted with. Poetry is the practice that sustains living precisely because it feels its way out and through it without seeking to *solve* or *think* (Lorde 2017, 8).

I believe there are six core solicitations and aspects of Lorde's essay that move in ways deeply interwoven with one another:

- 1) A movement against problem-solving, which is a movement for being-in-relation and experiencing how living is practiced and about finding a practice of thinking-being. It is about living differently to what the world of the continuum prescribes – differently to what structures oriented towards profit and linear modes of power suggest to us (Lorde 2017, 10);
- 2) An intense solicitation for feeling that takes the form of a plea as well as an encouragement to trust, deepen, explore feelings and to let them guide us – to trust and practice feeling (Lorde 2017, 8 f.);

- 3) A belief in survival and change is promoted through Lorde's. belief in changing dreams and ways of living in order to change ourselves, each other, and essentially the conditions of our living (Lorde 2017, 10–11);
- 4) A solicitation for courage and possibility, which is to be tasted, believed in, and accessed through a practice of feeling (Lorde 2017, 8 f.) as tasting possibilities gives us strength and courage that will sustain survival and change (Lorde 2017, 8–10);
- 5) A movement of language-making as, poetry, for Lorde, creates language. and it makes us know and inhabit the dimensions of our experience we have been encouraged to un-see by providing us with space and courage to make language where there has been only silence before (Lorde 2017, 10–11). This language-making is therefore a mode of thinking-being that fosters curiosity and courage to inhabit what is yet without words, without form; and
- 6) A plea to recognize possibility – to taste and realize and feel possibility through poetry (Lorde 2017, 10).

The following core insights move through Lorde's most fundamental claims and train of thought: poetry is not a luxury – rather is it a necessity of survival and change; and poetry moves as this necessity because it commits to feelings and experience (Lorde 2017, 8, 10). Through this commitment to feeling, poetry coins language, that then can express and charter 'revolutionary awareness and demand' (Lorde 2017, 10).

This Lordian account of poetry can be read as a form of epistemic resistance as it deliberately resists the logics of the *Mathematics-Rationality-Human* continuum that center *thinking* and devalue feeling. These structures have been deeply analyzed in anti-colonial and feminist works to show that the association of women and people of color with *feeling* rather than *thought* is integral to the *Mathematics-Rationality-Human* continuum and to the epistemically violent worlds birthed by it. Lordian poetry forms an *epistemic wildness* in its commitment to movements of re-membering and re-claiming the epistemic lives and resources that have been discarded due to the hegemony of binary notions of order. *Wildness* here refers to deliberate divergence from what is construed as thinking-being in the worlds of the continuum.

My proposal is to develop *wild mathematics* by forming a way of understanding mathematics that fundamentally leans on Lorde's thought on the necessity of poetry.

Lorde claims that poetry is not a luxury, but a vital necessity of survival because the language-making that poetry forms, is a vital necessity of survival (Lorde 2017, 8–9). I believe there can be forms of mathematical practice that are vital to survival in just this way and can thus form a practice of feeling and language-making that comes into itself through *wild mathematics* as a practice of thinking-being.

I propose *wild mathematics* as a commitment to a *distillation of experience* as Lorde proposes and practices it. I believe the core solicitations of Lorde's practice of poetry can be read as lessons for fashioning *wild mathematics* as both a notion and a practice being and of re-doing thinking in the following ways.

- 1) It can be understood as a movement against problem-solving and for being-in-relation and experiencing. Crucially Lorde's essay teaches me that *wild mathematics* cannot be and is not *a new idea*. *Wild mathematics* is a practice of re-doing, re-memembering, re-collecting feelings, experiences, thoughts, and modes. It is a practice of re-doing mathematical practice into a practice of experiencing and being-in-relation with the situation that is living.
- 2) An intense solicitation for feeling as a central practice of *wild mathematics*. In this, mathematical practice itself shifts its form from that of problem-solving towards that of an event¹ in and of itself – an event of thinking-being. *wild mathematics* is a practice that is felt and experienced and it is a practice of deepening, and expressing, and exploring feelings.
- 3) *wild mathematics*, as a practice of exploring the deepest meanings of 'it feels right to me' (Lorde 2017, 9) is a belief in survival and change. It is a practice of experiencing possibility – the possibility of other worlds and of other mathematical practice feeling differently than it previously has felt. It is the possibility of feeling and being differently than the thinking-beings of the continuum, the possibility of speaking, the possibility of inhabiting modes of thinking-being different to those modes we have been told we need to choose from amongst continuum-based modes. *wild mathematics* is any mathematical practice that centers survival and change and forms a

1 My use of the notion of the event is based in process philosophy and leans on the work of Brian Massumi and Erin Manning (Manning and Massumi 2014) in emphasizing the process as a process rather than as a pathway arriving at place X as the notion of the event emphasizes the becoming.

space to sustain the situation that is living and changing how this situation feels.

- 4) A solicitation for courage and possibility comes from the revolutionary power of Lordean poetry because it makes its poets *less afraid*. Poetry, according to Lorde, provides courage, because possibilities can be tasted while “the old fears and warnings” are battled and felt too (Lorde 2017, 7 f.). So, *wild mathematics* is the mathematical practice we create that gives us courage because we can taste possibility; – because we taste what we can do –we taste the wildness that mathematics can be –we taste new thinking-beings –and through which we taste the existing ones anew.
- 5) A movement of language-making as poetry for Lorde, “helps give name to the nameless so it can be thought” (Lorde 2017, 8) and *wild mathematics* is committed to just this endeavor of language-making. *wild mathematics* is a form of language-making as well as a form of mathematical language-making, which commits to mathematics as a possible language.
- 6) A plea to recognize possibility as *wild mathematics* makes its practitioners taste themselves differently and inhabit their thinking-being differently. *wild mathematics* is a practice of tasting and touching oneself as possibility and it is a practice of tasting and touching the possibilities of mathematics and of worlds and modes of thinking-being different to those scripts the continuum has generated for us.

These general notes on *wild mathematics* need to be realized and created through re-imaginings and in experiments of and with wild-mathematical practice. This is no simple task and one that needs to be fulfilled collectively and continuously through spaces and modes that continue to be formed and moved and changed and lived. However, to give as concrete a vision for *wild mathematics* as I can, I will provide propositions for possible wild-mathematical experiments and practices for each of the aspects just discussed:

- 1) *Wild mathematics* against problem-solving takes at least two fundamental forms that decenter problem-solving as a mode. First, the mathematical quality of insolvability can be centered in a wild mathematical practice. Instead of a problem to be solved or a proof of falsity, mathematical insolvability could be made into an experience to be had. It could be explored how mathematical practice changes when insolvability is lovingly moved into the center of interest of mathematical thinking-being. Second, *wild mathematics* can center all mathematical modes and practices that are not

oriented towards forming problems and their solutions. A such, the core practice of *wild mathematics* could be to move these mathematical modes to the center of what it means to practice mathematics and to invent other modes like them.

- 2) *Wild mathematics* is a practice of feeling, which, as Lorde proposes, takes on many forms – there are the dimensions of deepening, of feeling, of committing to feeling, of exploring feeling, and of expressing feeling. Deepening feelings through mathematical practice could be any way of carving out time and space to feel by means of mathematical practice or expression. This could mean forming mathematical practice that accompanies or inspires one to be in touch with one's feelings. It could also mean forming a mathematical practice that expresses feelings in a way that deepens them. Or it could mean choosing or creating a mathematical practice that feels symbolic of either a feeling itself or of a situation to be felt.

Committing to feeling could mean deepening feeling or it could mean forming a mathematical practice that is designed to feel and/or that is moved by feeling and by intuition. Exploring feeling through wild mathematical practice could be any mathematical practice that deepens, explains or symbolizes a feeling, an experience, a situation felt. Expressing feelings in and through *wild mathematics* means giving mathematical language-making a feeling and stretching out what mathematical language-making includes so language-making can fit and expressing our feelings. The dimensions of expression, exploration, commitment, and deepening of feelings are as interwoven in wild mathematical practice as they are in Lorde's notion and practice of poetry. One example of these dimensions interwoven in mathematical language-making could be the formation of three interconnected equations I created in order to give mathematical expression to rape culture: $1+1=2$ and $1+1=also$ and $1+1=1000$. The first equation describes the logic the survivor-victim is evoked to fulfill: *Give us proof and we will believe you* is a $1+1=2$ logic. $1+1=also$ describes the how proving the credibility requested of the survivor-victim is systemically unfulfillable. $1+1=1000$ symbolizes the immensity of possibility that lies within and beyond the confinements of said unfulfillable credibility. It is precisely the simultaneity of all three equations that is a practice of feeling-with. These equations stem from a commitment to experience the situation of being a sexual assault survivor. These equa-

tions in their simultaneity deepen my feeling of confusion. They make me commit to it. They make me explore it.

- 3) *Wild mathematics* for survival and change is about sustaining living and changing living, which might seem like two different endeavors, but they can be highly entangled (as they are in Lorde's writing). There are many things mathematical practice can be that sustain living, e.g., mathematical practice as a motion of escapism can be deeply sustaining. Mathematical practice in most day-to-day applications can be sustaining. Mathematical practice as an experience of one's subjectivity can be sustaining, which is guided by the question: what would mathematical practice need to be for you to keep living when it is hardest to do so?
- 4) *Wild mathematics* can be a source of courage. Lorde's writing on the aspect of courage reveals how poetry makes her access things that would have otherwise scared her too deeply to be considered. Poetry is a space to dare and a space to feel more sheltered than other places so that new ways of feeling and thinking-being are suddenly possible, precisely because they are suddenly safe. What could mathematics do or need to be to form such a space? Can we make mathematical practice into a world that feels sheltering enough to provide the courage to dare? This is about learning how to make mathematical practice feel radically different than to what the *Mathematics-Rationality-Human* continuum has made it into – it is not a problem; it is not a test; it is a space and a temporality. How can we facilitate mathematics that feels like a warmly radical space?
- 5) *Wild mathematics* is a practice of language-making. Here again, *1+1equals2* and *1+1equals0* and *1+1equals1000* provide examples. This is mathematical language-making of a confusion and pain facilitated by the many-layered and many-colored violence myself and many other survivors know intimately. What do we need to do to re-member mathematical practice as a language that is for us to speak? A language that is already partly in existence and partly for us to make. How can we practice mathematics as a language never to be mastered and always to be made?
- 6) *Wild mathematics* is a practice of tasting possibility. Possible worlds are already part of the fabric of mathematical practices. Wild mathematical practice commits to mathematical language-making as a practice of imagination in a highly intuitive and deep sense of the word. A such, imagination is not "a practice of the head," but as a radical commitment to where possibilities are felt. What can be felt through the knowledge that infinities are different sizes? What can be tasted and heard in drawing

Voronoi diagrams²? What possibilities are felt in studying chaos theory? Chaos Theory is a theory of unpredictability. It is a study of how drastically and radically systems can be forever changed by minor changes and minor gestures (see Manning 2016). Wildly studying chaos theory means committing to the political rhythms of this knowledge: the rhythms of possibility tasted through making mathematics wildly.

I believe there are three core lessons of Lorde's essay that should be carried into what *wild mathematics* means and is as an image and a mode of thinking-being:

- A) *Wild mathematics* is not a new idea, but a practice of making mathematics feel different. It is a practice of re-doing and re-collecting what mathematical language-making and practicing can be when we are committed to epistemic wilding, i.e., to intuitively and radically changing the epistemic makeup of our worlds – to change what does and does not count and to change what living is – to change our thinking-beings to what they always had the potential to become.
- B) *Wild mathematics* is a practice of feeling that is committed to the notion of distilling experience. wild mathematical practice comes into itself by believing in the worthiness of feeling and experience being distilled and by trusting in mathematical practice to bear the power to do this distilling.
- C) Problem-solving is a mode of thinking-being and a mode of mathing³. It is a mode of thinking and a mode of living that wild mathing and epistemic wilding radically moves beyond.

These Lordian lessons for *wild mathematics* as notion and practice will be carried into these next movements of thinking-with.

2 Voronoi diagrams are a way to part and explore spaces. For an accessible and practical explanation see D'Agostino 2020.

3 Through the term 'mathing' I emphasize that this is about a mathematical practice, a mathematical doing.

Exploration 2 with Hélène Cixous

Wild Mathematics as Writing

Hélène Cixous is an author and philosopher writing in the tradition of difference feminism⁴. Much of her work has been focused on how writing by *woman* is a mode of resistance. *Woman* here refers to a social position, as well as to an intrinsic force of *woman*, born from the disruption *woman* causes in phallogocentric worlds⁵ (Cixous 1976, 875 f.). Cixous' work is interwoven with matters of epistemic spheres and epistemic resistance. She considers how *woman* is made and positioned in phallogocentric systems and how she can re-do this making of herself (Cixous 1975, 880). I focus on her essay *The Laugh of the Medusa* because my thinking-with Cixous on the question of *wild mathematics* centers around considering *wild mathematics* as a practice of writing and this essay by Cixous centers the question of writing and the writing of *woman*.

Cixous' considerations in this essay are based on her analysis that the tradition of writing thus far has been heavily shaped by 'reason', which she understands as a deeply phallogocentric notion and mode (Cixous 1975, 879). Her expression *woman writing herself* refers to her proposition that there is urgent need for a different form of writing – a nonphallogocentric form of writing – a *woman writing* in that it begins with the difference of woman and that it writes and re-writes being-woman (Cixous 1975, 879) as it rewrites woman thinking-being. Such writing to Cixous is a mode of re-doing *woman* and re-doing her body and sexuality and what they have been made to endure. It is a writing very deeply connected to *woman* bodies and sexualities – a writing with a bodily dimension and a wildness to it: *We're stormy, and that which is ours breaks loose from us without our fearing any debilitation* (Cixous 1975, 878). Cixous imagines a form of writing that frees powers that have been oppressed, and that *woman* has been made to oppress in herself. The writing that frees these powers is *stormy* and makes *woman stormy*.

4 Difference feminism is a branch of feminism that advocates for a perspective that centers 'the difference of woman from man' as a revolutionary force. For more detailed accounts see Bray 2004, Sellers 1994, Cixous and Clement 1986.

5 'Phallogocentrism' refers to a mode of patriarchal dominance, centering logics of command, authority, and control.

Further she writes:

Censor the body and you censor breath and speech at the same time. Write your self. Your body must be heard. [...] To write. An act which will not only "realize" the decensored relation of woman to her sexuality [...]; it will give her back her goods, her pleasures, her organs, her immense bodily territories which have been kept under seal; it will tear her away from the superegoized structure in which she has always occupied the place reserved for the guilty (guilty of everything, guilty at every turn [...])—tear her away by means of this research, [...] this emancipation of the marvelous text of her self that she must urgently learn to speak. [...] We must kill the false woman who is preventing the live one from breathing. Inscribe the breath of the whole woman. *The Laugh of the Medusa*, 880

Here Cixous details the extensiveness of censoring and suppressing the body. She elaborates that this oppression suppresses breathing⁶ and with it –speaking. She speaks distinctly towards *woman*, when she says *Write your self*. With this practice of writing, she refers to a practice of making the body heard – of extending beyond the censorship placed on *woman bodies*. Cixous imagines a form of writing that un-does the censored relationship *woman* has to her sexuality – a writing that actualizes sexuality, body, and woman in a way that goes beyond phallogentric scripts and censorships. She writes that there are *immense bodily territories* to womanhood, and she imagines a form of writing that realizes these territories and makes us re-discover them – find them under the censorship placed on them. In phallogentrism, she continues, *woman* is the always-guilty and it is the *woman* writing that re-makes *woman* by tearing being-woman from this place of guilt. She understands the violence of phallogentrism to make a *false woman* – the guilty woman without her body and breath and speech. The *false woman* suppresses the live woman, and it is the doing of writing to give *woman* back her body and breath to make her the *live woman*. Accordingly, writing is how woman saves herself by giving herself breath and speech and writing is the act through which woman realizes – *feels* and *knows*

6 Questions of breath and sustaining breathing have grown to be crucial endeavors of Black Studies. One of many brilliant explorations here is put forth by Alexis Pauline Gumbs in her book *Undrowned* (Gumbs 2020). I will return to a wild-mathematical reading of *Undrowned* in other contexts but will leave this note for readers to explore their breathing and their mathematics and the work of Gumbs in case they have not encountered her already.

– the many powers taken from her. Writing actualizes her thinking-being and realizes her relation of beyondness to the *Mathematics-Rationality-Human* continuum.

So, let me propose *wild mathematics* as a practice that can do just that and be a practice of writing for the breath and bodies of *woman*:

- 1) *Wild mathematics* as *woman mathematics*: for Cixous there is a form of writing that is uniquely that of woman by means of centering all that is hers – her experience, her life, her body, her breath, her sex, and her speech. *Mathematics* moves interwoven with and parallel to phallogentric writing; it sleeps with *reason* and stabilizes phallogentric systems. So, *wild mathematics* needs a life as *woman mathematics* that is a mode of *woman writing* as Cixous describes it – a mathematical practice that centers her body and speech and that formulates a movement of making *woman* closer with herself with the thinking-being of her many bodies, and with her capacities and immensities. *Wild mathematics* commits to forming and finding practices that assist us as *woman* to ‘read the text of ourselves.’
- 2) *Wild mathematics* for the body: writing for Cixous is intrinsically and deeply interwoven with the body (Cixous 1975, 975). She writes that woman has been driven away from her body and her writing through the very same violence and by the very same system. As a result, both her body and her writing need to come alive together and can only do so together (Cixous 1975, 975).
So, if *wild mathematics* is committed to this form of writing – learns from it, wants it, does it – it is committed to the body. *Wild mathematics* then is committed to uncensoring the body – the blood, the sexual, the orgasm, and nonorgasm⁷. *Wild mathematics* is a home to *woman bodies* and centers them to see what happens next.
- 3) *Wild mathematics* for breathing: the suppression of writing is a suppression of breathing to Cixous. *Wild mathematics* as a practice of writing is a practice of breathing. It asks: What must mathematics be to foster breathing? And then it experiments – it believes in the breathing of the woman body as a

7 Sexuality and orgasm play a distinct role in Cixous' *the Laugh of the Medusa* as practices and symbols of ‘the newly born woman’ (Cixous 1976). With ‘nonorgasm’ I refer to all the modes of sexuality not moving as orgasms or as conventionally sexual practices.

re-doing of *Mathematics* and to be wildlymathematical⁸ is to be a thinking-being of beautiful immensity.

- 4) *Wild mathematics* for speaking: much like the dimension of the body and the breathing speech too is an integral part of *woman writing* according to Cixous. *Wild mathematics* wants the speaking woman and believes that there is something wild and something mathematical to be spoken by *woman*. *Wild mathematics* formulates itself through the endeavor to be part of the stormy speaking and to help make it.
- 5) *Wild mathematics* for re-making *woman-body* and *woman-sexuality*: The writing Cixous envisions, and practices re-makes *woman*, her body, and her sexuality. *Wild mathematics* too moves to re-do *woman* as it does not believe in the *guilty woman*; it believes in the *live woman* and wants the *live woman*. As Hottinger points out, *Mathematics* makes gender, it makes *woman* into the being other to *reason*, into a thinking-being other to *Mathematics* and contained and kept under a rock by the Mathematics-Rationality-Human continuum (Hottinger 2017, 46–47). *Wild mathematics* wants *woman* as a being not opposite but integral to itself – to its movements and formations.
- 6) *Wild mathematics* to subvert guilt: The *Mathematics*-centric world creates the *guilty woman* because it constitutes the continuum-based thinking-being that forms the figure of the *guilty woman* and that keeps *woman* guilty because she is made *other to thought*. The *Mathematics-Rationality-Human* continuum reproduces the logic that makes *woman* always-guilty, such as the notion of *proof* as it is used to make *woman* guilty in the context of sexual violence⁹. *Wild mathematics* chews away at the very systems – the logics and the *reason* – making *woman* guilty.
- 7) *Wild mathematics* as a practice of writing: when *woman* writes she re-makes writing. She makes writing into something different to the phallogocentric mode of writing governed by *reason*. *Wild mathematics* re-makes mathematics and re-makes writing by formulating *wild mathematics* as a practice of writing – a mode of written expression that centers *woman* and her breath.

8 I write *wildlymathematical* expression here to indicate the sheer inseparability of the mode of wildness with the proposed mathematical practice.

9 The Mathematics-centric notion of *proving* is the same notion of *proving* applied to demand unfulfillable criteria of evidence and credibility from victim-survivors. For a more detailed account see my paper *does one plus one equal two?*.

This creates a form of mathematical writing that moves beyond *reason* and beyond the *Mathematics-Rationality-Human* continuum.

I will now suggest mathematical experiments and modes to these qualities of *wild mathematics* learnt through Cixous:

- 1) *Wild mathematics* as *woman mathematics*: this aspect speaks to *wild mathematics* being committed to assisting us so that we can ‘read the text of our-selves.’ This can take many forms as any (mathematical) practice that makes woman feel her body, her strength, and her breath. This can mean fostering and centering mathematical expression that expresses being-woman in phallogentric systems or that expresses the *live woman* or her body. It can mean experimenting with mathematical modes and practices and enlarging the meaning of what it is to *practice mathematics* until *woman* realizes a sense of herself and her body through the practice of a woman thinking-being. It can mean centering her body and her blood. –what does mathematics become when there is blood¹⁰?
- 2) *Wild mathematics* for the body: *wild mathematics* centers the body – especially bodies made *woman*. This centering of the body can take many shapes. It starts with the body of *wild mathematics* not being a specific body – it is not the still body or the male body or the white body. The bodies of *wild mathematics* are the bodies that want to *know* themselves – the bodies invested in their storms and wildness. *Wild mathematics* is the mathematical practice that gives space and expression to these bodies and to the thinking-being they birth. It centers–them in what it is to *practice mathematics* and finds out what this will look like.
- 3) *Wild mathematics* for breathing: this breathing is a bodily and an epistemic breathing¹¹. *Wild mathematics* is on a quest for mathematical modes, practices, and notions that foster breathing. This quest might begin with breathing more than with mathematics. What are the techniques that extend breath, calm breathing, or deepen it? What do these practices do to the body? What do these practices do to mathematics?
Wild mathematics might connect to relations of the breath and mathematical modes that already exist as many techniques for breathing, such as interval breathing, include a practice of counting – of counting series of

10 For an exploration of the epistemic texture to menstruation see Nana and Kather 2024.

11 For a detailed account on *epistemic breathing* see Weber 2024.

breathing (see e.g. Wilson 2024). This already is a mathematical practice of the breath. *Wild mathematics* will devote to such practices and create more.

- 4) *Wild mathematics* for speaking: this speaking is not only verbal speaking, but any mode of speech. *Wild mathematics* centers speech. This will take many forms. One of them could be to make mathematical practice itself into a form of speaking – a mode of expression. Another could be to center verbal speaking by making mathematical practice into a practice of reading aloud. *Wild mathematics* will also – most importantly – inspire and move to speak. It will be intrinsically interwoven with speech because it will be a force moving *woman* to speech.
- 5) *Wild mathematics* for re-making woman-body and woman-sexuality: *wild mathematics* can move to form expressions of woman-body and woman-sexuality. *wild mathematics* asks to be a part of a woman realizing her body and her sexuality by opening spaces for experiences of body and sexuality that overlap with mathematical practices and with mathematical thinking-beings.

This also might take the form of appropriating mathematical modes and practices for experiencing body and sexuality, such as infinity by asking: how can infinity be sensed in one's body and in one's sexuality? Creating practices that can do this is wild and it gives a sense of the immensity of bodies and of *woman* – through wild-mathematical practices of thinking-being.

- 6) *Wild mathematics* to subvert guilt: this dimension relies very heavily on the capacity of *wild mathematics* to change what it is *to prove* and to change what it is *to be woman*. As Cixous establishes, the place of *woman* in a phallogocentric world is the place of *the guilty*. This place of *woman* is fashioned through the *Mathematics*-centric notion of *proving* – as I have established in chapter two, and it is the continuum-based notion of proof that maintains and legitimizes the place of *the guilty* as the place of *woman* by evoking thinking-being unfulfillable to *woman*. So, remaking proving is a mode of remaking *the guilty* and remaking *woman*.
- 7) *Wild mathematics* as a practice of writing: wild mathematics re-makes writing and mathematics. It forms mathematical practice into a writing practice in making it a mode of expression and of forming sense – a sense of words, of worlds, of bodies – a sense of thinking-being. Writing in Cixous' sense moves from a position of oppression, so practicing *wild mathematics* as writing is to put those whose writing and bodies and sexualities have

been silenced – many of them *woman* – at the forefront of mathematical expression.

These movements of thinking-with Cixous towards *wild mathematics* are found in the following characteristics of *wild mathematics*:

- A) *Wild mathematics* is a practice of writing that changes what writing is by changing what *reasoning* is. In doing so, it changes the continuum and its scripts – both through re-making mathematics into writing as Cixous describes it and through the expression of oppressed bodies and voices.
- B) *Wild mathematics* is for body and sexuality. This is not meant on a conceptual level; rather *wild mathematics* fosters a sense of body and sexuality and senses of self in feeling-with bodies and sexualities.
- C) *Wild mathematics* re-makes woman. It wants for woman to become *the live woman* and stray far away from the *guilty woman*. This is partly accomplished through *wild mathematics* re-doing the *Mathematical* foundations of the guilty woman, such as *proving*.

Exploration 3 with Denise Ferreira da Silva

Wild Mathematics as a Re-Making of Value

In this second exploration I re-read an essay that has featured prominently throughout these last chapters: $1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$; *On Matter Beyond the Equation of Value* by Denise Ferreira da Silva. Much like in exploration 1, I will first recapitulate da Silva's equation and the core thoughts of her essay. Next, I will gather what there is to learn for forming *wild mathematics* through da Silva's essay and especially the equation that gives this essay its name. Third, I will outline possible wild-mathematical practices inspired by da Silva. Fourth, I will summarize the core thoughts and characteristics for building *wild mathematics* that stem from my reading of da Silva's essay.

My references to this paper this far have focused on da Silva's critique of *mathematical necessity*, as both a notion and as a mode, which is historically and presently utilized to uphold colonial and white forms of supremacy and dominance (da Silva 2017, 4). However, there is a second part to this paper that centers a thought experiment in the form of an equation. Throughout the first half of her essay, da Silva shows that Blackness has been and still is conceptually de-valued (da Silva 2017, 5). This is the starting point to her equation-thought-

experiment, which I have briefly referenced as a form of potential mathematical disobedience in chapter three. For the purpose of this chapter, however, I am focusing on how da Silva develops her equation in building a testament to the disruptive powers of ‘matter beyond the equation of value’ (that is Black life here).

da Silva situates her work and her equations in the theoretical and political movements of considering Blackness a disruptive force, which is always already there and never in opposition to whiteness, but rather underneath, in between, and beyond whiteness (da Silva 2017, 9). This mode understands Black life as a resistant life, in its non-normative capacity and with this resistant capacity comes epistemic resistance in the sense that the disruptive force of Blackness that da Silva summons, is a form of resistance against notions of *value*, *human life*, and *rationality* (da Silva 2017, 9 f.). In other words – a resistance against what I have called the *Mathematics-Rationality-Human* continuum. According to da Silva her thought-experiment-equation is, “designed to help the imagination break away from the enclosures of modern thought” (da Silva 2017, 1). This Equation of Value builds on da Silva’s previous definition of “life = 1” and “blackness = 0” (da Silva 2017, 9). Multiplication and division are applied to describe the relationship of effectivity (da Silva 2017, 9). Da Silva develops these definitions through different equations. However, to focus on da Silva’s resistant re-formation of value, I center the equation that constitutes the last part of her experiment, as well as the title of her essay:

$$f) 1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty$$

[...] this procedure has no result because it is impossible to divide something by zero. I have chosen $\infty - \infty$ (infinity minus infinity) or ∞ / ∞ (infinity divided by infinity) to picture the result because it is undeterminable, it has no form [...]. It is neither life nor nonlife; it is content without form, or *materia prima* – that which has no value because it exists (as ∞) without form. [...] I claim a radical praxis of refusal to contain blackness in the dialectical form.

$$1 \text{ (life)} \div 0 \text{ (blackness)} = \infty - \infty \text{ or } \infty / \infty: \textit{On Matter Beyond the Equation of Value}, 9$$

Here da Silva displays the equation that her thought experiment ends with as an equation without result and without form. It does not deploy something that is determinable as life or nonlife. To resist a form resists containing a value or nonvalue¹². And it is blackness, which disrupts the Eurocentric system that

12 Da Silva draws from Moten 2003, Hartman 1997, and Spillers 1987 here.

seeks to attribute and negate value by means of *necessity*, by means of *effectivity* (da Silva 2017, 9 f.). It is resultingly this attribution and negation of value that forms and upholds the anti-Black systems that shape the politics and realities, in which 'Black lives don't matter' (da Silva 2017, 5).

So, we can learn about the scope of *wild mathematics* from da Silva. *wild mathematics* moves in relation to Blackness and thus in relation to re-forming value, to disrupting colonial systems of attribution as well as the negation of value. So, the guiding question here becomes how to form mathematical practices that chew tunnels into *value*. This is the scope and the legacy of what *wild mathematics* ought to do and of what *wild mathematics* has to learn from da Silva's essay. What follows now is a collection of impulses for *wild mathematics* derived from da Silva's *Equation of Value*:

- 1) Moving beyond *mathematical necessity*: da Silva made it clear that it is *mathematical necessity* from which notions and practices of causality derive that ultimately shape exclusive notions of *being-rational* and *being-human* through *Mathematics* as an image of thinking-being (da Silva 2017, 4, 6). Thus, mathematical notions, practices, and lives committed to wildness need to move their mathematics beyond a notion of *mathematical necessity*. *Wild mathematics* moves without *necessity* as a point of reference, which is to say wild mathematical practices do not move 'against mathematical necessity,' but rather in mathematical spaces where there is no meaningful existence of a notion of *mathematical necessity*.
- 2) Against causality and towards radical relationality: the notion of mathematical necessity informs the notion of causality, and it is the cause-and-effect-framework that produces binary notions and systems, essentialism, and informs universalized notions of being-human (da Silva 2017, 4, 6). Because it is precisely the notion of causality that is integral to forming notions that reproduce "when someone is human, then they X/they do not X" or "when someone is a woman, then they X/do not X." And while many exclusions certainly do not take the form of such sentences, we do know that what Fricker refers to as our hermeneutical resources – the interpretative resources that shape our day-to-day meaning-making – are informed through systemic stereotypes, exclusions, biased notions, and narratives (Fricker 2007, 156). And da Silva provides us with reflections necessary to realize that these constructions of social roles and biased narratives and notions deeply rely on the notion of causality in place and as an intellectual practice.

So, the mathematical practices of wildness exceed causality because a) causality is a form of order and order is what wildness does not strive for and because b) causality provides the basis for hegemonic notions and forms of essentialism. Instead, *wild mathematics* is committed to relationality: to the messiness and complexity of experiencing, seeing, feeling, and knowing relations between entities or situations or within entities or situations themselves. Rather than relying on and shaping frameworks of causality (like *Mathematics* does) *wild mathematics* centers relationality as its point of reference.

- 3) Moving beyond determinacy and re-doing value through this movement: the notion of value and practices of attributing/not-attributing value relies on the notion of determinacy for there is no attribution of value without notions of practices of determining value (da Silva 2017, 6 f.). Da Silva's essay moves through the ways in which causality, determinacy, and value are a) integral to one another and b) inextricably interwoven with *mathematical necessity* and thus with *Mathematics*. *Mathematical necessity* is an integral reference point for *causality* and *causality* is an integral reference point to *determinacy*, and *determinacy* is an integral reference point to *value*. So, moving beyond causality as discussed above is interwoven with moving beyond determinacy. When there is no causality-effect-form then there is no determinacy, no determination and no value that can be deduced through forms and practices of causality and determinacy. Therefore, moving beyond determinacy is a form of re-doing value.

This dimension of *wild mathematics* bears anti-capitalist potential as *wild mathematics* fosters wild economics and demands economics that do not reference linear processes of value-making through their practices and movements. Summoning *wild mathematics* to re-make markets is by no means a stretch as the phenomenon of performativity describes how mathematical models – for example as they are applied in the context of predicting financial markets – shapes said financial markets to move in increasing accordance with the model (Tarim/Gozluku et al. 2023, MacKenzie 2006, Mackenzie/Millo 2003). So, mathematical models bear the capacity to make and re-make economic movements. *Wild mathematics* re-makes value in relation to mathematical notions and practices as well as in relation to markets.

- 4) Embracing intricacies of mathematics with thinking, speaking, and doing are the intricacies da Silva details throughout her essay and these are the intricacies *wild mathematics* also commits to. As da Silva shows, *Mathematics*

bear the dimension of both being and shaping forms of thinking, speaking, and doing – shaping thinking-being. It is this power of mathematical notions, practices, and worlds, that *wild mathematics* curiously and radically fosters to re-do worlds with anti-hegemonic, nonlinear movements. So, *wild mathematics* is a mode of thinking, doing, and speaking that both shapes thinking, doing, and speaking as it deliberately moves through the radical inseparability of all three.

- 5) Letting *wild mathematics* foster *wild subjectivities* fosters dimensions of subjectivity. ‘The subject without properties’ is what da Silva calls the subject and the subjectivity at the heart of exclusive notions of reason, value, and the human. Striving for or assuming such a ‘subject without properties’ stems from a notion of subjectivity that is deeply informed by universalism, determinism, and *rationality*. *Wild mathematics* moves non-universally, non-deterministically, and non-rationally by refusing to make these notions into any form of reference. Taking into account da Silva’s considerations of the intricacies between these notions and a specific practice and notion of *subjectivity*, we can learn that *wild mathematics* will need to foster *wild subjectivities*, i.e., subjectivities that do not reference universalism, determinism, or *Rationality* – subjectivities that exceed the continuum.
- 6) Learning from Blackness: In da Silva’s essay Blackness is a disruptive force and a ‘matter beyond the equation of value, a ‘horizon of existence.’ In short, Blackness for da Silva is not a category, but a reference point and a revolutionary, disruptive force (da Silva 2017, 2). To enfold its own disruptive forces *wild mathematics* needs to learn from Blackness and become Black in the sense of becoming an entity that discloses ‘horizons of existence’ other than white and Western norms of existence – horizons of existence that exceed the thinking-being of the *Mathematics-Rationality-Human* continuum. Also, just like in da Silva’s work, Blackness is not a category, but a referent (da Silva 2017, 1–2). Learning from Blackness to fashion, learn, and re-call *wild mathematics* can never take the form of a ‘taking from’ Blackness or of an appropriation of Black thought and movements by white people. What it should mean, I believe, is a deep and honest appreciation of Blackness and how Black lives know and live. Forming and practicing *wild mathematics* as a horizon of existence entails straying from and disrupting any logic of epistemic dominance as modes of existence are not categories to be rated, but they form an incalculable multiplicity of situations to be experienced (to recall Lorde here). Black-

ness is a force of life precisely because it is disruptive to Eurocentric, continuum-based thinking-being. So *wild mathematics* should strive be a force of thinking, being, speaking, and doing and a force of mathematical life and thought precisely by being-beyond and in-between what these notions and practices already mean in systems dominated by patriarchy, whiteness, coloniality, and neurotypicality¹³ – dominated by the scripts of the *Mathematics-Rationality-Human* continuum.

To center mathematical practices and notions I will now suggest possible mathematical experiments or changes to mathematical practice that reflect each of these six lessons:

- 1) Moving beyond *mathematical necessity*: *wild mathematics* is mathematical practice and mathematical notion that does not have mathematical necessity as a reference point. This brings up considerations, questions, and experiments regarding what it is to mathematically prove or what the mathematical sign “=” (“to equal”) means. In particular, –two essential consequences for mathematical practice that derive from being-beyond mathematical necessity are that *Mathematical proving* is re-invented in *wild mathematics* and 2) it is re-called from those mathematical practices, that have never centered the notion of *mathematical necessity* in *mathematical proofs*¹⁴. Similarly, in *Mathematics* “=” describes a relationship of (*mathematical*) necessity. So, *wild mathematics* re-calls the meanings of “mathematical proving” and of “equaling” and it experiments with these notions and practices. *wild mathematics* re-calls and invents different versions of what it is ‘to prove’ and what it is ‘to equal.’
- 2) Against causality and towards radical relationality: I believe this lesson expresses itself in deep relation and in similar ways to what I have described in 1). Additionally, *wild mathematics* develops a focus on mathematical notions and practices that center relationality, such as modes of proving that rely on the relationality between mathematical entities or on the relationality between mathematical and non-mathematical entities. Centering re-

13 On the relations of patriarchy, whiteness, coloniality, and neurotypicality see e.g. Kather 2024, Price 2022, Manning 2020.

14 For an example of a practice of mathematical proving without *mathematical necessity* see Shulman 1996.

lationality can also take the form of creating mathematical expressions for relations in societal or political contexts.

- 3) Moving beyond determinacy and re-doing value through this movement can take many forms and certainly many more forms than I alone could hope to imagine (as, of course, goes for all of these suggestions). First, the movement beyond determinacy is connected to the notion of *mathematical consistency* and a striving towards such consistency. For now, we can establish that moving beyond determinacy may well take the form of practicing inconsistent mathematics.

Re-doing value is what I believe to be an effect of being-beyond determinacy in causality. However, re-making value and attribution of value within and through mathematical modes does pose intriguing practical questions. For example, when writing that “ $X=1$ ” is understood to ascribe a value to X . When *wild mathematics* re-makes value, what does that mean for definitions such as this one? Do they no longer exist? Or do they exist but shape-shift into a propositional definition, that itself can shape-shift?

- 4) Embracing intricacies of mathematics with thinking, speaking, and doing calls for deep re-inventions of what mathematical practice is and is not. It also calls for a re-doing of the notion that there are clear-cut differences between mathematical knowledges and non-mathematical knowledges and between mathematical practices and non-mathematical practices. *Wild mathematics* forms mathematical practices that think, speak, and do forms of mathematical thinking-being.

This can, will, and needs to take many forms. One of them consists in re-calling and learning mathematical practices that employ bodies in mathematical practices, such as finger counting¹⁵. This is one possible way to re-call the mathematical modes that never separated intellectual from bodily endeavors. Another mode might be to engage in mathematical practice as a form of speaking by employing mathematical modes of modes of personal expression.

- 5) Fostering the dimension of subjectivity in letting *wild mathematics* foster *wild subjectivities*: the most common way to be a subject is to move through the threads and lines and rules laid out by ‘the subject without properties’ – by attempting a sort of closeness to and performance of universalism, determinism, and rationalism. This is the sort of subjectivity fostered by

15 For more details on finger counting see Morrissey/Liu et al. 2016, Fischer/Brugger 2011 and Geary/Bow-Thomas et al. 1993.

Mathematics. I believe it is one of the trans-historical and yet continuous movements of an image of thinking-being that fosters subjectivity (or subjectivities).

So, *wild mathematics* too will take up the task of making, re-making, favoring, centering and de-centering subjectivity. So, I will briefly explore a) what these *wild subjectivities* are characterized by and b) how *wild mathematics* can foster wild subjectivities.

Wild subjectivities are wild in the sense that they are non-ordered. They are not opposed to order; they just do not keep order as a point of reference. *Wild subjectivities* are those subjectivities that move in, with, and through the in-betweens and beyonds of universalism, determinism, and rationalism as well as the in-betweens and beyonds of the *Mathematics-Rationality-Human* continuum.

- 6) Learning from Blackness: what *wild mathematics* can and ought to learn from Blackness is the movements and beings of a disruptive force, which – as da Silva phrases it – ‘discloses a new horizon of existence.’ This commitment can take many forms. One of them might consist of practicing *wild mathematics* as a form of existence and a mode of thinking-being. This ties in with the exclusions that the *Mathematics-Rationality-Human* continuum forms for they do not only move on the level of norming thinking but rather form an Image of thinking-being with an underbelly that moves to form rigid and exclusionary notions of being-human. Learning from Blackness means a) to move beyond and in-between systems of *Mathematics* – not against them – much like Blackness never simply moves against, but always beyond *whiteness* and b) to practice living that has not been established as *valuable*.

I believe the central question that is posed here is how to make *wild mathematics* into practices of living and practices of thinking-being: while also closing these mathematical modes and practices off to anything. Wild-mathematical practice will be disruptive, not because it tries to be, but by the very nature of its wildness and because disruption comes with modes and practices that are non-containable and non-calculable (in the way Manning employs the term of non-calculability, Manning 2020, 3 f. and 210 f.). This is what *wild mathematics* shares with Black life and where *wild mathematics* too needs the wisdom of survival that Blackness carries.

There are three core aspects that I believe da Silva's essay teaches us about *wild mathematics* – its characteristics of the image of thinking-being and its underbellies and currents:

- A) *Wild mathematics* moves beyond, in-between and underneath, any practices and notions of mathematical necessity. This brings with it the same beyondness in relation to determinacy and causality as these modes and notions are not points of reference to *wild mathematics* or to anything formed through its thinking-beings.
- B) *Wild mathematics* is re-doing value and with that re-doing the countless unspoken rules and currents that move to make some lives *less valuable* than others. As da Silva teaches us, this notion of value and its repercussions stem from the lives of determinacy, fashioned by the notion of *mathematical necessity*. So, to move mathematically without mathematical necessity as a point of reference is to abolish the notion of value and the practices of *evaluating* that it enjoins that have shaped the world we have known so far.
- C) *Wild mathematics* is a mode of living, a mode of thinking-being, a 'horizon of existence' (da Silva 2017, 2) and a disruptive force in its capacity of not being-capturable. Much like Blackness never simply moves against whiteness, *wild mathematics* too, is not against the *Mathematics-Rationality-Human* continuum but rather moves without the continuum as a reference point.

These lessons and characteristics of *wild mathematics* move with us into the next movement of thinking-with – a movement that centers the questions of being-human in relation to *wild mathematics*.

Exploration 4 with Sylvia Wynter

Being Human as Mathematical Practice

This exploration thinks-with Sylvia Wynter in order to deepen my considerations on *wild mathematics* in relation to *the human*. I will introduce Wynter's thought, drawing from her 2003 interview with ProudFlesh since this interview provides a comprehensive and unique walk through her decades of writing. Then, I will identify lessons for *wild mathematics* to then suggest mathematical experiments regarding these lessons and characteristics. The chapter concludes with the core characteristics of *wild mathematics* found through

Wynter. Wynter's work centers the re-making of a world deeply formed by the universalization of a particular genre of being human: *the human* of the *Man-Math*-centric worlds and *the human* of the *Mathematics-Rationality-Human* continuum. Wynter's work is an endeavor of epistemic resistance. Its point of ignition (*what is it to be human?*) is distinctly epistemic because it refers to the multi-layered consequences and the re-makings of an episteme¹⁶ – to speak through Foucault and Wynter.

As a writer, theorist, and activist Wynter shaped discourse on and struggles against anti-Black norms of being human. In her work “the Man” is the Western version of being human that has been universalized into the only genre of being human (e.g. Wynter 2003, Wynter 1994, Wynter 1984). Wynter believes the world to be “Man-centric” and advocates for a re-making of the world into a “human-centric” world:

Then we say, “How do we create a world?” I am arguing that you cannot do it in terms of “Man.” You cannot do it in the logic of the order of consciousness of “Man.”

PROUD FLESH INTER/VIEWS: SYLVIA WYNTER, 12

We are going to have to struggle for an entirely new definition of what it is to be human.

PROUD FLESH INTER/VIEWS: SYLVIA WYNTER, 15

Wynter argues that the Man-centric world moves through a specific Man-centric order of consciousness. Thus, to re-make the world into a human-centric world is to change the order of consciousness. Wynter's notion of ‘consciousness’ draws from W.E.B. Du Bois' notion of ‘double consciousness’ and it is deeply related to the second quote as in a colonial world being-human is being Man and therefore distinctly white. Du Bois established that this forms a conflict for Black people on the level of consciousness: the conflict between wanting and needing to be ‘human’ on the one hand and not wanting nor being able to negate one's own Blackness on the other hand (Du Bois 1994). So, when Wynter emphasizes the necessity of struggling for “an entirely new definition of what it is to be human” she too advocates for a different order of consciousness (see e.g. Wynter 2006 B, 17). Black Studies to Wynter is on the forefront of

16 Wynter takes up Foucault's thought on a regime of truth (Wynter 2006 B, 7 and Foucault 1979).

the very “battle against “Man” and for the “human”(Wynter 2006 B, 22). Wynter goes on to detail that this is the very reason that university departments attempt to rid themselves of Black Studies (Wynter 2006 B, 18 f.). This is because the very “body of knowledge” – which includes universities – centers around keeping the Man-centric world as it is (Wynter 2006 B, 6 f.). “Body of knowledge” therefore refers to educational systems as well as to wider logics and form of consciousness. ‘Condemnation’ is one integral aspect of the logic the Man-centric world according to Wynter, which depends on the selection of ‘an exceptional Black that serves as a proof that “all the Blacks in the prison are right to be there”¹⁷’ (Wynter 2006 B, 22).

The Man – the universalized genre of being human – is distinctly Western, distinctly male, and distinctly bourgeois (see e.g. Wynter 2006 B, 15, 22, 24). Wynter’s thought on *the Man* covers many dimensions and bears a materialist dimension that emphasizes the interwovenness of material conditions with genres of being (Wynter 2006 B, 24). Wynter is convinced of a multiplicity of genres of the human and advocates for a world that rids itself of *the Man* as its center in so far as *the Man* is the center of this world and his genre of being has become reference point for *Normalcy* (Wynter 2003, 3). This normalcy shapes how humans move through the world and which systems they foster, “as long as we continue to all want to be good men and women of the Western-bourgeois kind, wherever we are in the world, we will destroy the world” (Wynter 2003, 27). Following and insisting on Western-bourgeois genres of being is therefore what forms economic systems and environmental catastrophes.

Wynter’s legacy calls us to abolish the Man-centric rhythms, systems, and worlds to build human-centric ones instead. This change needs to be brought through what she calls a “a new order of consciousness” – a radical re-making of knowledge and consciousness itself. The notion of poesis is one of the practices she establishes as part of such a movement:

Essentially, they’re [Black poets and musicians] actually part of the process by which we are transforming the poesis of being. [...] Power is always linked to the poesis of being. [...] We now live in the poesis or autopoiesis of “Man.” How can we bring all the knowledge we have gained into the autopoiesis of

17 Wynter explains how Black men are systematically and disproportionately put and kept in prisons through the very workings of the prison system and the educational system (Wynter 2006 B, 11 f.)

the human?

PROUD FLESH INTER/VIEWS: SYLVIA WYNTER, 33

Wynter here points out that power is always linked with a formation – a poesis – of being. Thus, the current poesis is one of “Man” and what is needed is a formation, “a poesis of the human.” She suggests that this is exactly what Black poets and musicians are up to – they are re-doing consciousness through forming a poesis that “signifies repressed orders of cognition” (Wynter 2003, 32).

So, let me propose what *wild mathematics* and its making learn from Wynter:

- 1) *Wild mathematics* is to *feel—with*. Wynter describes how “we’re moving into another order of consciousness” when we feel something in our own flesh that we read about or see (Wynter 2003, 16). She suggests it is this *feel—with* that moves us into an order of consciousness that is not Man-centric – and not built through the *Mathematics-Rationality-Human* continuum.

So, what we, meaning those of us who are looking to make *wild mathematics* a mode of thinking-being, need to ask is how *wild mathematics* relates to the flesh and how *wild mathematics* can foster moments in which we *feel—with*? What does *wild mathematics* have to become so that it helps us to feel our flesh and to feel this flesh be moved despite not being itself physically touched?

Wild mathematics will foster ways of thinking-being and (mathematical) moments that open us to *feel—with*.

- 2) *Wild mathematics* re-makes what it is to be human. As I have argued in chapter two of this work, *Mathematics* is an integral part of the Man-centric order of consciousness and the Man-centric body of knowledge. Resultingly, *wild mathematics* has an active part in a) abolishing Man-centric Mathematics and b) re-making what it is to be human. The latter moves on the level of subjectivity. Political subjectivity, as Wynter points out, has long been preserved for those fitting the genre of *the Man* (Wynter 2003, 29). *Wild mathematics* re-makes *mathematical subjectivity* and, in doing so, *human subjectivity*.

Through these endeavors *wild mathematics* is indebted to Black Studies and moves with a constant need to learn from and with Black Studies as the forefront of struggles against *the Man* towards *the human* (Wynter 2003, 22). Re-making what it is to be human is deeply interwoven with the intellectual and practical recognition that many genres of being human exist; there-

fore, *wild mathematics* moves towards the wildness that arises through a genuine multiplicity of *how to be human*.

- 3) *Wild mathematics* makes a new order of consciousness. *wild mathematics* is related consciousness and commits itself to fostering wild orders of consciousness that take the place of Man-centric orders of consciousness. These wild orders of consciousness are dedicated to multiplicities of being and to a simultaneity of modes of thinking, being, and speaking. They move with wildness as their paradigm so they will have no interest in forming nor in ordering genres of being through hierarchy or universalization. Wildness in relation to consciousness refers to the nonorderability of the *feel—with* and the practice of being human due to the wild and dense multiplicity of human thinking-beings.
- 4) *Wild mathematics* re-writes “the body of knowledge.” The Man-centric world is the *Mathematics-centric* world, or the world fashioned by the *Mathematics-Rationality-Human* continuum. Therefore, re-doing *what it is to practice mathematics* is re-doing this body of knowledge. Furthermore, *wild mathematics* moves without binary modes and notions. This abolishing of binary modes is part of making a world without the ‘logic of condemnation,’ – and in refuting this logic, which essentially relies on dividing Black life into ‘worthy Black life’ (the “exceptional Black”) and ‘unworthy Black life’ (the disproportionate number of Black people in prisons in America). Moreover, academic disciplines uphold the Man so that re-making the body of knowledge means re-making academia. So, *wild mathematics* will be part of re-making academia and put an end to academic disciplines as they exist in their Man-centric manner.
- 5) *Wild mathematics* re-makes class. *wild mathematics* moves along the dimension of class struggle as part of its movements to re-fashion the human. The movements of *wild mathematics* center wild multiplicities of being-human that do not recognize class as an organizing factor.
- 6) *Wild mathematics* is a poesis of being human. *wild mathematics* makes formations of being human and cultivates mathematical practices as genres of being. The poesis of wildness forms nonordered consciousness and genres of being human that do not refer to the *Mathematics-Rationality-Human* continuum and its thinking-being. The poesis of *wild mathematics* makes being human into a distinctly nonorderly affair of the flesh that *feels—with*.

Let me now propose potential starting points for mathematical experiments and practices for each of these lessons:

- 1) *Wild mathematics* is for *feeling-with*. Where *Mathematics* moves in entanglement with 'rationality', *wild mathematics* moves in entanglement with 'the feeling flesh.' That is to say, *wild mathematics* is no longer primarily understood as a way of thinking, and it is not practiced as such. *wild mathematics* needs to become a way of feeling our flesh and *feeling-with* things allegedly 'outside' of our bodies. From the very beginning of thinking-into what *wild mathematics* can be, it was apparent that it moves drastically beyond binary modes and notions of thinking-being. This now takes on a new layer of meaning for if making the world human-centric is to *feel—with—as* Wynter describes it (e.g. to feel a bomb in our flesh that did not hit us), then what it takes is to do so is to re-do the notion and practice that there is something "outside of us." So, *wild mathematics* will join this movement and *feel—with* – it will foster it by chewing away at the binary notion of an "outside and an inside" to our bodies and to our flesh.
- 2) *Wild mathematics* re-makes what it is to be human. *Mathematics* constitutes an integral reference point for Westernized notions of being human (see e.g. Hottinger 2016, 8 f., 145 f.). So, *wild mathematics* can re-make what it is to be human by moving away from *the human* of the *Mathematics-Rationality-Human* continuum by exceeding the *Mathematics-centric human*.
- 3) *Wild mathematics* as ways of being (human): *wild mathematics* formulates itself in and through genres of being human, such as being-mathematically or being-wildly. These many genres of being always exist in plural and they are always in a state of coming-into-existence. The genres of being formulated through *wild mathematics* are never complete, never universal, and never singular, but always in relation with one another, the environment of the creatures who do the being, and with the process of coming into existence itself.

Wild mathematics re-writes "the body of knowledge" by re-writing mathematical notions and practices that constitute *the Man* and the practices birthed by continuum, such as *mathematical necessity*, *determinacy*, *consistency* or *binary*. Furthermore, as I have argued in detail earlier, I believe the *Mathematical* definition of *proving* to be an integral part of Westernized-male body of knowledge. So, re-writing the body of knowledge is to re-write what it is to prove. It is to make proving into a wild practice and to re-invent the notion "to equal" from one of *necessity* into one of *relationality*.

- 1) *Wild mathematics* re-makes class. *wild mathematics* fosters genres of thinking-being that do not produce hierarchies related to class. Furthermore, *wild mathematics* moves beyond notions of *mathematical necessity* and *causality*. Mathematically and wildly re-writing causality is a form of re-writing class because class, as a category, functions through notions and practices of causality. Class excludes because it is understood as a social category that can legitimately determine material circumstance. So, re-writing causality through *wild mathematics* re-writes class by breaking-open the notion and practice of such a determination.
- 2) *Wild mathematics* is a poesis of being human. *wild mathematics* can enfold its power to formulate genres of being human in-process through its poetic dimension in the Lordian sense. *wild mathematics* is a form of poetry that moves to formulate genres of *being human otherwise*. *wild mathematics* is a form of poetry as a deepening of experience, deepening to *feel-with* whatever we encounter and deepening the experience of the flesh as this will move us to new orders of consciousness and a poesis of *being human otherwise*.

I believe what *wild mathematics* has learned and derived from Wynter bears three core characteristics that need to be carried out in all following experiments and considerations of *wild mathematics*:

- A) *Wild mathematics* formulates genres of being human by moving as a poesis of *being human otherwise*, which commits to the feelings of the flesh and the relationality of different genres of thinking-being. *wild mathematics* is therefore indebted to Black Studies and devoted 'against the Man and towards the human.' So, while in many ways *wild mathematics* moves precisely not *against* but *beyond*, a case of againstness does characterize *wild mathematics* – an againstness that constitutes its devotion to be a notion, practice, and being that moves against *the Man* and Man-centric normalcy.
- B) *Wild mathematics* re-writes the body of knowledge and the order of consciousness by re-writing mathematics. Radically re-making what it is to think mathematically is to re-make what it is to think and to re-make what it is to think is to re-make what it is to be (human). This is the enterprise of *wild mathematics*: to partake in the movement of re-making consciousness and knowledge itself by means of re-making *what it is to practice mathematics* and thus to exceed the *Mathematics-Rationality-Human* continuum.

- C) *Wild mathematics* fosters the flesh and its capacity to *feel*—with. *wild mathematics* re-makes recognized boundaries and categories to give way to the feeling flesh not as a unifying power but as a string that interweaves different genres of being (human) and makes their radical relationality feel-able.

Thinking-with Wynter has made the urgency of positioning *wild mathematics* in a relation to the violently exclusive universalized genre of being (human) abundantly clear. So, the next exploration stay with this urgency of re-making what it is to be human through *wild mathematics* and think-with (and feel-with) Erin Manning.

Exploration 5 with Erin Manning

For more-than-human Bodyings and the Wildness of Relationality

Erin Manning has been writing on neurodiverse life and on norms of thinking-being for more than two decades. The thinking-with of this chapter focuses on the prelude and sixth chapter of her (2020) book *For a Pragmatics of the Useless*. *For a Pragmatics of the Useless* explores the relationship of Black life and neurodiverse life in great detail by considering neurodiverse life in relation to ‘the human.’ Thinking-with this exploration will provide another essential layer to exploring and establishing the relationship of *wild mathematics* to ‘the human.’ Her prelude as well as chapter six focus particularly strongly on incalculability and the relationship of neurodiverse life and of Black life to ‘the human.’

Manning’s considerations bear a dimension of epistemic resistance insofar as the forms of resistance to norms of being that she discusses are related to what it is to *think* (Manning 2020, 3 f., – 2016, 6 f.). Manning argues that there is a systemic centering of ‘the human’ presupposing whiteness and neurotypicality (Manning 2020, 226). As such, what she calls ‘more-than human tendencies of the body’ are the things bodies do or crave to do that do not fit the model of the neurotypical human, such as *stimming* (Manning 2020, 3 f., – 2016, 6 f.).

In *For a Pragmatics of the Useless* Manning draws from a model she introduced four years back in *The Minor Gesture* (2016): the ‘volition-intentionality-agency triad.’ This triad describes features of accounts of being in the world that believe in a causality and determinacy between a single being willing something, intending something, and then acting (see e.g. Manning 2016,

6 f.). Mannings concern here is that this model might further construct neurotypicality as ‘the measure of being’ (Manning 2020, 64).

Let us begin thinking-with her in a moment of the prelude, where Manning thinks-with Fred Moten on incalculability:

What remains incalculable for Moten is value itself, a value for modes of knowing unstratified, anexecutive. [...] The aim is never toward calculability, however. The aim is toward a practice that returns to the question of how the schizz cleaves experience to produce emergent collectivities that value existence differently, and how these minor socialities in turn enhance the unaccounted-for. What must remain incalculable [...] is the very question of the being of relation.

For a Pragmatics of the Useless, 12–13

Here Manning quotes Moten’s considerations of the incalculability of value – a value that refers to an unorganized, non-guiding mode of knowing. *The schizz* refers to an intervention into a process – a cut after which the process continues differently and distinctly – although this change is not brought on through a ‘subject decision,’ but by a movement that splits from ‘the normative relational’ (Manning, Massumi interviewed by Agostinho, Laberge 2019, 206). So, what Manning describes next is that here there is clearly no effort to move incalculability towards calculability, but rather an interest in ‘the schizz’ and its potentiality to make collectivities emerge that relate value and existence differently to one another. These *minor socialities* as Manning calls them need to remain incalculable and their ‘being of relation must remain incalculable.’

Manning argues for collectivities of being-in-relation and for practices of valuing existence to be made otherwise through these socialities. This call for these minor socialities becomes clearer throughout chapter six:

Sociality is perhaps the connection here, between Black life and neurodiverse life, sociality as an emergent quality of bodying, as an emergent force for the more-than that is life living.

For a Pragmatics of the Useless, 220

Manning suggests that there are docile and nondocile socialities. These are respectively: modes of sociality widely accepted as ‘human socialities’ and socialities that do not fit with the rigid and largely unspoken norms of ‘human sociality,’ insofar as they do not fit with the human sociality birthed by the con-

tinuum – such as Black life and neurodiverse life. She refers to these nondocile socialities – these Black and neurodiverse modes of life living as *more-than human*, to highlight their exceeding of the narrow white-neurotypical definition of *the human* and their exceeding of *the human* of the *Mathematics-Rationality-Human* continuum.

More-than-human bodies are those bodies whose lives cannot be captured by *the human*, i.e., those bodies and lives that exceed the logic of the single being and the logic of one (Manning 2020, 3 f.) and thus, those that exceed calculability. It is the white-neurotypical human that remains calculable. The more-than-human modes are the lives lived through nondocile socialities – *minor socialities*, which are lives lived through being in relation and thus resisting the logic of ‘being a single being’ (Manning 2020, 7 f. and Glissant 1997).

This deep affirmation of relationality can be put contextualized by re-calling Manning’s notion of autistic perception proposed in detail in *the Minor Gesture* (2016). Autistic perception, Manning outlines, strays from the neurotypical norm of analyzing and categorizing sensory input by perceiving in a mode of non-normative relationality (Manning 2020, -2016). So, affirming relationality and refusing the logic of ‘being a single being’ is to affirm neurodiverse life in its radical capacities to be life lived otherwise.

I suggest gathering the following impulses for *wild mathematics*:

- 1) *Wild mathematics* for nondocile socialities: *wild mathematics* fosters and builds minor socialities in Mannings sense and moves in a constant relationship of learning-from and feeling-with Black life and neurodiverse life. Practices of *wild mathematics* seek to a) give way and space to nondocile socialities that have always already been there as well as b) create modes of sociality not reliant on the white-neurotypical human and its bodyings. So, *wild mathematics* makes – and is itself – a multiplicity of modes of sociality: the nondocile socialities and the minor socialities. In these socialities lie no scripts that demand obedience, but rather movements of togetherness that are constantly being invented.
- 2) *Wild mathematics* as more-than-human mathematics: we know from da Silva and Wynter that *wild mathematics* is not a practice of producing the human in its Westernized-white-neurotypical form. Furthermore, with Manning we learn about the more-than-humanness of *wild mathematics* – about *wild mathematics* as a practice of living in more-than-human bodies and more-than-human thinking-beings. So, *wild mathematics* is committed to all modes that exceed the rigid norms of humanness; it fosters the

more-than-human modes by fostering the mathematical modes that are more-than-*Mathematics*. *Wild mathematics* is all that carves out spaces and modes for more-than *Mathematics* and more-than *the human*.

- 3) *Wild mathematics* for more-than-human bodyings: *wild mathematics* does not use the body that moves according to the *human* scripts – the continuum-based scripts as a point of reference. Rather, *wild mathematics* commits to nondocile and more-than-human bodies and bodyings. It forms mathematical practice and mathematical wildness that invites all bodies and all bodyings and that moves with ever-lasting curiosity about the body, which is not made docile. So, *wild mathematics* moves with a commitment to the body and nestles in the more-than-human lives of bodies.
- 4) *Wild mathematics* for relationality: *wild mathematics* does not move with 1 as its reference point as it is not in the business of committing to single beings. *Wild mathematics* is an image of thinking-being devoted to relationality – to the chaos and wildness, and the nonorder of relationality. Living *mathematically wild* is to be-in-relation with the more-than *Mathematics* and *the human*. Living *mathematically wild* is to form modes of perception, thinking, and living that *feel-with* relationality.
- 5) *Wild mathematics* for incalculability: *wild mathematical* practice is committed to incalculability. It is mathematical movement not interested in calculability, but in accounting for the lives of incalculability and for lives made incalculable. *Wild mathematics* itself remains incalculable as part of its devotion to its own wildness as its wild episteme is the incalculable body of knowledge and the modes not accounted for by whiteness or neurotypicality. *Wild mathematics* is a) itself incalculable, b) invested in incalculability as an integral string of *wild mathematics* as an image of thinking-being and c) devoted to incalculability in its practices.
- 6) *Wild mathematics* as a mode of autistic living is very deeply tied to the relationality and incalculability of *wild mathematics*. Autistic perception moves as a mode of being-in-relation. *Wild mathematics* moves in this mode as well and furthermore carves out spaces for autistic traits, modes, and bodyings in mathematical thinking-beings. This is because being autistic is a way of being wild, of perceiving wildly – as in nonorderly according to the scripts of neurotypicality nor according to the scripts of the *Mathematics-Rationality-Human* continuum. So, autistic thinking-being is always infused with a wildness in knowing and perceiving – with a more-than-humanness in what is seen and lived and spoken. *wild mathematics* can be a manner of autistic living and a mode of being autistic.

Wild mathematics knows the many autistic minor socialities and it knows autistic lives and histories. *Wild mathematics* learns from autistic wildness, carves out spaces, invents modes of autistic thinking-being, and values autistic perception in its movements of mathematical thinking-being.

I will now form more practice-based propositions for (mathematical) experiments related to these newly found aspects of *wild mathematics*:

- 1) *Wild mathematics* for nondocile socialities is deeply related to changing *what it is to practice mathematics*. *Mathematics* suggests mathematical practice to be a solitary affair that is filled with codes and orders of masculinity and whiteness and with scripts of the *Mathematics-Rationality-Human* continuum. *Wild mathematics* forms mathematical practice into affairs of minor sociality. *Wild mathematics* is practiced collectively and learns from Black life and neurodiverse life. It is a practice of living and surviving. *wild mathematics* re-invents what qualifies as a valuable life by abolishing the *Mathematical* basis of white-neurotypical definitions of value (namely *mathematical necessity* and *calculability*) and with this *wild mathematics* becomes a practice of living and a practice of nondocile minor socialities.

- 2) *Wild mathematics* as more-than-human mathematical practice: *Mathematics* is deeply human-centered and even assumes *Mathematics* to be a characteristic of 'being human' as a distinctive and defining character of 'the human species' (see e.g. Hottinger 2017, 12 or Brooks 2021, 4).

Wild mathematics does not move in this logic of species-distinction; it is neither in the business of categorizing beings into species nor of believing mathematical practice to be connected to being a particular sort of creature. Rather, *wild mathematics* identifies with more-than-human thinking-beings: it recognizes the number sense of animals as mathematical practice (see e.g. Messina/Potrich 2021, Brannon 2005, Verguts and Fias 2004) or *crip time* (see e.g. Kupperts 2014, McRuer 2018, Samuels 2017).

Wild mathematics is the mathematical practice that is more-than *Mathematics*, and it is a form of living more-than the human. This can take many shapes, but above all, demands a committed orientation of wild mathematical practices towards more-than-human modes and bodies – to finding and forming more-than-human modes and experimenting with what they might mean mathematically as well as how they keep changing the notion of *wild mathematics* itself.

- 3) *Wild mathematics* for more-than-human bodyings: centering more-than-human bodyings can take many forms. One of them could be to consider stimming as a potential part of mathematical practice. For example, by re-calling, as well as making mathematical practices that actively work with the body in a way that can function as a practice of stimming and as a mathematical practice, e.g., finger counting – a method of counting through bodily activity of the fingers (Morrissey/Liu et al. 2016, Fischer/Brugger 2011, Geary/Bow-Thomas et al. 1993). These movements can at the same time be a form of stimming and counting. To me this is a wonderful example of mathematical practice that moves with and for more-than-human bodyings and a wild mathematics that recalls bodily mathematical modes to invent new ones.
- 4) *Wild mathematics* for relationality: *wild mathematical* practice moves in the logic of relationality, which is to exceed ‘the logic of one.’ Straying from ‘the logic of one’ is to re-invent notions and practices of ‘to prove’ and ‘to equal.’ Rather than these mathematical modes establishing a determinate relationship – a relationship of necessity as in ‘only one,’ only one possibility, only one outcome – they need to be re-invented into a state of wildness and of wild relationality.
- 5) *Wild mathematics* for incalculability: *wild mathematics* is interested in the mathematical modes that irritate the mode of *calculability* and attributions of value, such as consideration of the different sizes of infinities. By means of their different sizes they evade practices of attributing one value and confuse images of calculability and of univocality.
Wild mathematics nestles in the incalculability within Mathematics while moving to remain incalculable itself by inventing modes that center and foster the incalculable. *Wild mathematics* is the mathematical practice that does not count/does not do counting. This could take the form of relating to numbers like animals do – with a ‘number sense,’ i.e., an intuition for quantities not based in counting (Messina/Potrich et al. 2021, Verguts/Fias 2005, Brannon 2004).
- 6) *Wild mathematics* as a mode of autistic living: one of many possible practices here is that of mathematical stimming as outlined in 5. Practicing *wild mathematics* in relation to autistic life mainly takes the form of studying autistic traits, modes of perception, modes of sociality, and modes of living in order to learn autistic wildness and to learn to practice autistic wildness mathematically. This can take the form of expressing autistic traits or of studying autistic thinking-being or perceptions though mathematical

modes of communication or expression. Or it could take the form of making *wild mathematics* into a potential reference point for autistic socialities.

I propose to carry forward four core characteristics of *wild mathematics*:

- A) *Wild mathematics* is more-than-human in its devotion to more-than Mathematics and the more-than of the human. *Wild mathematical* practice moves with more-than-human bodyings and fosters (mathematical) curiosity in the more-than-human tendencies of the body.
- B) *Wild mathematics* is wildly relational; it moves with relationality as the core notion in its image of thinking-being and practices of living.
- C) *Wild mathematics* remains incalculable and fosters the incalculable; and thereby, re-doing the logics that place value differently on different lives.
- D) *Wild mathematics* is autistic in three dimensions: a) it learns from autistic modes and from autistic wildness, b) it forms spaces and invents modes of autistic living, and c) it values autistic perception in its movements of thinking-being.

Exploration 6 with Gayatri Spivak

Wildmathematical Worlds

This final movement of thinking-with comes into itself with decolonial theorist Gayatri Chakravorti Spivak and the founding figure of *epistemic violence* as a term, discourse, and movement. Her (1988) essay *Can the Subaltern Speak?* is understood as the foundational text for the concept of *epistemic violence* as well as questions of subaltern expression and resistance to epistemic violence.

As I have established early on in this work, my understanding of epistemic violence draws especially heavily from Spivak. She forms the notion to establish that knowledge itself is shaped by power, e.g. through pre-existing frameworks, narratives, or modes of representation. Her notion of “the subaltern” refers to a wide range of people marginalized through their race, gender, class, or along other axes. However, *Can the Subaltern Speak?* focuses primarily on Western colonialism and the narratives and forms of violence that stabilize systems of Western colonialism, such as Western economic power. An important example in her essay refers to different names and narratives given to

particular forms of feminicide¹⁸ in India: one is a Western narrative of protection, criminalizing the man of color and objectifying the harmed woman, and the other negates there was any violence committed (Spivak 1988, 93). Spivak writes that these two forms of naming reproduce logics that legitimize each other and move to erase any possibility for the woman in question to speak (Spivak 1988, 93). Moreover, she writes:

Imperialism's (or globalization's) image as the establisher of the good society is marked by the espousal of the woman as object of protection from her own kind.

Can the Subaltern Speak?, 94

Spivak problematizes the Western self-narration of in which they have been the only ones that have established 'a good society' and shows how through this narrative wide-ranging forms of domination can be legitimized by through production of morality itself. This is because the very idea of *what is good* – according to Western standards, effectively inscribes a Western-colonial perspective into ideas of morality and of 'a good society.' This colonized morality bares teeth in notions of 'protection' (as has been recently explored in detail by Dorlin 2020) as 'protecting women' becomes a colonial narrative told only from a distinctly Western perspective in order to make woman of color into 'the thing that needs saving,' the man of color into 'the thing women need protection from,' and the global South into a world that 'requires Western intervention.'

Spivak closes her essay with the following words:

The subaltern cannot speak. There is no virtue in global laundry lists with 'woman' as a pious item. Representation has not withered away. The female intellectual as intellectual has a circumscribed task which she must not disown with a flourish.

Can the Subaltern Speak?, 104

Through her verdict *the subaltern cannot speak* Spivak emphasizes the radical and depth of epistemic violence: colonality moves in the very logic of representation and of speaking. This situation establishes what Spivak here refers to as

18 'Feminicide' is used to name killings of women that are committed distinctly due to patriarchal logics and systems.

a *task as an intellectual*: a self-reflexivity of those in relative power, a call to acknowledge and explore one's own involvement in pre-existing frameworks entailing epistemic violence.

I suggest the following impulses for *wild mathematics* through thinking-with Spivak:

- 1) *Wild mathematics* as a re-invention of knowledge itself: The *Mathematics-Rationality-Human* continuum builds and legitimizes patriarchal and Western-colonial bodies of knowledge. Re-making *Mathematics* – as *wild mathematics* re-writes knowledge. So, *wild mathematics* moves to change what it is to know through changing what it is to *practice mathematics* and what it is to *know mathematically*.
- 2) *Wild mathematics* as a re-do of representation as a logic: Through her example of ritual killings of Indian women, Spivak shows how the very logic of representation does a disservice to the women in question and even to 'the female body' (Spivak 1988, 99). An essential dynamic of this narrative and violence of representation is connected to the two forms of naming it – the two narratives in question being opposing names/narratives, which stabilize one another by forming two poles. It is the movement between these two poles that silence the woman burned (Spivak 1988, 93). So, this violence of representation, as Spivak makes visible, moves with the logic of the binary. This is where *wild mathematics* can partake in re-doing representation as a logic as *wild mathematics* moves to re-do the logic of the binary and with this can move to re-do the logic of representation.
- 3) *Wild mathematics* as re-making subjectivity: In her example, Spivak brings up how the very notion of 'free choice' and 'subjectivity' arise through patriarchal-colonial logic¹⁹ (Spivak 1988, 99). Thanks to Hottinger, we know that this is the exclusionary subjectivity built through the *Mathematics-Rationality-Human* continuum. *Wild mathematics* re-makes what it is to practice mathematics and with that re-makes mathematical subjectivity and subjectivity as a general notion.
- 4) *Wild mathematics* as self-reflexivity: *Wild mathematics* tends to the task and the special responsibility Spivak emphasizes that 'the intellectuals,' and the relatively privileged to have. This is to say that while *wild mathematics* moves as a disruptive force it does not believe itself untouched by the colonial-

19 The colonial narratives built into notions of 'subjectivity' and 'free will' have been explored extensively by Saidiya Hartman in her (1997) book *Scenes of Subjection*.

patriarchal making by the world of the continuum and it responds to this world by making modes and collectivities that foster self-reflexivity as Spivak imagines.

- 5) *Wild mathematics* as subaltern expression: *wild mathematics* is devoted to moving from those perspectives that have been relegated to the margins as these are the wild perspectives – the ones that cause disruption to the *Mathematics*-centric world.
- 6) *Wild mathematics* as re-making ‘the good’: fostering epistemic violence through notions of morality works when ‘the good’ is conceptualized to be a universal, ahistoric category so that it can be inhabited and universalized through one dominant perspective. This dynamic moves with what I have called *the logic of the binary* as well as *the logic of one* in which a logic of a good-bad-binary and *the logic of one* – in terms of universalization – are both birthed by the *Mathematics-Rationality-Human* continuum. *Wild mathematics* re-makes the logic of the binary as well as the logic of one by moving in the more-than spaces to these logics. With this *wild mathematics* can move to partake in re-doing morality and the epistemic violence it fosters.
- 7) *Wild mathematics* for *wild economics*: Spivak is uncompromising in emphasizing the interwovenness of Western economic power and Western narrative power – how one fashions, formulates, strengthens, and sustains the other. As I have established before, even though it is not the central focus of this work, I am convinced that the *Mathematics*-centric world has a material, economic dimension that manifests and sustains itself through a *Mathematics*-centric economics and financial market. So, *wild mathematics* aims for wild economics and its economic dimension is anti-capitalist. With this, *wild mathematics* re-makes narrative powers and their economic and material bases.

I propose the following mathematical interventions in relation to learnings-with-Spivak:

- 1) *Wild mathematics* to re-invent knowledge itself: *Wild mathematics* re-makes what it is to *think mathematically* and thus re-makes knowledge. I have provided more detailed examples of what this can look like so I will not go into detail here. To summarize, this re-writing of knowledge very crucially entails an un-doing of *the logic of the binary*, *the logic of one*, *the logic of calculability*, and a re-writing of the notion of *proving*.

- 2) *Wild mathematics* as a re-do of representation as a logic: *Wild mathematics* partakes in re-doing of the logic of representation. It does so through centering nonbinary, inconsistent mathematical modes, and moving without two-value systems or modes as a reference point.
- 3) *Wild mathematics* as re-making subjectivity: *wild mathematics* makes wild subjectivity, which is disruptive, more-than-human subjectivity. By exceeding the *Mathematics*-centric metric *wild mathematics* exceeds *the human* and *human*-centric subjectivity. By changing what it is to practice mathematics, new subjectivities are made and subjectivities other to the *human*-centric are re-called.
- 4) *Wild mathematics* as self-reflexivity: *wild mathematics* moves as a form of reflexivity – it knows the lives of epistemic violence closely and it fosters subjectivities that want to know their internalized, pre-existing frameworks and their violent potential. *Wild mathematics* fosters collectivities that form such spaces of reflexivity and it strives to appropriate mathematical modes for this purpose by asking: how can theorems, practices, and notions in the realm of the mathematical be found and founded to formulate tools for self-reflexivity? This could take the form of using *wild mathematics* as a mode of expression or communication in order to communicate perspectives, experiences, position, and dynamics one might have been/be part of.
- 5) *Wild mathematics* as subaltern expression: *wild mathematics* moves from the margins; it looks, and speaks, and breathes from within and from the outskirts – the margins of histories, worlds, and textbooks. Practicing wild mathematics as a form of subaltern expression means that a) *wild mathematics* comes into itself as a mode of expression and communication and strays from logics of epistemic domination, and b) *wild mathematics* centers most the voices from the margins in movements of that support and listen to their mathematical and nonmathematical speaking as well as their inbetweens and beyonds.
- 6) *Wild mathematics* as re-making ‘the good’: as discussed before, this aspect primarily moves through *wild mathematics* – through its sensing of the incalculable, nonbinary, nonuniversal by centering, experimenting, and inventing mathematical modes that exceed consistency, binary, and universalism.
- 7) *Wild mathematics* for *wild economics*: *wild mathematics* embraces mathematical performativity as a phenomenon that could realize epistemic wildness in financial markets through the means of *wild mathematics*. This does not however mean that *wild mathematics* moves with economic systems in

mind – it does not! What it does mean is that *wild mathematics* believes in unknowingly disruptive and powerful dimensions and ramifications to mathematical models and to *wild mathematical* models in particular. So, *wild mathematics* moves to re-call and invent mathematical models that foster epistemic wildness – that is unordered frameworks and modes. And it does so with a trusting and hopeful intuition for the relationalities connecting these models to economic and material worlds.

I believe there are three final core characteristics learnt-with-Spivak for *wild mathematics*:

- A) *Wild mathematics* moves for and with subaltern expression by centering perspectives from the margins of the *Mathematics*-centric world and making *wild mathematics* into a mode of expression for these worlds and their words.
- B) *Wild mathematics* re-makes knowledge itself by re-making what it is to think mathematically.
- C) *Wild mathematics* re-makes *subjectivity* by re-making mathematical subjectivity into a *wildmathematical subjectivity* that fosters other wild subjectivities.

4.2 Moving Mathematically towards Epistemic Wildness

Wild mathematics is an image of thinking-being that moves against, underneath, and beyond the grain of the *Mathematics-Rationality-Human* continuum and moves to re-make the *Mathematics*-centric world.

Through this movement *wild mathematics* is interwoven with a wider impulse towards what I call *epistemic wildness*. *wildness* here implies a) a re-claiming of frameworks that have been made to work towards domination and towards the upkeeping of hegemonic worlds²⁰, and b) a devotion to that which is deemed non-orderly in the *Mathematics-human*-centric worlds fashioned by the continuum. And with this comes a devotion to and trust in the disruptive force of the nonorderly, the wild epistemei.

20 For detailed accounts of the role the notions of 'wildness' played and continues to play in colonial-patriarchal worlds, see Pepperell 2023, Halberstam 2014, or Estés 1995.

The first two chapters of this thesis have established the transhistorical continua of violence made and upheld by the *Mathematics-Rationality-Human* continuum. I theorize these findings as a call to place re-makings of mathematical practices and notions at one of the forefronts of epistemic resistance – at one of the forefronts of epistemic wildness. So, *moving mathematically* refers to a political-epistemological movement towards *epistemic wildness* that forms its movement with a constant – implicit and explicit – interwovenness with *wild mathematical modes*. The nonseparation of the two words emphasizes the inseparability of movements towards epistemic wildness and movements towards *wild mathematics*. Much like the players of the *Mathematics-Rationality-Human* Continuum, epistemic wildness and *wild mathematics* too build a continuum – a continuum of resistance, a continuum of wild, and of more-than-human thinking-being.

The role of *epistemic wildness* and *wild mathematics* is to re-do what it is to think and what it is to be. Through the six endeavors of thinking-with these chapters formed eight crucial characteristics of *wild mathematics* as an image of thinking-being. Resultingly, at the very heart of the lives of *wild mathematics* lie the following motions and aspects:

- A) *Wild mathematics* moves beyond and in-between mathematical necessity by affecting a re-doing of determinacy, and with that a re-doing value and attributions of value.
- B) *Wild mathematics* is a practice for the body, of the body, and towards the wild body – such as the more-than-human body, the stinging body, and the uncaged woman body.
- C) *Wild mathematics* is a mode of being, fostering, and inventing collectivities of minor sociality.
- D) *Wild mathematics* is radically relational – never moving with binarism as a mode. *Wild mathematics* is – – to borrow words from Erin Manning – ‘always more than one’.
- E) *Wild mathematics* re-makes what it is to be human and to be a subject by re-making *what it is to practice mathematics*.
- F) *Wild mathematics* is a practice of feeling and feeling-with. It is never a practice in the mode of ‘problem-solving’ or ‘the rational.’
- G) *Wild mathematics* distills experience, communicates, and expresses.
- H) *Wild mathematics* is indebted to Black Studies, to Black life and movements, to decolonial and decolonial-feminist movements, and neurodiverse thinking-beings.

Wild mathematics is not a counter-concept to *Mathematics*, but rather it is what has always lived in the margins of the *Mathematics*-centric world. *wild mathematics* invents and nurtures these (mathematical) creatures of the margins so that we can re-make all our worlds and inhabit our more-than-human thinking-beings and our ways of wildness.

Conclusion

Resisting the *Mathematics-Rationality-Human* Continuum

This is a love story, a story about love.
Erin Manning, The Perfect Mango, 29

As I write the final words of this work, I recognize what I make visible at the beginning this work: the connection between the killing of knowledge and the killing of lives that embody thinking-being, which exceeds the continuum and the *Mathematics-Human*-centric world. As Spivak taught me, killing takes on many forms and as Wynter taught me, the killing begins with the policing of being. Therefore, the killing of knowledges and lives moves in ways so dense and deeply interconnected that we can either lose hope in a world not based on killing – or that we fully commit to the making of different worlds. I believe in different worlds, and I believe in understanding this one and I believe that writing helps guide me into the thinking-being that is my own.

At its core this thesis is a reaction to the many killings of lives and the many killings of knowledges that have happened and continue to happen. As I have stated in the beginning pages of this work, I sensed that *Mathematics* carries out a distinct role in these killings. So, this thesis started out with the objective to explore Mathematics as part of a continuum that builds epistemic violence and killer bodies of thinking-being such as the *Mathematics-Rationality-Human* Continuum.

My first two chapters set out to understand the complexities, the histories, and the systems that go into the many killings this world commits in relation to *Mathematics*. My last two chapters set out in reaction to the histories and the brutalities of the continuum – to form mathematical disobedience and to create mathematical practices that are otherwise to *Mathematics*.

Chapter One established a historical perspective on *Mathematics* that further characterized and defined *Mathematics* as an Image of Thinking. This ex-

ploration found a Western notion and practice of proving at the heart of *Mathematics*. Furthermore, my readings of contemporary scholarship, Ancient Greek philosophy, and the philosophy of Enlightenment showed that *Mathematics*, as an Image of Thinking, is created only in inextricable interwovenness with *the Rational* and *the Human*. Thus, this first chapter resulted in two core findings, which have guided the chapters that followed: 1) *Mathematics*, *Rationality*, and *the Human* are not separate notions, but rather build the *Mathematics-Rationality-Human* Continuum; and 2) the existence of this continuum shows that Images of Thinking are never separable from Images of Being because thinking-being too builds a continuum. Therefore, *Mathematics*, *Rationality*, and *the Human* are to be understood as images of thinking-being.

Chapter Two moved to contemporary times and focused on the framework of epistemic violence in relation to *Mathematics* and in relation to the *Mathematics-Rationality-Human* Continuum. It set out to define specific ways in which *Mathematics* enfold epistemic violence and in which it partakes in the killings of this world. The epistemic violence established through the *Mathematics-Rationality-Human* Continuum shapes and limits sense-making, meaning-making, and subjectification, which are established as mutually interwoven with one another. This is because the thinking-being provided by and legitimized through the continuum creates systems of sense-making, meaning-making, and subjectification, which in turn continuously reproduce the *Mathematics-Rationality-Human* Continuum. The core findings of this chapter are threefold. Firstly, the *Mathematics-Rationality-Human* Continuum lies at the core of epistemic violence; it is itself epistemically violent and produces thinking-being, that continuous the continuum's legacy of epistemic violence. Secondly, there are four interwoven notions through which *Mathematics* enfold epistemic violence: *Binarism*, *Necessity*, *Universalism*, and *Proof*. And thirdly, epistemic violence lies at the core of this world as The *Mathematics-Rationality-Human* Continuum creates the Man-centric world and seeks to regulate all thinking-being to fit Man-centric metrics.

Chapter Three explored mathematical forms of disobedience against *Mathematics* and against the *Mathematics-Rationality-Human* Continuum by drawing from existing work on epistemic violence. Crucially, it was shown that mathematical disobedience keeps *Mathematics* as a point of reference and seeks to subvert the *Mathematics-Rationality-Human* Continuum precisely by relating to its logics of meaning-making thus re-doing them in the process. Throughout this chapter, I established seven interrelated forms of mathematical disobedience: 1) disobedient appropriation, 2) disobedient symbolism, 3) disobedient

communication, 4) disobedient expression, 5) disobedient necessity, 6) disobedience against binarism, 7) disobedience against universalism. The findings of this chapter included these seven forms of mathematical disobedience and an exploration of the possibilities and impossibilities of mathematical disobedience. Mathematical disobedience seeks to subvert and transform the *Mathematics-Rationality-Human* Continuum; however, its movements remain inside the continuum and thus remain (at least in part) bound to the logics of the continuum.

Chapter Four began with creation of an Image of Thinking-Being that commits to re-making the world: *wild mathematics*. This chapter thinks-with and learns-from texts, that simultaneously engage acts of epistemic resistance while considering epistemic resistance. I propose *wildness* as an objective in order to a) re-make the *order-wildness* binary so heavily leaned on in colonial-patriarchal world-making and b) to name the rebellious messiness always already there, which exceeds the *Mathematics-Rationality-Human* Continuum. I form six explorations, which each result in lessons for and further making of *wild mathematics* as an Image of Thinking-Being for rebirthing worlds. Through these explorations I consider: 1) *wild mathematics* as a distillation of experience (with and thanks to Audre Lorde), 2) *wild mathematics* as writing (with and thanks to Hélène Cixous), 3) *wild mathematics* as re-making value (with and thanks to Denise Ferreira da Silva), 4) being human as a practice of *wild mathematics* (with and thanks to Sylvia Wynter), 5) *wild mathematics* in relation to more-than-human bodies and the wildness of relationality (with and thanks to Erin Manning), and 6) *wild mathematics* as a movement towards other worlds (with and thanks to Gayatri Spivak). This chapter proposes that we need epistemic wildness, and we need wild genres of thinking-being to help re-birth this world and it is the existence of the *Mathematics-Rationality-Human* Continuum that compels us to wildly remake mathematical practice and to remake thinking-being into what our more-than-human tendencies seek out.

Putting final words to the matter of the *Mathematics-Rationality-Human* Continuum or to our multitudes of wild thinking-being is an impossible task. It is impossible, because this thesis is supposed be a small part of movements of re-inventing what it is to think and be – mathematically and otherwise. I believe in committing to impossible tasks because – to recall Audre Lorde – we do not need to move in modes of problem-solving. Committing to impossible tasks is to commit to a vision that cannot be fulfilled, but that can move as a guiding light – a compass. So, I commit to the impossible task of finalizing

this journey through the histories, complexities, in-between and beyonds of the *Mathematics-Rationality-Human* Continuum.

This thesis established that the *Mathematics-Rationality-Human* Continuum is foundational to epistemic violence and that *thinking-being* builds a continuum. Additionally, it showed that it is thinking-being that requires re-making and images of thinking-being otherwise to the *Mathematics-Rationality-Human* Continuum. I believe in these re-makings and in the more-than of the continuum. I believe *other worlds are possible*. And I believe those other worlds have other thinking-beings and they have other mathematical thinking-beings. I can sense them already now. And the reason I can see them lies in my journey through the four temporalities of the *Mathematics-Rationality-Human* Continuum as it is the mapping of temporalities, which is also a mapping of possibilities – in encounters with multiple temporalities of the mathematical – is an event of resistance.

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