

World Food Trends and the Future of Food

Edited by
Marianna Nobile

Preface by Warren T.K. Lee



Hórisma 6

Ledizioni 
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Via Alamanni, 11 - 20141 Milano - Italy
www.ledizioni.it
info@ledizioni.it

World Food Trends and the Future of Food
Edited by Marianna Nobile
Prima edizione: novembre 2015

ISBN cartaceo 978-88-6705-392-6
ISBN ebook 978-88-6705-404-6

Copertina e progetto grafico: ufficio grafico Ledizioni
Immagine di copertina: *Edible thoughts*, by Andre Viktor Gazza
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Informazioni sul catalogo e sulle ristampe dell'editore: www.ledizioni.it

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Volume finanziato con il bando "1000 lire" dell'Università degli Studi Milano-Bicocca e dal bando "Attività culturali" dell'Università Statale di Milano.

*“If one person dreams alone
it remains a dream.
But if we all dream together,
it becomes reality”
(H. Camara)*

This publication is part of *“Hórisma”*, a series that aims to spread multidisciplinary analysis - both theoretical and empirical - of young scholars willing to look beyond the limits of their own discipline.

The search for an area of common discussion led to the creation of a joint project of four publications:

- *“Family, Work and Institutions. A Look at the Future”*, edited by Riccardo Bonato and Giovanni Castiglioni;
- *“World Food Trends and the Future of Food”*, edited by Marianna Nobile;
- *“Security in the City. Practices of Control in the Contemporary Urban Spaces”*, edited by Sebastian Saborio;
- *“Equalities: Rights, Resources, Challenges for the Future. Young Researchers Dealing with Intergenerational Conflict”*, edited by Leda Rita Corrado.

The scientific project and the fundraising activity were lead by the eleven members Advisory Board of *“Hórisma”*. This interaction stimulated the sharing of resources and the selection of topics of interest for a generation facing adult life.

The editors of the individual volumes were the points of reference for the realization of this scientific project, collecting the contributions for the four publications through an international call-for-papers. The different geographical and disciplinary backgrounds of the young scholars provided multiple points of view for the discussion on the selected topics. The contents were then evaluated with a blind-review by the Scientific Committee of *“Hórisma”*.

The project was funded by the University Milano-Bicocca and the University of Milan, with the support of three student associations: *“Studenti Indipendenti”*, *“Liste di Sinistra”* and *“Associazione Studenti Bicocca”*.

I would like to express my sincere gratitude to all those who contributed.

Milano, 13 novembre 2015.

Riccardo Bonato
Direttore di *“Hórisma”*
www.horisma.com

*“Audentes fortuna iuvat”
(Virgilio)*

Acknowledgments

This book would not have been possible without the coauthors who kindly shared their knowledge and passion. Riccardo Bonato and the Hòrisma team were integral to making this book come to life.

I am grateful to the many teachers, mentors, colleagues, and friends who along the way fostered my interests and curiosity in developing multidisciplinary projects on issues, such as food and nutrition, that nowadays deserve particular consideration.

I would like to thank all who were engaged in this project, especially Dr. Warren Lee for his remarkable contribution in writing the Preface.

Special thanks to Andre Viktor Gazza whose enthusiasm and artistic talent gave rise to the picture on the cover.

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Preface

It's my great pleasure to write a preface for this volume of Hórisma which is a collection of insights and perspectives on the world food trends and the future of food by a group of young scholars. The essays were developed based on critical analysis and research undertaken in four major areas: (1) intellectual property rights and legal protection for creative cuisines in the culinary industry; (2) public skepticism towards techno-scientific innovations in food science and technology and the voice of the consumer including needs, expectations and concerns for future food and nutrition Responsibilities to regain consumers' confidence in food innovations; (3) urban horticulture, a growing trend in the cities that has contributed to urban food security and nutrition, as well as a wide range of benefits to local communities and environment; and, (4) taste as a driver of food choice in people - a preliminary study on young people's preference for bitter taste.

The issues highlighted in the essays will have important implications on future food trends and the future of food, namely healthy diets and healthy food choices, pleasurable gastronomic experience with cuisines, consumers' confidence on food innovations and food safety, and the sustainability of food security and nutrition and the living environment.

The arguments and deliberations in the essays were based on solid research. The authors gave a logical presentation of relevant facts and research findings that are interwoven together. The essays are written succinctly and supported by appropriate illustrations that make for easy reading. This volume of Hórisma has provided food for thought in world food trends and the future of foods for food

and nutrition policy makers, law makers, nutritionists, agro-economists, food technologists, researchers, food manufacturers, chefs and consumers.

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Introduction

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The current scientific debate about food and nutrition has gained particular attention in 2015 thanks to the Milan Universal Exposition, whose theme is *Feeding the Planet, Energy for Life*. The issue of food production and consumption is undoubtedly important, especially in relation to the global transition in dietary patterns that have several implications in the food industry marketing in light of the changing socio-demographic factors and other consumer trends. The analysis of relevant topics on food requires a careful consideration that embraces technology, innovation, culture, traditions, and creativity and how they are related to food and diet. For this reason, four essays written by young scholars have been collected in order to identify areas of shared multidisciplinary interests that are part of a new global food and nutrition challenges. The aim of the following papers is to investigate issues related to food safety, consumption, research and technology, bearing in mind that knowledge and best practices sharing is an urgent need to address a global change. Stimulating dialogue among different disciplines, as well as promoting an integrated and multidisciplinary

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approach, is crucial to face all the issues concerning food and its linkages to law, technology, society, and science.

In the first essay, Jacopo Ciani, taking into consideration the growing public interest for gastronomic experiences, focuses his attention on the intellectual property right claimed by chefs to protect their culinary creations. Analyzing the U.S. and Italian laws, the author highlights the hardship of protecting recipes through the copyright law. In most of the U.S. cases Courts considered recipes mere statements of facts, while in Italy the Court granted protection in explicit terms, as expression of literary creativity, rather than to the content of the recipes. Subsequently, Ciani recognizes that not only the recipe, but also the dish itself, considered as a work of art, requires legal protection. Nevertheless, it remains an intellectual property *vacuum*; it is not covered by formal intellectual property laws.

Turning the attention to technological innovations, the second essay focuses attention on how public opinion perceives food technologies. Andrea Rubin analyzes how public opinion considers the impact of science and technology on food, taking the example of the creation of “in-vitro meat”, also called “BicMac high-tech”, “synthetic burger” or “Googleburger”. Public opinion is the result of a complex process of cultural development that involves ethical principles, expectations and concerns about the future, economic and political interests. Most important, the author tries to explain that the common aversion to food technology is not caused by the so-called “scientific illiteracy”, but by the influence of social factors that drive public opinion.

Great importance is also given to the value of food production as expression of culture and vehicle of social cohesion. According to Valentina Cattivelli, the phenomenon of urban gardening deserves a careful consideration, since, apart from having meaningful environmental effects, it impacts social relations and health. Effectively, it has been shown that different kinds of urban gardening located in a specific Italian region have social outcomes, such as strengthening the community and consolidating values and traditions. Moreover, they represent a local food resource, that becomes an ideal complement to the rural food production and helps people to make healthier food choices.

Food choices are driven not only by public opinion and social factors, but by the biological function of taste perception as well. In this regard, Filippo Caremoli et al. analyze the correlation between

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perception and liking of bitter taste, food preferences and some genetic factors. Through a preliminary investigation of a homogenous sample of 66 college students, the authors collected data on bitter taste perception and liking. The results have been statistically elaborated in order to understand how a young population perceives bitter taste and how it can influence not only food preferences, but also health status.

Intellectual property rights and the growing interest in legal protection for culinary creations

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FOOD AS A SUPER-SIZED BUSINESS

The way of looking at food has undergone an impressive development. Originally conceived just as a perfunctory activity it has been transforming into a competitive, large-revenue, multimedia consumer industry for entertainment and leisure¹.

Food lovers actively look for new and unusual gastronomic experiences, ready to spend top money on dishes that delight their senses².

This new food culture has so deeply permeated our society that, tasting food and exercising our judgment, we all feel as if we were star cooks, rather than simply consumers.

Also when we stop eating, we continue to be entertained by Restaurant guides or by entire channel devoted to instructional cooking programs and competitions between aspiring chefs.

The emergence of celebrity chefs is just the evidence that food is today a super-sized business opportunity.

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1 Cf. Mennell 1996: 134-65; Broussard 2008: 691.

2 Cf. Telfer 1996: 24-40.

This increasing potential for fame and financial reward acts as a great stimulus for young chefs to create new dishes, conscious that the level of creativity in their menus will likely determine their success.

RECIPES' PLAGIARISM

If menu items, original dishes and recipes became a competing weapon in the struggle for the public approval, it is a logical consequence for chefs to attempt to invoke intellectual property ("IP") rights to protect the significant value in what they produce from misappropriation by competitors³.

The growing trend for ripping off culinary ideas⁴, now also through food blogs⁵, where bloggers often share the entire text of chef's recipes without any permission or acknowledgement⁶, stresses the need for reviewing food IP protection.

EXPO Milan 2015, focused on the topic of food sustainability, has raised the academic debate on the issue with a conference on "*Food design: value and protection*"⁷.

This chapter aims to contribute to the debate, providing a first insight into the protection of food design from a legal perspective.

THE CURRENT RULE ON COPYRIGHT PROTECTION FOR RECIPES

The Berne Convention (1886), governing copyright at international

³ Cf. Volpe 2006. Investors, *in primis* food publishers, might also be wise to demand intellectual property protections.

⁴ In 2006, the eGullet Society for Culinary Arts & Letters ousted Australian chef Robin Wickens of Melbourne's Interlude for including on its menu exact replicas of dozens of dishes from high profile American chefs. cf. <http://forums.egullet.org/topic/84800-sincerest-form/>; Lewis 2006: 20; Wells 2006, discussing recent occurrences of "copycat" cuisine.

⁵ Cf. Guevin 2007.

⁶ Lawrence 2011: 189-190, 203, explains how this practices may harm chef's revenues, reducing the interest in purchasing cookbooks and food magazines and taking away traffic (i.e. advertising revenue) from the chef's or publisher's websites.

⁷ The Event, organized by the Italian Group of the International Association for the Protection of Intellectual Property (AIPPI), was held on June 22, 2015 at IULM University, Milan. Cf. ipfood.aippi.it.

level, protects “*every production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression*”, such as original literary, musical, dramatic, choreographic, pictorial, graphic, sculptural, audiovisual and architectural works of authorship. Food dishes and recipes are absent from the list of protected subject matter but neither are expressly excluded from copyright protection⁸. The broad wording used by the legislator leads to interpret the list of protected works as non-comprehensive. As a result, the legislative wording favours judicial expandability of copyrightable subject matter⁹.

Nonetheless, until now, the response of several different legal systems to chefs’ demand of protection has been unsatisfactory. U.S. and Italian law are two significant examples¹⁰.

FOOD CREATIONS’ COPYRIGHT UNDER AMERICAN LAW

The few U.S. courts¹¹ that have addressed the issue as well as copyright law’s scholars have proven to be hostile to the notion that creators of recipes may obtain monopolies over their work¹². The Code of Federal Regulations, which elucidates the Copyright Act’s subject matter limitations, includes among materials not subject to copyright “*mere listing of ingredients or contents*”¹³. The U.S. Copyright Office has issued guidelines for this section: «*[mere list-*

8 See U.S. Copyright Act of 1976, 17 U.S.C. § 102(a) and (b) (2000) and Italian “Legge sul diritto d’autore”, No. 633 of April 22, 1941 (hereinafter only “L.d.a.”), artt. 1-2, reproducing the same language of art. 2575 Italian Civil Code.

9 Courts found eligible for copyright protection several creations which are not expressly listed in the provision (such as, cartoons’ characters, web sites, the format of a tv program, advertisings, museums and others). For more references cf. Marchetti et al. 2012: 1347. According to Pollack 1991: 1523 and Straus 2012: 248: «*the statutory language and legislative history of the Copyright Act should not be an impediment to expanding copyright to encompass cuisine*». On the contrary Fabiani 1987: 119: «*Copyright protects works which satisfy the eyes’ or hears’ pleasure. It does not extend to creations that delight the palate*».

10 For a look at other countries (Canada, Sweden, Netherland and Germany) cf. Mout-Bouwman 1988: 235.

11 The legal status of recipes has not been often litigated. That could be because of a certain custom of respecting credits of other chefs when using their recipes. Fauchart et al. 2006, ascertained that an informal norm-based IP system exists among chefs, acting as a mechanism of dispute prevention.

12 Cf. Patry 2007: § 4:23.

13 37 C.F.R. § 202.1(a) (2007).

ings of ingredients as in recipes, formulas, compounds or prescriptions are not subject to copyright protection. However, where a recipe or formula is accompanied by substantial literary expression in the form of an explanation or directions, or when there is a combination of recipes, as in a cookbook, there may be a basis for copyright protection»¹⁴.

The rationale for this interpretation is the principle that copyright protects the expression of an idea (i.e., a textual or visual representation of a dish or the language of a recipe), but not the idea or the process itself (the concept of putting certain ingredients together to make a dish)¹⁵. According to this principle, a single recipe is considered a process of creating something, rather than a creative literary expression¹⁶. Thus, while copyrighting cookbooks or menus¹⁷ is generally allowed under current law, bare recipes' eligibility for protection is far less clear¹⁸.

In *Publications, Int. v. Meredith Corp.*, the plaintiff, arguing to possess copyrights in its recipes for dishes containing a particular brand of yogurt, tried to prevent a competitor from printing substantially similar recipes. The Seventh Circuit concluded that, while recipes are not *per se* excluded from copyright protection, those in question constituted "*mere listings of ingredients*", thus being excepted from copyright protection¹⁹.

14 U.S. Copyright Office - Recipes, <http://www.copyright.gov/fls/fl122.html>.

15 The "idea/expression dichotomy" is adopted by every modern copyright system pursuant to art. 9 TRIPs and art. 2 WIPO Copyright Treaty, which exclude copyright protection for "*ideas, procedures, methods of operation or mathematical concepts as such*". See art. 2, no. 8 and no. 9 L.d.a. and 17 U.S.C. § 102(b). For wide bibliographical and jurisprudential references see Marchetti et al. 2012: 1326.

16 Kaufman 2009: «*The ingredients used in a recipe and the process for putting them together are the facts needed to create the dish. As no one can claim copyright in facts, bare recipes are not copyrightable*».

17 Cf. *Oriental Art Printing, Inc. v. Goldstar Printing Corp.*, 175 F. Supp. 2d 542, 548 (S.D.N.Y. 2001), finding a valid copyright in the overall design of a Chinese restaurant menu; *TM Foods of Avon, Inc. v. Jimmy John's Enters.*, No. 05-CV-0220 (S.D. Ind. Oct. 5, 2005) where a sandwich franchise claimed copyright and trade dress in its menu layout. The parties settled and the alleged infringer agreed to destroy its menus and paid \$50,000. Straus 2012: 195, states that «*A menu's overall layout is also entitled to thin copyright protection, as long as it meets the (minimal) creativity requirement*».

18 Cf. Cooper Dreyfuss 2010: 1450: «*Chefs cannot protect the ingredients of individual recipes, but they can use copyright to protect compilations of recipes and the way that recipes are expressed*». Straus 2012: 193, speaks about a «*peripheral support*» of traditional IP law for cuisine, because these cookbooks often serve as marketing materials that draw customers to the chefs' restaurants.

19 88 F.3d 473, 480 (7th Cir. 1996), according to which «*The identification of ingre-*

The *Meredith* decision was confirmed.

In *Lambing v. Godiva Chocolatier*, the Sixth Circuit was brief in its rejection of plaintiff's copyright infringement claim for copying the recipe and design of her truffle²⁰.

In *Lapine v. Seinfeld*, Lapine claimed that Seinfeld had stolen her idea to publish a cookbook containing recipes designed to teach parents how to hide vegetables in their children's food. The Second Circuit disagreed: «[s]tockpiling vegetable purees for covert use in children's food is an idea that cannot be copyrighted»²¹.

More recently, the same conclusion was reached by a federal judge in Ohio in *Tomaydo-Tomahhdo LLC et. al v. Vozary et. al*²². Two Cleveland restaurateurs opened a pair of restaurants serving casual fare like sandwiches, pizza, wings and salads. Three years later, the founders split and the departing one soon opened his own restaurant serving similar menu items. The federal court dismissed the remaining founder's claim of copyright infringement, explaining that copyright protects the particular layout of a recipe in a published recipe book or the photos that accompany the recipe, but not the idea or instructions.

In all these cases, courts have ruled that recipes are mere statements of facts, dictated solely by functional considerations. They are not a work of authorship of the sort that copyright law is designed to protect, but just the instruction about how to create an edible product²³.

dients necessary for the preparation of each dish is a statement of facts» and «[The] recipes' directions for preparing the assorted dishes fall squarely within the class of subject matter specifically excluded from copyright protection by 17 U.S.C. § 102(b)». In dicta, however, the Court stated «[N]othing in our decision today runs counter to the proposition that certain recipes may be copyrightable». It suggested the need to distinguish between "barebones recipes" and ones where «the authors lace their directions for producing dishes with musings about the spiritual nature of cooking or reminiscences they associate with the wafting odors of certain dishes ...».

See also *Barbour v. Head*, 178 F. Supp. 2d 758, 764 (S.D. Tex. 2001), where the 5th Circuit relied on *Meredith* to conclude that the plaintiff's recipes contained «*more than mechanical listings of ingredients and cooking directions*» and thus might be «*sufficiently expressive to exceed the boundaries of mere fact*». Indeed, the recipes provided helpful commentary, anecdotal language, and suggestions for food presentation.

20 142 F.3d 434, (6th Cir. Feb. 6, 1998).

21 2009 WL 2902584 (S.D.N.Y. Sept. 10, 2009), *aff'd* 375 Fed. Appx. 81 (2d Cir. 2010).

22 N.D. Ohio 29 Jan., 2015. Cf. *Singer* 2015.

23 *Nimmer* 2012: § 2.18 at 2-208: «*the content of recipes are clearly dictated by functional considerations, and therefore may be said to lack the required element of originality, even though the combination of ingredients...may be original in a noncopyright sense*».

...AND UNDER ITALIAN LAW

In Italy, the issue has recently come up with a decision of the Court of Milan²⁴. It stated that recipes can be protected by copyright on the sole condition that the author has introduced a minimum grade of creative character in the simple narrative of preparation, even if they are based on traditional formulas publicly known.

The plaintiff, arguing to possess copyrights in its instructions for the production of handcraft cured meats, published on line, challenged the unauthorized use of the opponent, who edited a book containing identical recipes.

The Court granted copyright protection to the texts, but clarified that this protection does not concern the content of the recipes²⁵ or the instructions for their preparation, but only their expressive and literary form. It includes the language, the layout of the texts and, most of all, the selection and research of the relevant contents: all elements able to reveal an albeit minimum personal contribution of the author²⁶.

CULINARY DISHES AS WORKS OF AUTHORSHIP

All the above-mentioned cases have focused on recipes rather than on restaurant dishes.

Of course, protecting recipes, as a writing exercise, is something different from protecting the dishes (i.e. the end product)²⁷. In fact, to be protected is not the art of cooking in itself, but the way the publisher represents and explains them.

24 Trib. Milan, March 14, 2013 / July 10, 2013, P.S. v. M.V. and A.S. Editore s.p.a.

25 Ghidini 2015: 208, endorses this approach. Fabiani 1987: 117 clarifies that this content, even if original, should be kept freely available to the public.

26 Similarly cf. Trib. Casale Monferrato, Nov. 11, 1996, *Dir. Ind.*, n. 3/1997, 259; Pret. Ferrara, Jun. 9, 1992, *Dir. aut.*, 1992, 403 and Pret. Venezia, April 24, 1969, *Dir. aut.*, 1970, 348, that excluded copyright protection for a pamphlet collecting traditional recipes from Veneto, without any creative character even in the language. Cf. Fabiani 1987: 116; Cavallaro 1997: 262.

27 Pollack 1991: 1499; Buccafusco 2007: 1131, states that courts have «*confuse[d] the [copyrightable] work of authorship with the instructions about how to perform it*»; Broussard 2008: 716, highlights «*the faulty assumption that the recipe for a dish, rather than the dish itself, is the proper subject matter of copyright protection*».

As a result, another chef could recreate the underlying dish that the recipe describes, without infringing upon the copyright.

ALTERNATIVE MEANS OF PROTECTING CREATIVE CUISINE

Interestingly, some chefs, skeptical that copyrights could be invoked to protect their menu items, explored alternative litigation strategies, not asserting copyright infringement but rather relying on trade secret²⁸, patent or even trade dress claim²⁹. It is difficult to think that such an attempt to protect a chef's cuisine will be successful.

Using trademark or trade dress law to protect cuisine is problematic, mainly because it constitutes an attempt to protect not a sign but the product itself³⁰. According to art. 3(1) lett. e) Dir. 2008/95/EC and art. 7(1) lett. e) Reg. (EC) No. 207/2009 on the Community trade mark, no claim to trade mark protection is possible if it is held that the shape of the dish results from the nature of the goods themselves or that the shape of the goods affects their intrinsic value³¹.

²⁸ Trade secret law offers little legal recourse once a secret gets out. In *Buffets, Inc. v. Klinke*, 73 F.3d 965, 968 (9th Cir. 1996), the 9th Circuit held that trade secret law does not protect dishes offered at an all-you-can-eat restaurant, because cuisine such as barbecue chicken and macaroni and cheese are American staples.

²⁹ In *Powerful Katinka, Inc. v. Edward McFarland*, No. 07 Civ. 6036 (S.D.N.Y. filed Jun. 26, 2007), Rebecca Charles, chef of the Pearl Oyster Bar in Manhattan, filed a complaint against her former sous chef, arguing that he pirated Pearl's entire menu. The suit was settled out of court. Cf. *Krizman* 2009: 1010, *Wells* 2007: A1, *Wells* 2008: B2. A similar lawsuit was filed in *Vaca Brava, Inc. v. Hacienda Vaca Brava & Steak House, Inc.*, No. 3:09-cv-01633 (D.P.R. July 8, 2009), where the plaintiff complained that Hacienda infringed its trade dresses in presentation of steak dish. Also this case settled. More recently, in *N.Y. Pizzeria, Inc., v. Syal*, No. 3:13-CV-335, at *2 (S.D. Tex. Oct. 20, 2014), the Southern District of Texas recognized that there were «rare circumstances» where food plating may be protected by trade dress if it is distinctive and serves no functional purpose. *Cunningham* 2009: 41, states that «trade dress should not be construed to protect the cuisine itself», but only eventually the image of a restaurant (menu, décor and atmosphere) as established by the leading case *Taco Cabana*, 932 F.2d at 1119.

³⁰ For other problems with protecting edible creations under trademark or trade dress law cf. *Cunningham* 2009: 41-45. *Contra* *Straus*, 2012: 188, arguing that which explores how trade dress law could work as an alternative area of legal protection of restaurant dishes.

³¹ *Mout-Bouwman* 1988: 238: «if one wants to register the shape of a dish as a trade mark, that shape will in any event have to be distinct, definite and simple, that is it should not be a plate with food on it, but a shape which is permanent and sufficiently distinctive, such as a geometric shape or a simple abstract shape».

Until now, the EU case law have proven hostile to grant trade mark registration to the shapes of food³².

Patent law, on the contrary, is used to provide protection for highly innovative and truly new culinary techniques³³, but it is necessary to convince the patent office that the creation is novel, non-obvious and has certain advantages over ordinary food (i.e., has industrial utility)³⁴. Culinary creations rarely include such technological innovation and many of them will lack these requirements³⁵.

More frequent are cases of application and successful registration of design patents for presentation of food³⁶.

EU legislation provides a quite broad definition of what Community design is, as it applies to every features of the appearance (lines, contours, colours, shape, texture and/or materials of the product itself or its ornamentation) of a product, that is to say any industrial or handicraft item³⁷. As a result, design protection can be sought for

32 The EU General Court (GC) refused trademark registration a brown cigar and a gold lingot, both made of chocolate, on the ground that they were devoid of any distinctive character (joined cases, T-324/01 and T-110/02, Apr. 30, 2003). The same finding was achieved by the OHIM examiners with regard to chocolate lips (decision of Aug. 27, 2013). Cf. also T-8/08, Mar. 10, 2009, where the GC denies registration to a brioches resembling a shell and T-15/05, Mar. 31, 2006, refusing registration to an oblong shape of the gut for making sausages.

33 A culinary patent was granted to Homaru Cantu, molecular gastronomist chef, who invented a method for preparing edible sheets of paper and a fork that adds aromatic flavour to each bite of food (U.S. Pat. 7,307,249). A number of patents were granted to J.M. Smucker Co. for a «Sealed Crustless Sandwich» (U.S. Patent no. 2,463,439, no.3,782,270, no. 6,004,596 and no. 6,874,409), but the Federal Circuit court ultimately rejected those patents on the basis that the sandwiches were basically like ravioli and did not meet the novelty standard, cf. Jaffe et al. 2004:25-26, 32-34.

34 Cf. art. 27 TRIPs, art. 52 E.P.C., art. 45 C.p.i., 35 U.S. Code § 101-103, Quinn 2012.

35 Krause 2007; Cunningham 2009: 46-47; Lawrence 2011: 202; Straus 2012: 198. High is the possibility that recipes are in circulation, which predate a chef's work, as well as high is the bar for non-obviousness, being the restaurant business strongly competitive.

36 Mout-Bouwman 1988: 239. For instance, Contessa Food Products owned a design patent for "Serving Tray with Shrimp", (Pat. Des. 404,612). In ZB Industries, Inc. v. Conagra, Inc., 56 U.S.P.Q.2d 1739, 2000 WL 1863561 (C.D. Cal. 2000), the Central District of California found that its competitor' similar tray infringed Contessa's design patent. Other foods, such as various shapes of waffles (U.S. Patent No. Des. 373,452) and a "peace symbol shaped pretzel" have been the subject of design patents (U.S. Patent No. Des. D0423184, Apr. 25, 2000). Cf. Lewis 2013; Lord 2012.

37 See art. 1 Dir. 98/71 EC and art. 3 Reg 6/2002 on Community Designs ("C.D.R."); art. 31 C.p.i.

quite a wide range of items, including shapes of food³⁸.

However, there are also several downsides to design patents, which make them not a practical solution for most chefs. Also in this case, an applicant is required to meet the new and individual character standard³⁹. Second, prosecuting a patent is expensive and could take several years: considering the risk the applicant is willing to take, industrial food companies and restaurant chains are potentially more interested in seeking the benefit of the patent system, than the majority of chefs.

Further, not trade mark law, nor design law provide protection against third parties using the recipe as such⁴⁰. So they do not solve the problem of chefs who desire to share recipes through cookbooks or websites, avoiding others to publish their recipes for profit.

In conclusion, protection for restaurant's dishes is the exception and not the rule and food has been described as an IP's negative space, i.e. a space of creativity not covered by formal IP laws⁴¹.

PROTECTING FOOD PRESENTATION UNDER COPYRIGHT LAW

In light of the difficulties associated with utilizing trademark and patent law to protect chef's cuisine, copyright law still seems to be the most adequate answer, which chefs should look to.

Copyright law protects works of art. Food, cooked and plated by a

38 The design of a round shape cookie with chocolate chips on the surface and a layer of chocolate filling inside was registered as Community design No. 1114292-0001 and then declared invalid by the GC on the ground that it lacked individual character (T-494/12, 9 Sept., 2014). An international registration was also granted to Viennetta, the ice cream cake made by Unilever (No. DM/034592). On the contrary, the Board of Appeal upheld the refusal of a design application for an heart shaped tomato on the grounds that living organisms as such are not "product" for the purposes of article 3(b) C.D.R..

39 Recital 19 and Art. 4, 5, 6 C.D.R.

40 Mout-Bouwman 1988: 240: «*At best these laws perform a supporting function affording protection against the use of a specific name registered to designate a dish or against the presentation of that dish in a specific shape or configuration*».

41 Raustiala et al. 2006: 1768, defining IP's negative space as «*a substantial area of creativity into which copyright and patent do not penetrate and for which trademark provides only very limited proprietization*». They state that the restaurant industry functions in a «low-IP equilibrium», because, although it is legal to copy culinary creations, creative production somehow continues, contradicting the accepted wisdom that IP protection is required to stimulate creativity. Cf. also Rosenblatt 2011: 326.

chef who seeks to express himself in his creation, designing a dish that presents patterns of harmonious or contrasting flavours, textures, colour combinations, layering and placement, difficulty can not be considered a work of art worthy of copyright protection.

Traces of “culinary arts” date back to the Ancient Greece⁴² and today a vast literature on the philosophy of food exists, confirming that it is indeed an art⁴³. The existence of “museums” displaying food, of a culinary world of television chefs, other than the flashy cookbooks and gourmet restaurants, are probably the determinative proof that food is art.

Culinary dishes possess the expressive potential to convey meaning like other traditionally protected works of art: for example, a chef might utilize local products to capture the peculiarity of a region in a dish, or use some flavours, like lemon or tropical fruits, to express the idea of summer.

A “signature dish” is representative of the chef or the restaurant’s style, as a painting is representative of the painter’s style or movement.

Plating arrangements are intended to stimulate patrons’ aesthetic sense and patrons may act as art critics when they savour, contemplate and discuss their dishes as visual and flavourful expression of art⁴⁴. At the end, a culinary dish could be described not differently than a jazz piece or a painting as light, heavy, avant-garde, whimsical, ethnic, fusion or traditional.

Viewed in this way, a recipe ceases to be a functional list of ingredients, because it exists not merely as an instruction for the creation of the dish or as an edible product providing for nourishment, but as an object of art itself.

It is difficult to conclude that this kind of art lacks the low standard of originality that is the *sine qua non* of copyright-protected

42 Ghidini 2015: 208 mentions that in the *Deipnosophistae* (Trans. Olson, S.D., 2007, as *The Learned Banqueters*. Cambridge: Harvard Un. Press), a 600 B.C. Ancient Greek work by the Greco-Egyptian author Athenaeus of Naucratis, there are traces of a culinary competition, in the Greek city of Sybaris, whose prize was the exclusive right to exploit the winning recipe for an year. See also Frumkin 1945:143, considering it the first patents.

43 Telfer 1996: 46, explaining that food can be art when it is «*intended or used wholly or largely for aesthetic consideration*». Korsmeyer 1999: 109 argues that cooking can only represents a “minor art”, but this downgraded status should not exempt dishes from legal protection under copyright.

44 Buccafusco 2007: 1133, asked chefs their opinions on whether dishes are used as an expressive medium.

works⁴⁵. A lack of originality could still be argued by focusing on recipes that are admittedly in the “culinary public domain”⁴⁶, such as lasagne or tiramisu, but not easily considering recipes of modern experimental grand cuisine. Let’s think to the Cotoletta alla Milanese, which in Carlo Cracco’s hands becomes the Milano Sbagliata, a veal chop revisited by his creativity⁴⁷. It would make no sense to exclude eligibility for protection in respect of these innovations that have no gastronomic precedent⁴⁸.

FEASIBILITY OF COPYRIGHT PROTECTION

If a recipe shall conform to the requirements of creativity and originality, it should be considered a work of art protected by copyright, even if not expressly provided by the relevant law⁴⁹.

Someone suggested that dishes could be regarded as “*works of applied art*” which are treated as copyrightable subject matter category by the Convention⁵⁰. Nonetheless, this category is not embraced by many national laws (as the Italian one).

Others argue that they could be protected as “*pictorial*” works of authorship because their originality derives from the particular combination of techniques and colours that produces a notable aesthetic effect⁵¹.

Somebody proposed to consider dishes as “*sculptural*” works, remarking how food is intricately created, designed and placed with artistic precision on the plate⁵². Within this conceptual framework,

45 Cf. Feist Publ’ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991). With reference to Italian case law, cf. *ex multis* Cass. Oct. 27, 2005, no. 20925, *Foro It.*, 2006, I, 2080.

46 This term is used by Buccafusco 2007: 1130, for «*recipes that have been produced for years, if not for generations, and their original creators are unknown*».

47 Cf. <http://www.finedininglovers.it/ricette/secondi-piatti/carlo-cracco-ricetta-milano-sbagliata/>.

48 Kaufman 2009, however, points out that whether a dish is without precedent could be a difficult evaluation, because it is not univocal how long does a new preparation take to fall in the public domain.

49 See Caruso 2013: 332.

50 Broussard 2008: 722.

51 Caruso 2013: 332, states that dishes would represent a particular case of figurative work just as floral compositions or works of gardening.

52 Smith 2014: 7; Fischer et al. 2012.

however, culinary dishes would be considered only for their visual expressiveness and not their gustatory or olfactory expressiveness. Someone else proposed to consider the entire experience of going to a restaurant a “performance” akin to watching a dance show⁵³ and suggested the need for amending the copyright law in order to extend the protection explicitly to original “recipes” or “culinary works”⁵⁴.

ADDRESSING THE CONCERNS OF OPPONENTS TO COPYRIGHT PROTECTION OF CULINARY CREATIONS

Somebody alarmed that the expansion of copyright protection to culinary dishes would harm chefs more than it would help them⁵⁵. Because chefs and restaurants are used to work in an “open-source model”, drawing inspiration from fellow chefs’ ideas⁵⁶, utilizing copyright law to protect cuisine might clamp down on the free exchange of ideas. The removal of an indefinite number of sources to imitate from the culinary public domain and the fear that riffing on another chef’s dish would constitute copyright infringement could potentially chill innovative expression in cooking. Ultimately, the increased cost attributable to inventing new dishes could lead to fewer restaurants opening and higher prices⁵⁷. On the contrary, the extension of copyright protection to recipes by no means should encompass those traditional dishes clearly in the public domain such as lasagne or apple pie⁵⁸. Consequently, protecting food does not really reduce derivative creativity, but

53 Straus 2012: 212.

54 Cf. Pollack 1991: 1523, suggested that copyright should be extended to cover a new category of “edible art”. Later, cf. Broussard 2008: 725; Lawrence 2011: 218-219. For Italian doctrine cf. Caruso 2013: 334: «*it is clear the need for specific regulation of the phenomenon*».

55 Cf. Cunningham 2009: 21; Kaufman 2009; Buccafusco 2007: 1156: «*creating monopolies in dishes would not substantially reward innovators, promote knowledge, or enlarge the public domain, and that doing so might, in fact, have the opposite effect*»; Wells 2006, claiming that extension of such rights would be too difficult to enforce.

56 Cunningham 2009: 24, views cooking as a derivative art; Gemperlein 2006: F1; Wells 2006.

57 Cf. Buccafusco 2007: 1150; Cunningham 2009: 44.

58 Lawrence, 2008: 217.

merely prevent chefs copying other chefs' dishes, forcing them to create new ways of "plating"⁵⁹. Moreover, the public domain would only be enlarged if some chefs who would otherwise keep their recipes secret, would consent to publish them in return for copyright protection⁶⁰.

Existing limitations on copyright seem to be sufficient to maintain the right balance of innovation and idea protection, as normally happens for every work of art to which copyright protection is actually granted⁶¹.

Limitations would allow chefs to transform copyrighted dishes by altering the original work in a significant way to create a new dish. Reproduction of a copyrighted dish would be also allowed, for instance, when it is used to benefit public purposes, such as teaching to culinary arts students⁶².

At the same time, home cooks would not be precluded from preparing dishes they have looked at in restaurants or in a cookbook. Someone observed that the importance of the chef's ability in cooking renders a copyright system not strongly necessary, because the unauthorized imitation might do little to diminish the competitive advantage of being a first mover⁶³.

This assessment, in any case, should not be matter for the legislator, but rather for the author who alone should evaluate whether its copyright infringement should be pursued judicially or not.

THE BENEFIT OF EXTENDING COPYRIGHT PROTECTION TO CULINARY CREATIONS

Without copyrights, culinary creativity remains without any form of legal protection, except for unfair competition.

This lack of protection threatens the same growth of dining as a popular form of entertainment, due to its existential dependence on the originality and innovation embodied in their menu items.

59 Straus 2012: 256-257.

60 Cf. Buccafusco 2007: 1149-51.

61 Broussard 2008: 727. Mout-Bouwman 1988: 234, notes that "*there is nothing new under the sun*": the same debate took place about most other copyrightable works.

62 These exceptions are advocated in U.S. respectively as "transformative fair use" and "necessary fair use", Cf. Carrier 2004: 86, 97.

63 Cf. Cunningham 2009: 29; Carroll 2009: 1414-15.

Under a copyright regime that protects original culinary dishes, instead, chefs could find new incentives to create new menus and could be better equipped to profit from the time and money investments made in creating them, by licensing the right to reproduce written copies of their recipes on food publications. But Chefs would not be the only part concerned: copyright protection for recipes would benefit also easing confusion over whether another's recipe may or may not be freely used and shared.

A CULINARY INDUSTRY'S CODE OF ETHICS

Changing the copyright law so that chefs own and protect their recipes could appear more an aspiration than a viable solution.

A practical and time-effective alternative solution to copyright protection appears to be the adoption of a culinary ethics which provides for an inviolability of culinary IP clause⁶⁴.

Many culinary organizations published codes of ethics instructing member chefs to adhere to the highest level of professionalism by not copying others' creativity⁶⁵. In Italy, however, a professional ethical code still does not exist⁶⁶.

Even if they normally are not legally binding, chefs' adherence to these soft law instruments is quite strong, because it is generally required to maintain its membership and, consequently, its benefits. Thereby, adopting a code of conduct could be a very important

64 Buccafusco 2007: 1153-55 and Cunningham 2009: 21 argue that the "sharing with attribution" costume within the culinary community, renders copyright protection unnecessary. Others have also noted that high-IP regimes can result in reduced production and impeded innovation: cf. Cotropia et al. 2010: 921.

65 The International Association of Culinary Professionals (IACP) Code of Ethics expects its members to «[r]espect the intellectual property rights of others and not knowingly use or appropriate to [one's] own financial or professional advantage any recipe or other intellectual property belonging to another without the proper recognition» (http://www.iacp.com/join/more/iacp_code_of_ethics). Likewise, the U.S. Personal Chef Association instructs its members «[t]o respect the intellectual property of [one's] peers by not copying, reproducing or in any other way utilizing their written or published materials as [one's] own, even when this work has not been explicitly protected by copyright, patent, etc.». The homologous Italian Professional Personal Chef Federation (FIPPC) code of ethics does not provide for any similar provision (cf. <http://www.fippc.com/codice-deontologico/>).

66 To fill this gap, it is going to be published Coviello, C. *Food Law. Il diritto del cuoco, la tutela giuridica delle ricette*, containing a proposal of code of culinary ethics, cf. www.foodlaw.in.

step forward better protecting the fruits of chef's labour. However, while this convention may be sufficient to prohibit recipe theft among chefs, its efficacy does not extend to those who are not bound by these self-regulating norms and may do nothing to prevent recipe misappropriation on the Internet⁶⁷.

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⁶⁷ Lawrence 2011: 210; Straus 2010: 187, 200, according to which such norms "would seem to work best within small communities where social and professional sanctions have bite".

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Technological innovation at the dining table. Analysis on the attitude of public opinion about food science and technology of the future

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INTRODUCTION

In the wake of a series of important technoscientific innovations – from the recurring debate on GMOs to vegetable milk and the so-called synthetic hamburger – Italy has housed, for years, a debate about how the public opinion perceives food technologies¹.

A recent survey by the Eurobarometer highlighted a lack of confidence Italians have in positive impacts that science and technology might have, in future years, on food industry (Chart 1)². For years, scientists and opinion makers have reported the widespread

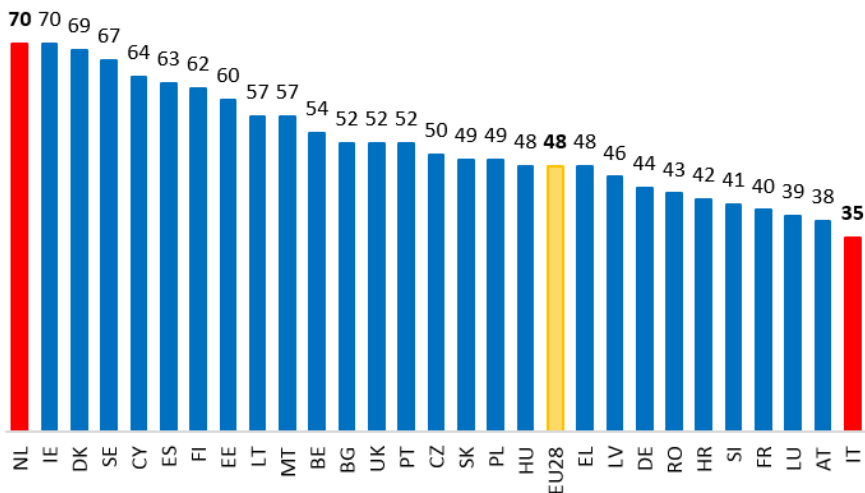
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1 Without any claim of being complete, among *food technologies* we can number: GMOs, food irradiation, nanotechnologies, animal cloning, functional food and synthetic biology. A definition of novel food, and the deriving European legislation, can be found on the following web page http://ec.europa.eu/food/safety/novel_food/index_en.htm.

2 European Commission, *Special Eurobarometer 419. Public perception of science, research and innovation*, Luxembourg, Office for Publications of the European Commission, October 2014.

misinformation on the field and ascribe public opinion's orientation now to media now to people's scarce awareness. Unlike citizens of other countries, Italian citizens are substantially skeptical when it comes to technoscience being on our tables. The aim of this paper is, at least in part, to analyze more in depth what Italians think about an issue as topical as science on our table. Besides giving some indications on the current state of this perception - through information and data provided by the most renowned and trustworthy national and international sources - this article allows to draw a comparison between two European realities, Italy and the Netherlands, that seem to represent conflicting positions.

CHART 1 - Feeling of a positive impact of science and technology on food sector in the next 15 years (%values).



Source: European Commission, *Special Eurobarometer 419. Public perception of science, research and innovation*, October 2014.

SCIENCE ON THE TABLE

A pure white plate with bread, lettuce, sliced tomatoes and 150g of a juicy hamburger. The night mood, on 12th August 2013, with tasters

and chefs rallied in west London, is very different from the relaxed, bucolic mood of a friends' barbecue. The location is a TV set connected, live and *via* the web, to millions of people. Because what Josh Schonwald, an American kitchen expert, and Hanni Rützler, Austrian researcher, are about to taste is the first burger from beef stem cells. Sitting next to them is the Dutch scientist Mark Post, its creator, waiting in trepidation. During the show, Post explains how they created a completely lab-grown food. Then, the awaited verdict comes: "*It's close to meat. It's not that juicy. The consistency is perfect ... (but) ... I miss salt and pepper!*" is Hanni Rützler's comment, to everybody's great satisfaction.

After the show, the reactions. "Frankenburger" is just one of the names by which the new food has been defined by media. A clear reference to the creature of the well-known novel by Mary Shelley, a character that has greatly influenced the collective imagination of general public about science³. The study that brought to the creation of "*in-vitro* meat" required a substantial economic investment. Sergey Brin, co-founder of Google, is one of the project's funders with his 250 thousand euro investment. The burger, resulting from the work of a Maastricht University team, has therefore been rebaptized "BigMac high-tech", "synthetic burger" and "Googleburger" by the press.

The recount of the presentation of the first burger entirely created in a lab gives us all the elements and heroes determining the relationship between food, science, technology and society: scientists, media, entrepreneurs, research institutes, governments and citizens.

In the debate about the acceptability of new food, we assist to the emergence of different frames encompassing economic, political and social aspects. Science and technology receive more and more media coverage and they look for their legitimation by extending their knowledge in daily life activities, like in the kitchen⁴. Still,

³ See Turney, 2000.

⁴ The last years registered an exponential growth of this trend which started in the last decades of XIX century with the appearance of the first texts about "scientific gastronomy". In 1825, in France, Brillat-Savarin published *Physiologie du Goût* (*The Physiology of taste*), a book that deeply marked the relationship between natural sciences and culinary art. In Italy, the success of Pellegrino Artusi's *La scienza in cucina e l'arte di mangiar bene* (*Science in the Kitchen and the Art of Eating Well*) is to be noticed as well. Today, the numerous publications (McGee, 1984; Bressanini, 2014) go hand in hand with the increasing number of chefs having a scientific education. Hervé This, the reputed father of molecular cuisine, is a clear example of

despite the proliferation of media dealing with “science in the kitchen”, Italian public opinion is particularly cautious. The recent Eurobarometer survey revealed that only 35% of Italians define themselves as “optimistic” about the possible positive impact that science and technology might have on food in the next 15 years.⁵ To confirm the weak link between technoscience and its application in the food industry – registered at the national level –, the comparative analysis of Italy, on the one hand, and Europe, and notably the Netherlands, on the other. In the Netherlands two people out of three are in favor of it. Researching the reasons that push to take such different positions forces us to look at the strategies of public understanding and at the attitudes when it comes to science and technology. An ever-growing theme on which national and European institutions are engaged through projects monitoring food transformation in the European context.⁶

Research on public awareness of science started in the 50’s. But it was in the 80’s that the focus moved mostly towards the degree of the public’s “scientific literacy”, the public understanding of science. In 1985, the Royal Society, the main scientific institution of Great Britain, commissioned a report entitled *The Public Understanding of Science*, which drew the conclusion that the main issue in the science-society relationship was the low level of scientific literacy of citizens.

The so-called deficit model of public understanding of science has emphasized the public’s inability to understand and appreciate the achievements of science – owing to prejudiced public hostility as well as misrepresentation by the mass media – and adopted a linear, pedagogical and paternalistic view of communication to argue that the quantity and quality of the public communication of science should be improved. To recover this deficit, public and private bodies – especially since the mid-1980s – have launched schemes aimed at promoting public interest in and around the science.

Their ignorance and their hostility to technoscientific applications

the scientific turn taken by culinary art. Chemist, This is a researcher at the *Istitut National de la Recherche Agronomique* (INRA) and cooperates with the *Académie des Sciences*. For a sociological dissertation, see Bucchi, 2013.

5 Eurobarometer 2014, quote.

6 See the HighTech Europe (<http://www.hightecheuropa.eu>) project which aims at supporting scientific and industrial knowledge in food transformation. In alternative, see the project Truefood (<http://www.truefood.eu>).

were the assumptions leading the PUS approach⁷. The assumptions highlighted two considerations:

- the scientific community influences the public's understanding of science, namely, the ability to understand science "correctly" depends on the level of education and the ability to understand science coincides with the ability to understand science as it is communicated by the experts.
- greater knowledge corresponds to a greater adhesion to scientific research and to technological innovations. Basically, if people were better informed, the number of conflicts would be smaller.

Several studies addressed substantial critiques to this approach, highlighting the fact that the variables of stakes are not strictly linked to the scientific literacy level only. A recent study about climate change - carried out in the USA - highlighted that the perception of the seriousness of global warming is influenced by one's political leaning (Chart 2).⁸

Research on public perception of biotechnologies, for example, has shown that the layers of population that are the most exposed and informed are highly skeptical and distrustful.⁹ Data show that scientific information, in Italy and -on average- in Europe, is pretty scarce.¹⁰ Food technologies, nevertheless, are scarcely known among non-expert audiences.¹¹

The most well-known technology is animal cloning, but in this case knowledge is not extended to the most scientific or technical aspects of the process.

The information deficit is not, therefore, to be considered the opposition of some sectors of public opinion, in particular, technical innovations and scientific. Understanding this attitude requires a social context that is more systematic and detailed than the dif-

7 For an in-depth analysis of science communication models, see Bucchi 2000, 2002 and Scamuzzi and Tiplado, 2015.

8 On the rapport between the assumed lack of knowledge and hostile attitudes towards technoscientific products, in a critique to the "deficit model", see Bucchi and Neresini, 2002, 2004, 2006; Hansen *et al.*, 2003.

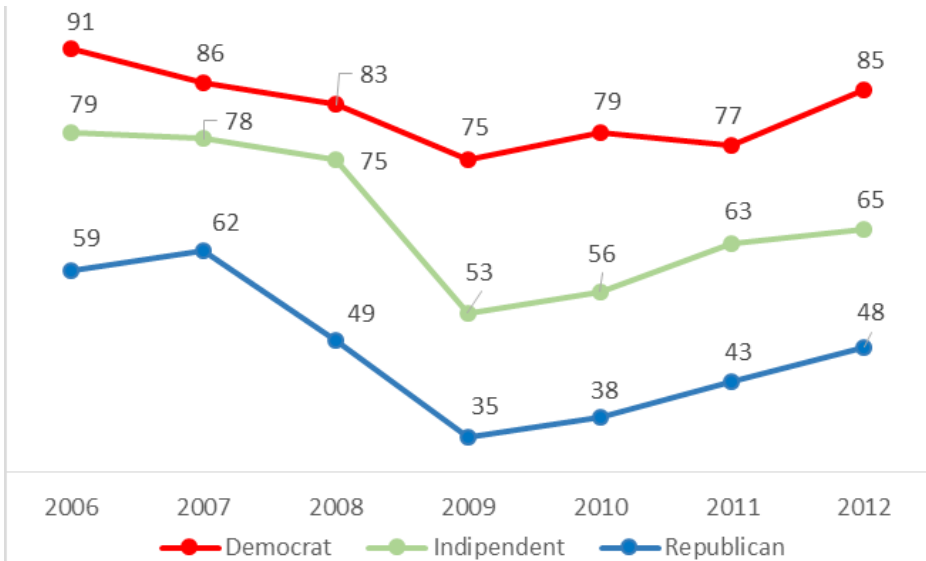
9 Gaskell & Bauer 2002; Bucchi e Neresini, 2002.

10 European Commission (2005) *Special Eurobarometer, 225. Social Value, Science and Technology*, Office for Official Publications of the European Commission, Luxembourg, June.

11 Lyndhurst, 2009.

ferent points of view of experts and lay people that can not be reduced to a mere information gap but intertwined other elements (ie, value judgments, confidence in scientific institutions, perception risk value associated with the use of some knowledge scientific practice) differently from the provisions of the deficit model.

CHART 2 - USA citizens considering global warming proofs evident by political affiliation (% values).



Source: Pew Research Center, *More Say There Is Solid Evidence of Global Warming*, October 2012.

RISK IS SERVED

The entrance of science and technology in daily gastronomic practice might not limit itself to what ends up in our plates only, but there might be a revolution behind the stove. What if, in the future, instead of a starred chef, a computer were to create recipes? We are not talking about a science-fiction future; IBM programmed Watson, an artificial intelligence system, which is the author of 65 new recipes.¹² Having in its memory all the taste combinations that we

¹² Recipes produced by Watson are in Baker & Hamm, 2015.

-as human beings- love, the system generates an infinite number of random ingredients combinations - excluding those not respecting taste requisites. But it is not today's reality that worries citizens, rather possible future scenarios. "Pressed food and lab-grown meat"¹³ is one of the titles on national press trying to investigate future trends in cooking. And this is not all. Food technologies are a source of worries for Italian and European consumers. Among the ten first risks linked to food that worry Italian citizens, seven are ascribable to technoscientific factors. Among European citizens the attitude is not more positive though. At a European level, 8 out of the ten first worries concern aspects linked to scientific innovation and technology in food (Table 1).

TABLE 1 - Risks associated with food that are a source of concern for European citizens. Comparison EU27, Italy and the Netherlands (values%).

		UE 27	ITALY	NEDERLANDS
1	Pesticide residues in fruit, vegetables or cereals	72	85	53
2	Pollutants like mercury in fish and dioxins in pork	69	83	57
3	The quality and freshness of food	68	82	37
4	Additives like colours, preservatives or flavourings used in food or drinks	66	81	56
5	Genetically modified organisms found in food or drinks	66	80	50
6	The welfare of farmer animals	65	75	59

Source: European Commission, *Special Eurobarometer 354. Food Related Risks*, Luxembourg, Office for Publications of the European Commission, november 2010.

Citizens are mainly concerned by the presence of residues or pollutants (pesticides, mercury, dioxins). The concern for GMOs is still very high in Italy (80%). In the European context GMOs are still perceived with skepticism on average (66%), while in the Netherlands this is a concern for one out of two citizens. The addition of substances like additives, colorings or preservatives worries almost 7 European citizens out of 10; 8 out of 10 fear to find these substances in food in Italy, while this value is much smaller in the Netherlands (56%) where it still concerns more than half of the population.

Functional food is the technology that generates the most positive reactions. Research conducted attributes this attitude to the fact

13 *Cibo stampato e carne coltivata in laboratorio*, *la Repubblica*, 30th July 2015, http://www.repubblica.it/ambiente/2015/07/30/news/cibo_futuro_2050-119537289/.

that consumers perceive great benefits and a low risk.¹⁴

Food irradiation and genetically modified food, instead, are considered dangerous. GMOs and animal cloning generate the greatest concerns, followed by synthetic biology and nanotechnologies.¹⁵ Citizens' worries mainly concern moral and ethical aspects. Notably, the opposition of what is perceived as "natural/traditional" and what is perceived as "artificial/industrial" often comes to light. In public debate, in newspapers or educational literature, a contrast has come to existence: it is the opposition between "traditional/organic" food on the one hand, and "industrial/chemical" food on the other.¹⁶

The *dioxins crisis* in Belgium, mercury in fish, botulin and aflatoxins in milk have considerably raised the issue of food safety within the public debate. According to major studies, the risks stem from the representation and the symbolic portrayal of the future.¹⁷ Even after the dreadful tragedy of Chernobyl, techno-scientific risks have been taken into account from social studies, thus being at the center of important speculations on their extent and the role played within a modern techno-capitalist society.¹⁸

Therefore public perception of risk plays a pivotal role in public communication on food technologies and their acceptance or rejection. In the last years, Italy's main studies have predominantly focused on public perception of risks linked to nutrition.¹⁹ The study carried out in 2010 from Eurobarometer on a European level raises further interesting observations: 65% of Italian people maintain that food consumed on a daily basis can be a potential source of harm to human health. It actually represents a bigger source of concern, if compared to the European average (48%). Only one Dutch citizen out of three believes that food can be a source of threat to health (Chart 3).

However, not all technologies are perceived with the very same degree of concern. For example, only little fear is generated from high-pressure treatment²⁰, whereas other technologies, - such as

14 Ronteltap *et al.*, 2007.

15 A study investigating public feeling about new food technologies conducted by Siegrist, 2008. For irradiated food, see Henson, 1995. For the acceptance of nanotechnologies in food, see Siegrist *et al.*, 2007.

16 Vanhonacker *et al.* 2013; Bressanini and Mautino, 2015.

17 Douglas and Wildavsky, 1982.

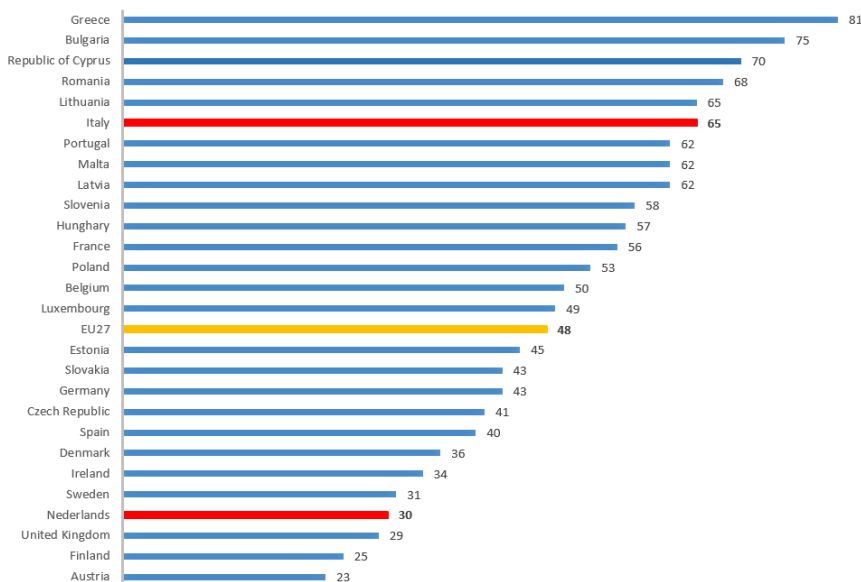
18 Beck, 2000; Giddens, 1994.

19 Arzenton *et al.*, 2005; Pellegrini and Saracino, 2015; Mascarello *et al.*, 2015.

20 Cfr. Butz *et al.*, 2003.

genetics - are little accepted all across Europe.²¹ Numerous studies have already highlighted the relevant role played by the social context: cultural and social norms influence both food tastes and preferences and also the acceptability of innovations.²²

CHART 3 - % of European citizens who maintain that the food they eat can cause harm to their health



Source: European Commission, *Special Eurobarometer 354. Food Related Risks*, Luxembourg, Office for Publications of the European Commission, November 2010.

However, so far, few studies have delved into the features of a social context that influences the acceptance of new techno-scientific practices in the agro-food industry.²³ Nevertheless, some studies have highlighted the role of trust in various public sectors (industrial, political, economic) as an influential factor in the process of acceptability of new food products. The considerations on trust and risk have described how the first could reduce or minimize dangers.²⁴ Thus, an increased level of trust with the social or

21 Cfr. Gaskell *et al.*, 2000.

22 Cfr. Rontentalp, Van Trijp and Renes, 2007.

23 Cfr. Rontentalp, Van Trijp and Renes *et al.*, 2007.

24 Make reference to the remarks in Giddens, 1994.

political turns out to be a drive for innovation. But the presumed hostility of the public towards the innovations of techno-science, beyond being associated with the lack of trust in the institutions, are often matched with a presumed hostility of citizens towards the work of scientists and science.

Italian people expect first and foremost environmental associations (77%) to adopt an ethical behaviour towards society, followed by scientists (72%) and then consumers' associations (71%). Also in the Netherlands - although with a higher level of trust if compared to the Italian context - scientists (87%) rank second, preceded by consumers' associations (90%) and followed by environmental associations (81%).²⁵ On average, voluntary associations or category associations collect more trust if compared to governmental, political and industrial bodies.

However, 71% of Italian people believe that science and technology have positive impact on society. A positive attitude can also be found in the Netherlands (88%).

Data confirm that the whole issue is not about a scientific and an anti-scientific culture.²⁶ It is not an opposition against innovation and technology, but a deliberate choice: Italian people (64%), along with the European average (61%), state to be against the further development of GMOs. The same portion is against animal cloning, that is to say a lower percentage if compared to the European average (70%). In the Netherlands 63% of citizens maintain being against the support of this technology; on the other hand there is a high percentage (79%) of those who are against animal cloning for food purposes. Only 29% of Italian people are against nanotechnologies; in the Netherlands this percentage equals 35%. The European average reaches 25%.²⁷

Sixty-three percent of Italian people believe that animal cloning for food purposes is "unnatural". 84% of Dutch people share this opinion.²⁸

Clearly citizens do not have negative prejudices towards science. Citizens have not lost their trust in science, however they have adopted a disillusioned attitude towards "scientific research and above all towards its relationships with the political power and economic

25 Ibidem.

26 *Scienisti e antiscentisti* [*Scientists and antiscentists*] is the title of an essay by Massimiano Bucchi (2010) the portray of citizens who are against specific technological innovations, often as a symbol of a society against, is dismantled.

27 European Commission, *Special Eurobarometer 341. Biotechnology*, Luxembourg, Office for Publications of the European Commission, October 2010.

28 Ibidem.

interests".²⁹ Moreover, across Europe people want to have an impact over those decisions that involve a specialistic knowledge.

MEDIA: FRIENDS OR ENEMIES?

The TV live presentation of a burger made with 20.000 muscle fibres synthesized from stem cells by the University of Maastricht, is an impetus for reflection on how citizens are informed and get information on the progress of science. Professor Post opts for television to present his techno-scientific artifact. This represents a winning choice as far as communication is concerned. That night millions of people were watching TV.

In Europe television is the most used tool to get information on science and technology (65%). In the UK, where the presentation was screened, 66% of citizens use television as a source of information, whereas in Italy television is used by 56% of citizens, followed by newspapers (24%), magazines (20%), websites (19%), books (13%), social media (10%) and radio (8%). Also in the Netherlands, television is the main source of information.³⁰

Ranking second among the media for European citizens, we find newspaper; ranking third websites, and then magazine, radio, books, social networks and blogs. The most quoted TV programmes are *SuperQuark*, *Tg Leonardo*, *Voyager* e *Geo&Geo*. Among magazines, among the most -read dissemination scientific magazines, we find *Focus*.³¹

European people maintain being informed on environmental issues (78%), new medical discoveries (65%) and techno-scientific discoveries (61%). If we consider the interest of European citizens and their level of information, 79% believe being "rather" or "well interested" in new scientific discoveries and scientific developments. On the contrary, just 61% believe being "rather" or "well interested". As to new medical discoveries, 82% of citizens say being interested and only 65% say also being informed.³²

The stereotype according to which citizens are not informed or not

29 Bucchi and Neresini, 2006, p.41.

30 European Commission, *Special Eurobarometer 341. Biotechnology*, Luxembourg, Office for Publications of the European Commission, October 2010.

31 Bucchi and Saracino, 2014.

32 European Commission, *Special Eurobarometer 340. Science and Technology*, Luxembourg, Office for Publications of the European Commission, June 2010.

interested into science has to be challenged. Data corroborate the idea that 50% of Italian citizens say being “interested” into the developments of science and technology. 27% of Italian citizens say being “interested and informed” on the developments of science and technology. Whereas, 23% believe being “interested though not informed”.

Interestingly, there is a tiny share of citizens, who, despite not being interested, get information on these issues (2%). In the Netherlands, the interest of Dutch citizens for the developments of science and technology is higher than in Italy (68%). 45% of Dutch citizens declare being “interested and informed”, whereas other indicators are similar to the Italian ones. Italian people declare getting information on GMO food (85%), on animal cloning for food production purposes (63%) and on nanotechnologies (37%).³³

On a European level, male citizens are - on a general basis - more interested into techno-scientific issues (45%); their age is on average equal to 55, they have a high level of education (52%), they use internet on a daily basis (48%) and detain a positive attitude towards the influence of science in society (42%).

We have already stated that a high rate of exposure to media and a high level of information is not sufficient to trigger positive attitude towards techno-scientific applications.

TABLE 2 - The most accurate sources to get information on food risks, accor-

	UE 27	ITALY	NEDERLANDS
Family and friends	82	80	67
Their physician/doctor and other health professionals	84	75	91
Consumer organisations	76	71	87
Environmental protection groups	71	68	66
Scientists	73	66	79
National and European Food Safety Agencies (EFSA)	64	61	77
European institutions	57	58	63
Farmers	58	54	49
Internet	41	44	49
Retailers	36	44	37
National governments	47	43	69
Media (Tv, newspaper, radio)	48	41	48
Food manufacturers	34	38	30

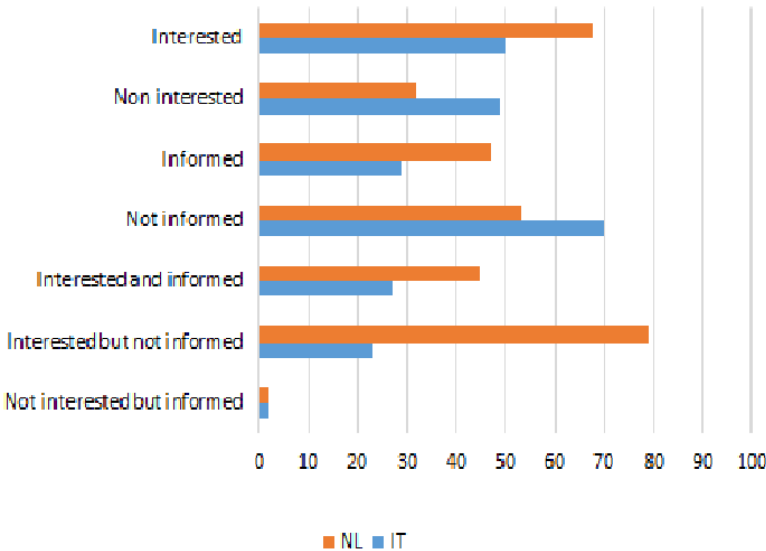
Source: European Commission, *Special Eurobarometer 354. Food Related Risks*, Luxembourg, Office for Publications of the European Commission, November 2010.

³³ European Commission, *Special Eurobarometer 341. Biotechnology*, Luxembourg, Office for Publications of the European Commission, October 2010.

Issues related to techno-science, in the age of post-academic science, are no longer relevant for the media debate; this however occurs just after an internal decision within the scientific community. On the contrary, these issues tend to penetrate the media when they are still in a stage of uncertainty and controversy. It shall be reminded that the media are also the context where an alliance is ratified: “lab-produced” meat has been supported by environmental associations willing to support the campaign against the transportation and the slaughtering of animals.³⁴

Internal debates within the scientific community, *policy* decisions and public debates always occur under the spotlights of the media for two opposing reasons: on the one hand, scientists themselves and research centers look for media exposure; on the other hand, there is higher request for transparency on the issues of research and innovation.

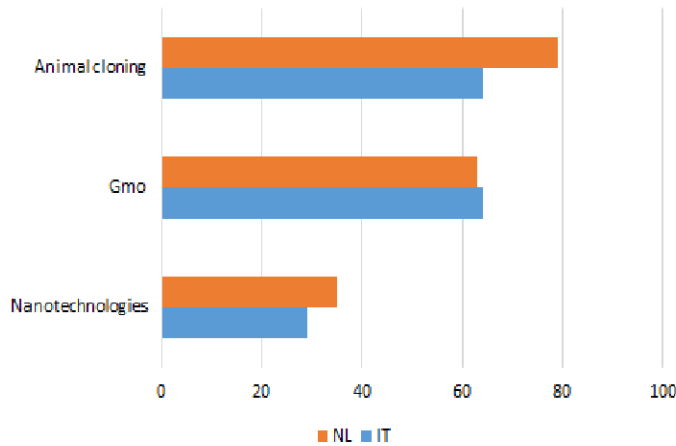
CHART 4 - % of Italian and Dutch citizens interest and informed about science and technology.



Source: European Commission, *Special Eurobarometer 354. Food Related Risks*, Luxembourg, Office for Publications of the European Commission, November 2010.

34 An example is the one received by the association PETA (*People for the Ethical Treatment of Animals*) that from its UK website (<http://www.peta.org.uk/blog/in-vitro-meat-the-future-of-food/>) has immediately welcomed with great enthusiasm the proposal of the Dutch scientist thus having its values and its *mission* respected.

CHART 5 – % of Italian and Dutch citizens opposed to certain food technology.



Source: European Commission, *Special Eurobarometer 354. Food Related Risks*, Luxembourg, Office for Publications of the European Commission, November 2010.

FURTHER FINAL CONSIDERATIONS

Scientific *expertise*, *decision-making*, political representatives and citizens are the stakeholders involved in the elaboration of the future. In the light of the political and social changes that have intervened, it is unthinkable to continue adopting a technocratic mode and invest in a *top-down* communication pattern. Citizens are willing to have their say on issues relevant for “experts” and the “citizens engagement” has become a key issue in many countries, not only on a European level.³⁵

³⁵ According to the 2013 Eurobarometer research, 55% of European citizens believe that they shall be asked if major decision on scientific and technological issues should be taken. The first country to officially introduce a social participation into the techno-scientific decisions has been Denmark with the introduction of the *Danish Board of Technology* (<http://www.tekno.dk>), linked to the Ministry of Science, Innovation and Education. In France the participation of citizens to the infrastructure works with an impact in the socio-environmental context commenced in 1995 under the name of *Débat Public* (<http://www.debatpublic.fr>). For Switzerland, please make reference to *PTA Suisse* (www.ta-swiss.ch). In Italy, a virtuous example of citizens' participation have occurred at local level, as the law of Tuscany Region n. 46/2013, *Public debate and promote regional of participation in the formulation of regional and local policies*. Make reference to the publication Pellegrini, 2005; Tipaldo, 2013.

The trend to interpret orientations of public opinion according to a scientific perspective, or linking this opinion to a mere problem of misinformation, does not consider the numerous study on social perceptions that have outlined how citizens' opinion and attitude are the result of a complicated cultural process that take into account economic, political, religious factors and above all a "broader idea of the world". All social stakeholders are called upon to contribute to the attempt of commencing a process of democratization of the decisions of research and technological applications in such a relevant field for citizens' health as nutrition. Hence, it is required to overcome the plain declarations of understanding which are formulated on various fronts (*policy makers*, communicators and part of the very same scientific community), in order to start concrete information actions, engagement processes and the involvement of citizens and of the numerous stakeholders in order to support and guide political decisions.

The innovative food technologies reveal, especially in the media public debate, some frequent *frames*, such as the issue of future, economic, ethical, juridical and scientific perspectives.³⁶ The interpretation *frame* through which such innovations are perceived and communicated play a pivotal role in the public arenas. Therefore, all stakeholders shall be involved in the process of rethinking new modes of organizing the renewal of innovation.

Each country shall implement strategies and engagement patterns that take into account the so-called the "civic epistemologies", that means how in each society has "shared visions that make a scientific statement credible, visions that change according to the specific cultural aspect of a society and a nation".³⁷

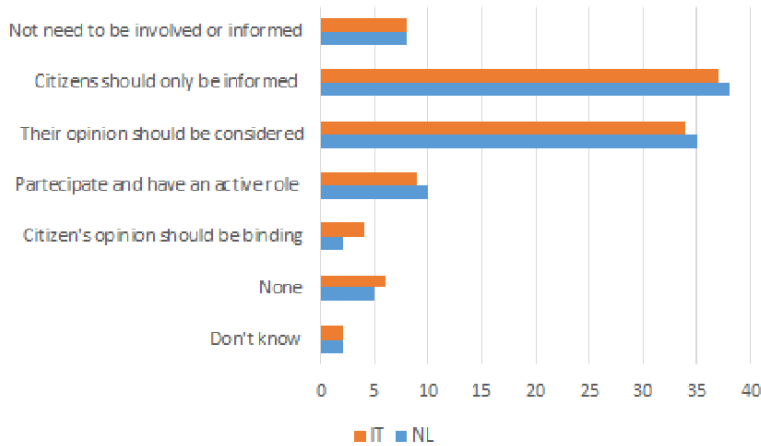
Accurate and widespread information are desirable. However, in order to overcome the *impasse* on contentious questions, institutions and forms of representations of citizens that can outstandingly tackle the challenges that science and society are nowadays raising. As a matter of fact, today the knowledge society cannot longer avoid the democratic challenge. Nor it will be able to avoid it in the future. It is about a future in which citizens will be willing

36 A theoretical reflection on the *frame analysis* shall be found in Goffman, 2001. Durant, Bauer and Gaskell (1999) who say that the *frames* shall be interpreted as "the essence of the problem" in a controversy Gamson and Modigliani (1989) maintain that the *frames* are "*interpretative packages*" which are used to provide a significance to an issue.

37 Jasanoff, 2005.

to voice out their opinion, in order to define, as experts or mere profane people, the food of the future.³⁸

CHART 6 - The involvement of citizens on issue of science and technology for Italian and Dutch.



Source: European Commission, *Special Eurobarometer 401. Responsible Research Innovation (RRI), Science and Technology*, Luxembourg, Office for Publications of the European Commission, November 2013.

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³⁸ Cfr. Bucchi, 2006.

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Not just food: the (new) importance of urban gardens in the modern socio-economic system.

A brief analysis.

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INTRODUCTION

The diffusion of urban gardens is not a recent phenomenon, but today it assumes a “new-found” importance.

The first examples of urban gardens are represented by the gardens of Nabucodonosor II of ancient Mesopotamia; in recent years, at the beginning of 1900, they were widely practiced in Dutch polder, the “stolen land” to the water in the Netherlands. However, their period of greatest diffusion was during and after the Second World War when many local governments incentivized these small forms of direct cultivation to meet the food demand of local people. Thanks to the modernization of agricultural practices that made access to food possible for the majority of the population, they passed into disuse in the '60s.

Today, on the contrary, we are seeing resurgence in the popularity of urban gardens.

Pressure on natural resources has become unsustainable and soil consumption, air and water pollution have reached impressive

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levels¹. The relentless urbanization of recent years has exacerbated natural resources consumption and has reduced agricultural areas near to the cities. Faced with this situation, policy makers are more careful to implement more “green” policies² and local communities are more interested in more sustainable lifestyles and consumer choices³. Part of the population is engaged in the recycling of certain materials or environmental education projects and is interested in agricultural practices, especially if practiced in small urban spaces and collectively. At the same time, the risk of social exclusion of the disadvantaged population is high and local governments are looking for cost-effective initiatives that provide employment opportunities for disabled or unemployed people, entertainment for elderly or children’s education.

In this complex socio-economic system, urban gardens are considered an opportunity for improving food supply, health conditions, local economy, social integration, and environmental sustainability. This article would like to investigate the reason of this rediscovered interest in this type of urban horticulture.

In particular, in the first paragraph, it details the social, environmental and economic reasons pointed out by several studies in developed countries. Subsequently, it describes the diffusion of urban gardens in Lombardy and its reasons.

Finally, it contains the results of a questionnaire administered to the regional population and administrations to understand the importance attributed to local initiatives of urban horticulture.

SOME CHARACTERISTICS OF URBAN GARDENS

Urban gardens are sharing social and urban regeneration experiences spread mainly in the rapid urbanization municipalities. They may include all fruit and vegetable food crops (including roots, tubers, tree nuts, aromatic plants, and mushrooms) or medicinal and ornamental species. Therefore, the adopted crop production systems are strongly related to the local culture and traditions, but, in general, within cities it is preferred to grow short cycle and highly perishable crops.

Housing type and population density influences the proportion

1 EEA 2014a

2 EEA 2014b

3 Cattivelli 2012

of green space available: their extension is usually between a few square meters up to 50-70 square meters.

Relative lands are mostly owned by the municipality; private citizens rarely make their own plots available free of charge to other people. Thanks to a public procurement procedure, local administrations rely on land to cultivate momentarily. The “aspiring farmers” must have some requirements set by municipal regulation. Usually, they are residents in the municipality for some years, elderly and people with no income. In a few cases, they are favored families. In other (rare) cases, lands are transformed spontaneously by citizens without permission.

SOCIAL FACTORS THAT AFFECT THE DIFFUSION OF URBAN GARDENS

Urban gardening promotes local social cohesion⁴ by fostering socialization among individuals with different educational and social extraction⁵, or belonging to different generations⁶.

In a more relaxed context compared to other traditional meeting places such as streets or shopping centers, in an urban garden, individuals can communicate more easily, are more likely to know each other and to exchange ideas and experiences - and not just about agricultural techniques. Thanks to the cultivation of typical products of their land of origin that are sometimes difficult to find in the most popular channels of food distribution, foreigners can “accelerate” their integration into local society, learn the habits and traditions of the place in which they have moved and know it better. Similarly, they can help local people to break down mistrust towards them or little knowledge of their countries of origin by suggesting recipes and production techniques. Families can strengthen their ties by spending more time together: after a day of work or school, parents can teach their children to cultivate or harvest fruits and vegetables, grandparents can educate their grandchildren to the practices of urban agriculture, but also the principles for a healthier diet and respect for the environment⁷.

This strengthening of neighborhood and family ties helps to con-

4 Wang & MacMillan 2013

5 Gurski 2004

6 Moller 2005

7 Tilston & Wade 2006

solidate the existing system of values and traditions, to strengthen the sense of community and to cement the social capital that is the basis of any form of participation (policy, volunteer, etc)⁸. Moreover, it helps to produce a new repertoire of rituals and practices that do not destabilize the dominant agricultural and social culture, but enrich it and make it more complete. By exchanging information and learning new concepts, in fact, people create new social schemes characterized by a rich variety of lifestyles, ethnicities and age groups; at the same time, they do not forget to hand down popular anecdotes and suggest local beliefs by contributing to the preservation and transmission of peasant civilization values and traditions that would otherwise be forgotten⁹.

Urban gardening could contribute to build and enforce this more heterogeneous social structure by offering a job opportunity to people with health problems or financial difficulties¹⁰. Sick or disabled people may find a suitable employment in this cultivation or an occasion to alleviate their suffering; unemployed people could exchange the time devoted to the cultivation with discounts on local taxes or other social benefits; the elderly, more active and long-lived, could find an activity to spend their free time and therefore reduce the noise associated with reduced physical condition.

Similarly, this activity has positive effects on the community's health¹¹. This is because the connections between man and nature increase individual welfare, improve life quality and human health¹², hand and body strength and flexibility¹³, increase physical functioning¹⁴ and decrease bodily pain¹⁵. At the same time, they provide mental and physical stimulation¹⁶, develop creativity, expression abilities, sensory stimuli¹⁷ and hand-eye coordination¹⁸ to

8 Gigliotti & Jarrot 2005, Bendt et al. 2013

9 Clement 2010

10 Van Veenhuizen & Danso 2007

11 Evers 2011

12 Sommerfield & Zajick 2010

13 Park & Shoemaker 2009

14 D'Andrea et al. 2007

15 Park et al. 2009

16 Infantino 2004

17 Curtin & Fox 2014

18 Cameron 2014

reduce stress associated with work, commuting, and family¹⁹.

The sharing of values and the increased socialization among individuals that derives also reduces social isolation and prevent forms of nervous associated disease²⁰.

Urban gardening helps people make healthier food choices: urban gardeners consume more vegetables than non-urban farmers?²¹. Additionally, pupils involved in horticulture projects are shown to be more interested in healthy eating and increasing their consumption of fruits and vegetables^{22 23}.

URBAN GARDENS AND THEIR ENVIRONMENTAL SIGNIFICANCE

Urban gardens may contribute to lower human pressure on natural resources by reducing the pollution²⁴ and mitigating the environmental alterations already present²⁵. At the same time, they support more resilient cities against frequent shocks²⁶ by reducing urban waste, improving biodiversity and air quality, and overall reducing the environmental impact related to both food transport and storage²⁷. Their realization in vacant, degraded or at risk of further urbanization spaces increases the possibility of environmental regeneration. However, the comparison between these environmental benefits and the costs of their implementation and cultivation remains largely uncertain.

In terms of CO₂ production, urban gardens have a negligible impact, albeit inferior to other forms of cultivation. To expound on this, forms of cultivation that mimic low maintenance forests or meadow landscapes and that are conducted in accordance with permaculture practices (heterogeneous vegetation, use of recycled water, reduced soil consumption, etc ..) are likely to have less of an environ-

19 Kim et al. 2004

20 Austin et al. 2006

21 Sommerfield et al. 2010

22 Parmer et al. 2009, Collins & Dunne 2009

23 Ruiz-Gallardo et al. 2013

24 Barthel et al. 2010

25 Lillywhite 2014

26 Zeeuw et al. 2011

27 Orsini et al. 2013

mental impact²⁸. With reference to the use of chemicals for their cultivation, despite being increased almost everywhere²⁹ resulting in a significant worsening of pollution³⁰, the promoters of urban farming projects encourage lower chemical use and organic approaches³¹. At the same time, because their implementation requires a huge use of water, urban farmers pay great attention to the efficient techniques and the increasingly restricted use of potable water³².

The daily comparison of less polluting cultivation techniques with other urban farmers undoubtedly contributes to the spread of these more environmental friendly practices³³.

Despite the importance of such practices, urban gardens are not free of any contamination, because they are grown in highly urbanized and polluted areas, and thus lead to serious health risks. Contamination by pathogens may result from irrigation with polluted water, inappropriate use of organic fertilizer, poor hygienic practices during post harvest and handling activities. In addition, it can be a consequence of inappropriate use of pesticides or high occurrence of insects/disease vectors attracted by agricultural production (for example, mosquitoes).

Studies about this theme are not so numerous, but, for this reason, this problem should not be overlooked.

The first results point out that these risks are not remote. In particular, heavy metal risk in horticultural crops grown in urban gardens is high, especially near railways and traffic roads³⁴.

ECONOMIC FACTORS THAT AFFECT THE DIFFUSION OF URBAN GARDENS

Urban gardening contributes to a new (and shorter) local food chain^{35 36}. Its agricultural items have partly substituted rural pro-

28 Favoino & Hogg 2008

29 Grey et al. 2006

30 Lillywhite & Rahn 2008

31 Cameron et al. 2012

32 De Pascale et al. 2013

33 Zezza & Tasciotti 2010

34 Orsini et al. 2015

35 Cattivelli 2014

36 Allen & Frediani 2013

duction of rapidly perishable products in the local market: the localization of the gardens near the markets in fact reduces the need of conditioning and storage infrastructures, post-harvest losses and production prices³⁷. However, their agricultural production is not sufficient to meet the fruit and vegetable needs of urban gardeners³⁸. Local productivity is low due to the small size of land, inefficient production techniques, low use of fertilizers. The surplus production is rare: to avoid an unsustainable waste, urban gardeners offer agricultural products to family and friends sell them in small local markets or activate more formalized distribution circuits on voluntary basis. As a consequence, this type of agriculture becomes an ideal complement to the rural production, crucial for the city food system, but it does not replace it completely. At the same time, it reduces the family budget for food purchases, but it is not the only source of income for gardeners³⁹.

By offering a large number of quoted social benefits, urban gardening helps local governments to reduce their social spending. However, due to the high purchase and maintenance costs of these green areas, these institutions cannot afford any promotion projects and prefer to sell them to private entities that convert them to other uses to get high profits⁴⁰. Incentives for urban garden transformations in residential and industrial sites are very profitable due to the high cost of urban land⁴¹.

OUR CASE STUDY: LOMBARDY REGION

Lombardy is one of the regions with the highest number of urban gardens in Italy⁴².

In its provincial capitals, there are about 2.800 urban gardens and their number has increased by 40%⁴³ when compared to 2012 numbers.

37 Drescher 2004

38 Cattivelli 2012

39 Cattivelli 2015

40 Bhatta & Doppler 2010

41 Groening & Hennecke 2014

42 ISPRA 2015

43 Coldiretti 2014

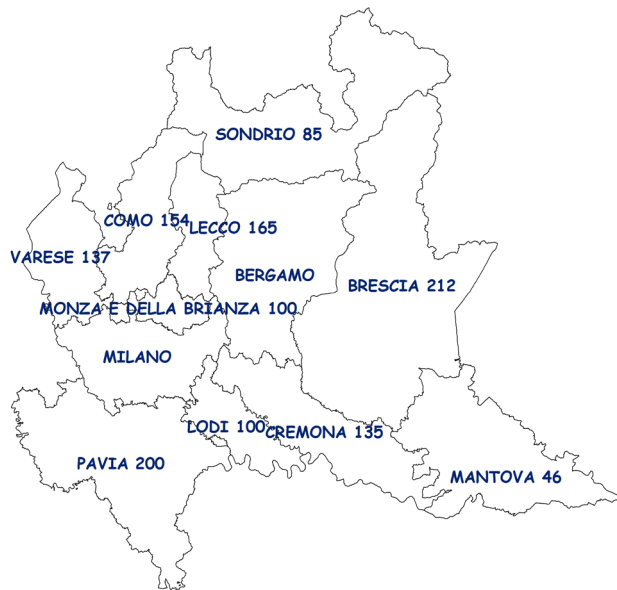


Figure 1. Number of urban gardens in the capital cities in Lombardy.
Coldiretti, 2014.⁴⁴

Urban gardens are most popular in Milan, Bergamo and Brescia. These cities are characterized by high land consumption and strong urbanization⁴⁵. In the south cities, such as Cremona and Mantua, where in recent years the conversion of agricultural land for residential and productive purpose is increased, the number of urban gardens is low, but growing⁴⁶.

In almost all cities, the gardens have been created for educational purposes in schools, reducing human pressure on heavily urbanized areas or for recreational purposes of the older population. In all horticultural projects, local governments prepare the land and offer the necessary equipment; voluntary associations are engaged in inclusion and learning activities.

Their interest is due to several reasons.

Lombardy is one of the most urbanized regions in Italy.

⁴⁴ Milan has 1384 urban gardens, Bergamo 63.

⁴⁵ CRCS 2014

⁴⁶ Bonomi 2011

	Anni '50	1989	1996	1998	2006	2008	2013
Piemonte	2,2-3,9	4,4-6,3	4,7-6,7	4,8-6,8	5,0-7,0	5,1-7,1	5,9-8,2
Valle d'Aosta	1,1-2,3	1,7-3,0	1,8-3,1	1,8-3,1	2,0-3,4	2,0-3,4	2,2-3,7
Lombardia	3,9-5,8	6,8-9,0	7,5-9,9	7,7-10,1	8,5-11,0	8,8-11,3	9,6-12,2
Trentino-Alto Adige	0,9-2,0	1,5-2,7	1,6-2,8	1,6-2,9	1,8-3,1	1,8-3,1	1,8-3,2
Veneto	3,0-4,8	5,0-7,1	6,2-8,3	6,5-8,7	7,7-10,1	8,3-10,8	8,6-11,1
Friuli-Venezia Giulia	2,2-3,8	4,4-6,3	5,0-7,0	5,1-7,1	5,5-7,5	5,6-7,7	5,8-7,9
Liguria	2,0-3,5	4,2-6,1	5,0-7,0	5,2-7,2	5,6-7,7	5,6-7,7	5,9-8,0
Emilia Romagna	1,8-3,0	5,7-7,7	6,4-8,4	6,6-8,7	6,7-8,8	6,8-8,8	6,9-8,9
Toscana	1,6-3,0	3,7-5,5	4,5-6,4	4,5-6,5	5,1-7,2	5,2-7,2	5,3-7,4
Umbria	1,1-2,3	2,6-4,2	3,1-4,8	3,2-4,9	4,2-6,2	4,2-6,2	4,3-6,3
Marche	1,9-3,5	3,9-5,8	4,6-6,6	4,8-6,8	5,1-7,3	5,3-7,4	5,7-7,9
Lazio	1,3-2,4	4,5-6,3	5,5-7,4	5,9-7,9	6,1-8,0	6,1-8,1	6,4-8,4
Abruzzo	1,0-2,2	2,7-4,3	3,2-4,9	3,3-5,0	3,6-5,5	4,0-5,8	4,2-6,1
Molise	1,3-2,7	2,2-3,7	2,4-4,0	2,5-4,1	2,7-4,3	2,8-4,5	3,0-4,7
Campania	3,5-5,4	6,0-8,2	6,5-8,7	6,6-8,8	7,2-9,5	7,5-9,8	7,8-10,2
Puglia	2,6-4,3	5,3-7,2	6,0-8,0	6,3-8,4	7,1-9,3	7,3-9,6	7,4-9,7
Basilicata	1,5-3,0	2,2-3,7	2,6-4,1	2,7-4,3	3,3-5,1	3,4-5,2	3,6-5,3
Calabria	1,6-3,1	3,1-4,8	3,4-5,2	3,4-5,2	3,9-5,7	4,3-6,1	4,5-6,4
Sicilia	1,4-2,8	4,5-6,5	4,9-6,9	5,0-7,0	5,5-7,7	5,5-7,7	5,8-7,9
Sardegna	1,1-2,3	2,0-3,3	2,3-3,7	2,4-3,8	3,2-4,8	3,3-5,0	3,4-5,0



Table 1. Estimation of land use in % of the regional surface. ISPRA, 2015

Until 1980, the more urbanized areas were the provinces of Milan, Bergamo and Brescia. The industrial development of those years has imposed the conversion of agricultural land into industrial areas. The increase in employment in the same provinces attracted much more local labor thereby stimulating demand for housing. This trend has slowed in the last 35 years. The available land is inevitably reduced and the economic crisis has interrupted the local growth and thus the demand for new industrial plants and houses. On the contrary, in the southernmost provinces, rates of urbanization have grown. The conversion of agricultural land has experienced a significant increase due to the availability of land to be converted and the slight delay of local economic systems restructuring.

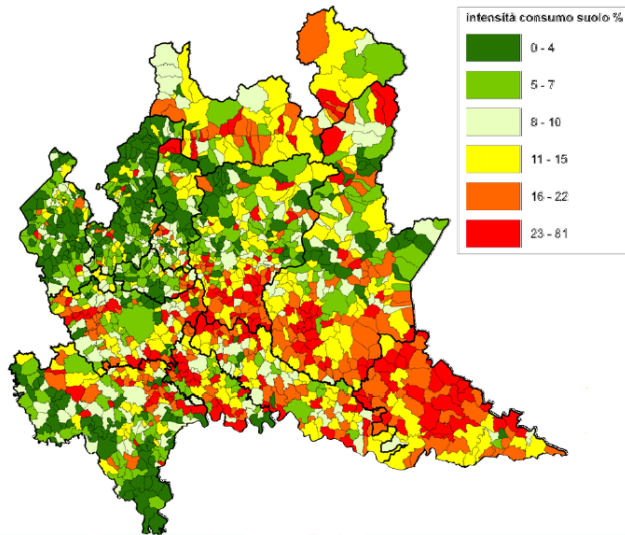


Figure 3. Soil consumption. Intensity of urbanized areas. Lanzani, 2011.

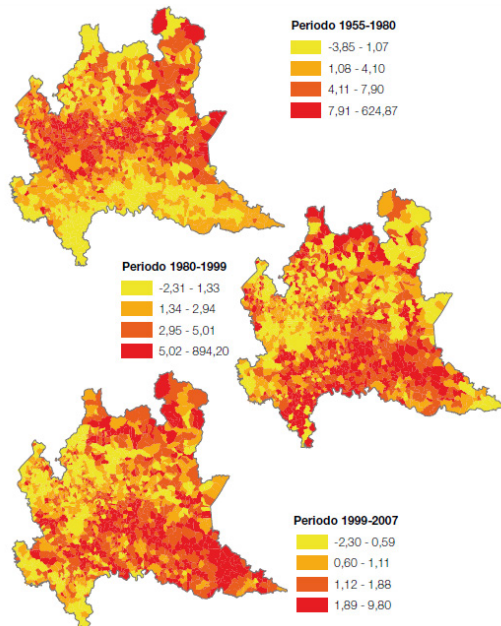


Figure 4. Growth rate of urbanized areas. Comparison several periods. Lanzani, 2011.

The trend of urbanization is closely related to demographic dynamics. The population density is high everywhere and especially where the urbanization rates have grown most in recent years.

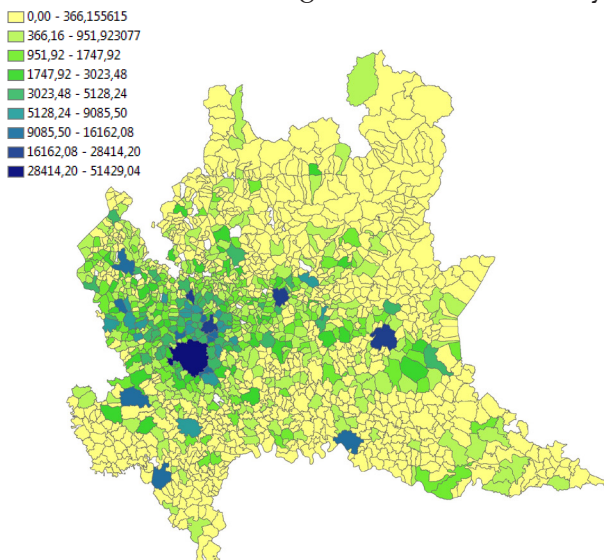


Figure 5. Population density. ASR Lombardy, 2015.

The diffusion of urban gardens is then motivated by the need to increase regional environmental quality. According to the OECD, Lombardy Region is characterized by a strong pollution given by a high amount of fine particles in the air. As a consequence, this region has one of the worst environmental performances in Italy and in Europe.

In contrast, this region has one of the best social performances across Europe. Civic engagement of the local population is considerable: the high number of people who vote in local elections is very high and, when compared across all OECD regions, the Lombardy region is in the top 24%. At the same time, choosing to associate for social purposes is deeply entrenched thanks to the over 5.000 voluntary associations present in all regions⁴⁷. These data demonstrate the interest of local people to participate actively in the local administration and adopt solutions and projects to promote greater social inclusion.

⁴⁷ ISTAT 2011

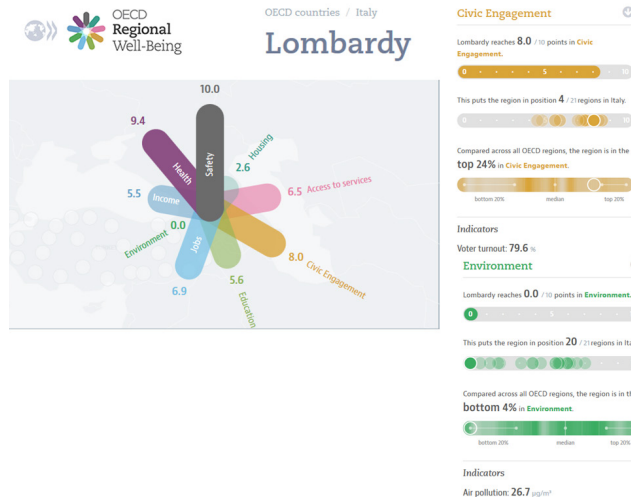


Figure 5. Civic engagement and Environment results of Lombardy. OECD, 2014.

THE IMPORTANCE OF URBAN GARDENS FOR LOMBARDY PEOPLE

To understand the importance attributed to urban gardens by citizens of Lombardy, they were administered some structured questionnaires. The first questionnaire was administered to urban gardeners of all capital cities. Between October 2014 and May 2015, about 1.800 questionnaires have been delivered to urban gardeners directly or through the municipal offices. The response rate was around 18% as the completed questionnaires were 321.

Thanks to the given answers, it was possible to draw the profile of the typical Lombard urban gardener. He is an Italian male, aged between 60 and 70, retired, but in the past has not been employed in agriculture. Moreover, he has a low income and owns a house, but without any gardens.

At the same time, this allows us to understand the social, environmental and economic motivations that led him to cultivate an urban garden.

According to a social point of view, the decision to cultivate is due to the following responses (they were allowed multiple responses):

To learn about agricultural practices and the rhythms of nature	48,1%
To meet new people and improve relationships with family / friends	35,2%
To adopt new and healthier consumption habits	46,6%
To engage in new social initiatives	45,8%
To improve the visibility of the places	14,5%
To recover the cultivation of not widespread plant species	7,6%
To share values	42,0%

Table 2. Social motivations of Lombard urban gardeners. Answers to submitted questionnaire. Our elaboration, 2015.

From these replies, it is possible to assume that urban gardens are useful to learn agricultural techniques and to meet new people. At the same time, they help to adopt new and healthier eating habits and strengthen cohesion within the reference community. With poor results, instead, they help to recover plant species that are not grown in the surrounding rural areas.

By considering the other responses to the questionnaire, it turns out that the environmental and economic motivations concern the following issues (also in this case, multiple responses are allowed):

To reduce pollution	9,8%
To retrieve abandoned or degraded lands	48,1%
To support local products	22,6%
To reduce food spending	24,8%
To contribute to food needs	49,6%
To modify consumption choices	44,6%
To provide services that otherwise would not guarantee by public administrations	30,8%
To activate public/private partnership projects for the provision of public services to the local community	11,3%

To promote employment of disadvantaged people	30,8%
To promote employment in general	8,3%

Table 3. Environmental and economic motivations of Lombard urban gardeners. Answers to submitted questionnaire. Our elaboration, 2015.

For Lombard urban gardeners, any horticulture experience is important to retrieve abandoned or degraded lands, but it does not help to reduce pollution. About 50% of them believe that this type of production is an alternative to the food purchase in the traditional distribution channels and therefore has a direct bearing on purchasing decisions and household budgets. By producing food items they need directly, about 35% of them have been solicited to change their food preferences and dietary restrictions, in favor of healthier consumption habits.

With reference to the economic benefits for the whole community, they assume urban horticulture as an alternative source of social services for disadvantaged people. Due to the contraction of social public spending, they think that local governments are not able to offer the same level of social services than in the past in order to increase social welfare, prevent and treat diseases, support occupation and the inclusion of people with health or economic problems. However, they are convinced that its contribution is limited to a specific sector or category of people and does not promote the employment of other population segments.

In the same period, the questionnaire was also submitted to 1.000 Lombard not urban gardeners, directly or through the local government. The response rate was slightly higher (22%). The sample of respondents is more heterogeneous and includes people from all age groups (retirees, singles, families, in particular).

Faced with the same possible answers, non-urban gardeners have considered important the following social factors:

To learn about agricultural practices and the rhythms of nature	55,1%
To meet new people and improve relationships with family / friends	30,2%
To adopt new and healthier consumption habits	49,7%
To engage in new social initiatives	42,8%

To improve the visibility of the places	10,5%
To recover the cultivation of not widespread plant species	3,7%
To share values	29,0%

Table 4. Social motivations of Lombard not urban gardeners.
Answers to submitted questionnaire. Our elaboration, 2015.

For non-urban gardeners, individual experiences related to urban horticulture are more important than social opportunities to share or meet other people.

Compared to the urban gardeners, they assume that they are more useful to adopt healthier consumption habits, and less as a hobby or opportunity for social commitment.

From the environmental and economic point of view, the results are not very different:

To reduce pollution	18,9%
To retrieve abandoned or degraded lands	42,1%
To support local products	12,6%
To reduce food spending	44,8%
To contribute to food needs	46,9%
To modify consumption choices	54,6%
To provide services that otherwise would not guarantee by public administrations	23,8%
To activate public/private partnership projects for the provision of public services to the local community	14,3%
To promote employment of disadvantaged people	28,3%
To promote employment in general	9,4%

Table 5. Environmental and economic motivations of Lombard not urban gardeners. Answers to submitted questionnaire. Our elaboration, 2015.

In environmental terms, non-urban gardeners assume the importance of urban agricultural initiatives to reduce pollution and regenerate vacant spaces, albeit with less conviction. In other terms, they evaluate positively the opportunity to modify their con-

sumption choices and reduce their spending of foodstuffs. In addition, they are not so convinced that urban horticulture aids local government to provide community services, but assume that it may stimulate public/private agreements.

At the end, the same test was submitted to the local administrations of the 12 Lombard provincial capitals.

The results are different:

To learn about agricultural practices and the rhythms of nature	66,6%
To meet new people and improve relationships with family / friends	25%
To adopt new and healthier consumption habits	66,6%
To engage in new social initiatives	25%
To improve the visibility of the places	66,6%
To recover the cultivation of not widespread plant species	25%
To share values	25%

Table 6. Social motivations of Lombard provincial capitals. Answers to submitted questionnaire. Our elaboration, 2015.

For these administrations, urban gardens are important to stimulate local population to adopt healthier consumption habits by learning new agricultural techniques. Contrary to citizens' assumptions, they are considered an instrument of territorial marketing to increase the local visibility.

Data relating to the attributed economic and environmental importance show a great attention to the environmental questions. In particular, local administrations support the realization of urban gardens to reduce pollution and, above all, to reduce urban pressure on vacant lands. At the same time, they do not ignore the impact of such initiatives on consumption and purchasing choices. With reference to their role of provider of public services, they do not fully recognize the substitute function of urban gardens, but they observe that their realization may promote public and private partnership among several institutions, organizations and private citizens.

To reduce pollution	33,3%
To retrieve abandoned or degraded lands	66%
To support local products	25%

To reduce food spending	8,33%
To contribute to food needs	25%
To modify consumption choices	25%
To provide services that otherwise would not guarantee by public administrations	25%
To activate public/private partnership projects for the provision of public services to the local community	66%
To promote employment of disadvantaged people	16,6%
To promote employment in general	8,33%

Table 7. Environmental and economic motivations of Lombard capital cities. Answers to submitted questionnaire. Our elaboration, 2015.

The last part of the questionnaire was structured to compare the willingness to pay in order to cultivate any urban gardens.

On average, urban gardeners pay about 27,55 Euros each year (on average). This cost includes charges for utilities (water, electricity) and the concession fee that some municipalities require. From the responses of the questionnaire, it seems that they would be willing to pay up to 45 Euros. Even non-urban gardeners would be willing to pay a similar amount (47.5 on average each year). The same data are not available for local administrations because they did not give more detailed information about indirect costs (staff, administrative procedures), in addition to the direct ones, incurred for their realization.

CONCLUSIONS

The importance of urban gardens in social, environmental and economic terms is now widely recognized. Their contribution in strengthening social capital by promoting the inclusion of disadvantaged people or amending, in positive terms, the eating habits is attested by numerous studies. Likewise, their realization in the vacant or degraded spaces is hoped to reduce the human pressure in urban areas or to mitigate, at least partially, the negative effects of pollution. Nevertheless, it helps to “shorten” the food chain and reduce costs for food commodities of urban gardeners.

With reference to Lombardy, these features are widely recognized

not only by scholars but also by citizens (urban gardeners and not urban gardeners) and local administrations. The importance attributed to them in relation to each issue varies from a few percentages with the exception of environmental themes. According to a social point of view, Lombard urban farmers recognize that urban horticulture promotes local social cohesion, fosters socialization among individuals with different social and educational extraction. At the same time, they assume their importance to stimulate and strengthen families' ties and the construction of a new rules system based on peasant tradition, local values and cultural influences from other localities. They agree with medical studies that have positive effects on quality of life and health in general. Even non-gardeners believe that social issues are important and recognize the positive effects of urban horticulture. While evaluating the opportunities, Lombard citizens (gardeners and non-gardeners) detect the low effectiveness of urban horticulture projects in reducing pollution, perhaps because without adequate information; on the contrary, local administrations assess them positively. All surveyed administrations are more confident because they think that the urban gardens reduce pollution, land use and beautify the city. Occupying the blanks or degraded land and requiring few pollutants (fertilizers in particular), they are convinced that they can be useful to reduce human pressure on natural resources. The positions are reversed with respect to the issues related to consumption and spending on food prices. Urban gardeners and especially non-urban gardeners expect to be useful in reducing the relative costs, but local administrations give them less importance. The first ones are convinced that the direct cultivation influences their consumption habits, while reducing the costs for the purchase of food products. The last are so confident about these opportunities that they do not think that the food chain may be shorter.

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Do you like it bitter? A preliminary study on food preferences for bitter taste in a young population

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INTRODUCTION

Bitter taste belongs to the category of adverse and negative sensations to be avoided. This attribute is often reported as obvious or taken for granted, so much so that ancient and modern literature contains many anecdotes about the bitter taste of poisons. These are often reported as a result of accidental and occasional taste or observed in relation to the fact that animals refuse to eat/taste them. While it is certainly true that the perception of bitter taste has, over thousands and thousands years of evolution, taken on a defensive function, i.e. to modulate the intake of toxic molecules, mainly produced by plants, and therefore prevent their excessive ingestion, many foods and beverages in common use (tea,

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coffee, many vegetables, chocolate and some alcoholic beverages) are nonetheless appreciated even though their prevalent sensory attribute is bitterness. The five basic tastes, besides giving a specific taste perception, also have other very important functions in nutrition¹. Bitter taste sensitivity has provided an important survival advantage to early humans, by allowing them to detect a large number of structurally diverse chemical compounds found in food, most of which are harmful toxins produced by plants, and by allowing them to regulate consumption. Bitter taste perception, therefore, allowed early humans to exploit sources of nutritious, but potentially toxic, foods by regulating the consumption of substances that might cause poisoning or death. During evolution, humans have also learned through trial and error that not all that is bitter is toxic; in this way, the value of certain bitter foods as medicines has been recognized, as a fact that is now explained, at least partially, at the molecular level.²

Nowadays, bitter taste sensitivity is probably less important to avoid poisoning, but it can still influence health through diet and through differences in preference for bitter foods, fruits and vegetables, as well as for sweet, fat, spicy and alcoholic beverages.

The human genome contains a gene family consisting of 25 functional TAS2R loci that encode for bitter receptors (T2Rs); from a phylogenetic point of view, they are well conserved, even though they have numerous genetic variants in specific sites, mostly Single Nucleotide Polymorphism (SNPs). This variability is correlated with the enormous difference in human bitter taste perception and, due to natural selection, it could have led to haplotypes that are more “sensitive” to bitter natural toxins produced by plants in different environments.³

One of the most well-known bitter taste sensitivity modulations is described for the TAS2R38 gene, encoding for variants of the T2R38 receptor that have different affinities for glucosinolates⁴. These are a family of bitter molecules widely distributed in the Brassica genus with an important role in preventing some kinds of cancer⁵. Within a range of synthetic molecules that bind to this receptor,

1 Efeyan et al 2015: 517(7534), 302-10

2 Appendino et al. 2013: Settembre

3 Soranzo et al. 2005: 15(14), 1257-65.

4 Gorovic et al. 2011: 71 (4), 274-279

5 Appendino et al. 2010: 9, 308

we find phenylthiocarbamide and 6-n-propylthiouracyl, the latter being more commonly known as PROP.

PROP it is often proposed for use in screening⁶ to divide the population into bitter non-tasters, bitter medium-tasters and bitter super-tasters. Independent researches, worldwide, have found that this is a Mendelian recessive trait⁷ and several studies have identified the different phenotypes “super-taster”, “medium-taster” and “non-taster”. In Caucasians (the best studied ethnic group), non-tasters, medium-tasters and super-tasters distribution is 30, 45 and 25%, respectively.^{8,9}

Many of the possible correlations between genotype and phenotype were studied, but taken singularly, it is not possible explain the difference in bitter taste sensitivity: researchers must also focus on physiological variables (like the density of taste buds and the number of fungiform papillae¹⁰, the presence of polymorphisms in other genes involved in the overall process¹¹, their expression and proper function¹²) and on psychological¹³, social and environmental factors (like habits to some foods or diets).

Food with some degree of bitterness is very common, i.e. plants such as cruciferous vegetables (broccoli, cauliflower, cabbage...), spinach and some types of salads, and fruits like grapefruit and oranges, but also cheeses, soy and other protein products, coffee, tea and some alcohols such as beer, sake and sparkling brut wine, in addition to the so-called “bitter liqueurs”.

Bitter molecules responsible for bitterness are structurally different and belong to various chemical classes such as fatty acids, peptides, amino acids, ureic and thioureaic molecules, terpenoids, alkaloids, glycosides, flavonoids, steroids, acetylated sugars, and metal ions. The response of each compound to one or more bitter taste T2Rs receptors using in vitro assays and less frequently by sensory analysis, are reported in several papers.¹⁴

6 Bufe et al. 2005: 15 (4), 322-327

7 Blakeslee 1932: 18 (1), 120-130

8 Zhao et al. 2003: 78 (4-5), 625-633

9 Tepper 2008: 28 (1), 367-388

10 Hayes et al. 2008: 33 (3), 255-265

11 Calò et al. 2011: 104 (5), 1065-1071

12 Iguchi et al. 2011: 6 (8), Article number e23165

13 Mennella et al. 2011: 36 (2), 161-167

14 Meyerhof et al. 2010: 35 (2), 157-170

Recent research is also focusing on studying possible correlations between bitter taste and disease: among these, there are not only metabolic diseases (e.g. type II diabetes and obesity), but also heart diseases, colic polyposis¹⁵, and prostate and colorectal cancer.¹⁶ Moreover, the activation of bitter taste receptors present in airways causes airway smooth muscle relaxation and bronchodilation, suggesting a link between bitter taste and asthma.¹⁷

The overall response of individuals to bitter food is difficult to estimate and correlate with molecular and genetic data, due to the complexity of the bitter taste apparatus and the simultaneous presence of many different bitter compounds. Nevertheless, for an understanding of food habits, it is important to define how much we perceive this sensation in different foods and whether we like it or not. In the present paper, we tried to: 1) understand how much we like bitterness in many different types of food; 2) measure the estimated intensity of bitter taste and 3) how much it differs from perceived intensity; and 4) stratify these data with the demographic characteristics of our sample of college students.

MATERIALS AND METHODS

PARTICIPANTS

A sample of 66 reportedly healthy subjects (30 females, 36 males; aged from 18 to 36; mean age: 22; 38% smokers) were recruited among students at the University of Gastronomic Sciences (Bra, Italy). Respondents were 63.6% Italian, 16.7% European and 19.7% non-European. Subjects voluntarily participated in the study and provided written consent. The data collection was conducted in individual sensory booths at the Food and Wine Sensory Lab of the University and social interactions were not permitted. The experimenter verbally introduced the subjects to the computerized data collection procedure (Fizz Acquisition software, version 2.46, Biosystèmes, Courtenon, France). The data collection session was organized in two steps. In

15 Basson et al. 2005: 50 (3), 483-489

16 Garcia-Bailo et al. 2009: 13 (1), 69-80

17 Grassin-Delyle et al. 2015: 15 (1), 63-69

the first step, participants filled in a questionnaire. In the second step, subjects performed a sensory test evaluating the bitter intensity perceived in several food products and in a sample of PROP cotton swab. Participants completed their task in 50-60 minutes.

QUESTIONNAIRE

The questionnaire aimed to collect personal information (age, gender, nationality, type of diet, smoking status, and presence of asthma) and to investigate the declared liking and estimated bitter intensity for 20 food products. Data on declared liking for vegetables and for bitter taste in general were also collected. Participants were asked to score their liking for the food products on a three-point scale (1 = unpleasant; 2 = indifferent; 3 = pleasant; plus a fourth option = I do not know), which was suitable to obtain a very clear indication of liking/disliking in absolute terms. In order to collect more precise information on the level of bitter-phobia, participants scored the estimated intensity of the bitterness for the food products, liking for the bitter taste and for vegetables in general on a nine-point scale (1 = very low intensity; to 9 = very high intensity; plus a tenth option = I do not know).

SAMPLES

Food Products: Broccoli (*Brassica oleracea* L. var. *italica*) and Red chicory (*Cichorium intybus* L. var. *foliosum* cultivar *radicchio*) were purchased from a local supermarket, washed with tap water and cut into small pieces and cooked in a steam oven (15 minutes, $99 \pm 1^\circ\text{C}$). Subsequently they were kept at refrigerator temperature ($4 \pm 1^\circ\text{C}$). Before the sensory evaluation, samples were kept at room temperature for 10 minutes and were presented to the tasters in disposable plastic dishes. Grapefruit juice (*Citrus x paradisi*), purchased from a local supermarket, was maintained at refrigerator temperature ($4 \pm 1^\circ\text{C}$) and was kept at room temperature for 10 minutes before tasting. Black tea, purchased from a local supermarket in the form of single bags, was prepared by leaving 8 tea bags in 1.5 liters of boiling still mineral water for 3 minutes to infuse. Black coffee was prepared with the moka pot using 60 g of coffee powder and 750 ml of still mineral water. Both black tea and coffee were kept at a constant temperature ($67 \pm 3^\circ\text{C}$) in a thermos (maximum for 15 minutes). Di-

gestive liqueur “*Fernet-Branca*”, purchased from a local supermarket, was an Italian bitter spirit characterized by low sweetness of the formulation, served at room temperature. Samples of 20 ml of tea, coffee and spirit were presented to the tasters in disposable plastic cups. Cotton swabs with PROP. We optimized the protocol described by Zhao et al. (2003), introducing some changes to the method described. The method has already been used in published researches, in which the overall genotype–phenotype concordance was also proved, inferring the correctness of the cotton swab PROP test.¹⁸ Commercial cotton swabs (with one of their extremities cut off) were dunk for 10 seconds in a saturated PROP solution made by rapidly dissolving 6-n-propylthiouracyl (PROP) powder (99.9% purity, VETRANAL Analytical Standard, Sigma-Aldrich, Saint Louis, Missouri, USA) in boiling deionized water (Merck Millipore, Billerica, Massachusetts, USA). Afterwards, soaked cotton swabs were hung overnight to make them dry properly and then stored in an airtight box. Determination of the PROP quantity hold on each cotton swab was performed as indicated by Zhao et al. (2003): ten randomly selected samples of cotton buds were left in an immersion in a 50 mL Falcon tube (Microtech Scientific, Orange, CA, USA) overnight at room temperature with 20 mL of methanol (CHROMASOLV® for gradient elution ACS, Sigma-Aldrich). As a control, a cotton swab without PROP was kept overnight at room temperature in the same conditions. PROP absorbance in methanol solution was measured at a wavelength of 275 nm by means of a UV/VIS spectrophotometer (Perkin Elmer Lambda 25, Waltham, Massachusetts, USA, equipped with the UV WinLab software v.2.85.04, Perkin Elmer). After filtration with a nylon filter (Microtech Scientific), samples were measured three times in cuvettes with 1 cm pathlength. The amount of PROP in each cotton swab was calculated using the following formula (assuming that all the PROP of each cotton swab was eluted from methanol): $PROP\ mass = (A * MW) / (\epsilon * V)$, where A is absorbance, MW is PROP molecular weight (170.233 g/mol), ϵ is PROP molar extinction coefficient ($15.8\ L * mol^{-1} * cm^{-1}$) and V is the volume methanol used. The average quantity of PROP in each cotton swab was 0.48 ± 0.01 mg.

SENSORY TEST

Participants evaluated the perceived intensity of the bitterness of the seven samples (broccoli, red chicory, grapefruit juice, black tea,

¹⁸ Risso et al. 2014: 9 (3), 401

coffee, cotton swab with PROP) on a general labeled magnitude scale (gLMS)¹⁹. Subjects were required to rinse their mouths prior to each evaluation. A 5-minute break was enforced between samples, and participants were required to eat plain crackers and rinse their mouths with still water during this interval.

DATA ANALYSIS

Data are expressed as Mean \pm SEM. The effect of product on liking and bitter intensity was assessed using a two-way ANOVA mixed model with interactions (fixed factor: product; random factor: subject) by performing Fisher's Least Significance Difference (LSD; $p < 0.05$). Statistical analysis of data was performed using the statistical software XLSTAT version 2011.3.02 (Addinsoft, Paris, France).

RESULTS AND DISCUSSION

CONSUMERS' PREFERENCE FOR BITTER TASTE

We looked for possible statistically significant correlations between demographic variables and the answers given for liking, estimated intensity and perceived intensity. In this case, however, any kind of correlation between the parameters taken into account was not identified. Therefore, estimated and perceived bitter taste intensity were not affected by these demographic factors.

In Figure 1, we report the frequency distribution of liking scores given from the totality of the subjects for bitter taste in general.

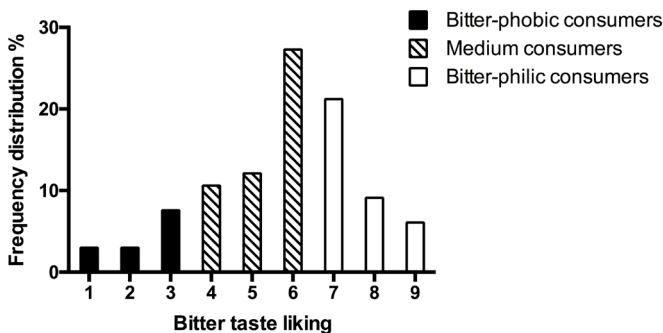


Figure 1: Frequency distribution of liking scores for bitter taste (66 consumers).

¹⁹ Green et al. 1996: 21 (3), 323-334

We observed a tendency towards medium-high values of bitter taste liking (more than 60% of tasters gave a score equal to or higher than 6), which indicate a general preference for bitter taste more than a declared disliking. This is a simple but relevant result that leads to an important consideration: bitter taste is not disliked, as often thought, in absolute terms. There is, certainly, an innate dislike for bitter taste; however, this changes during life, moving more and more towards acceptance, especially among young people and young adults who, with time and with acquired taste and sensory experience, tend to appreciate this taste much more. There is extensive scientific literature on the topic, which takes into account the perception and liking of bitter taste, depending on age, gender, social, demographic and cultural characteristics.^{20,21,22} Therefore, also within our panel of consumers, we confirmed that bitter taste is appreciated, more than disliked, from a heterogeneous population.

To investigate consumers' food preferences in relation to their liking for bitterness, we segmented subjects in three groups according to the score given to the liking for bitter taste in general and named them as follows: 1) *bitter-phobic consumers* (liking score ≤ 3); 2) *medium consumers* (liking score ranging from 4 to 6); 3) *bitter-philic consumers* (liking score ≥ 7). In our group of young subjects, we found the following distribution: Bitter-phobic consumers: 24.2% (n=16; average liking = 3.06 ± 0.27); Medium consumers: 39.4% (n=26; average liking = 5.69 ± 0.09); and Bitter-philic consumers: 36.4 % (n=24; average liking = 7.58 ± 0.16)

Then, we compared the average liking data calculated for the three groups of consumers for each food product taken into account. As reported in Figure 2, there is a statistically significant difference ($p < 0.05$) in liking for vegetables between bitter-philic and bitter-phobic consumers, showing that a liking for vegetables was lower for those consumers who declared disliking bitter tastes in general.

20 Mennella et al. 2005: 115 (2), e216-e222

21 Mennella et al. 2010: 11, 60

22 Negri et al. 2011: 53 (6), 601-605

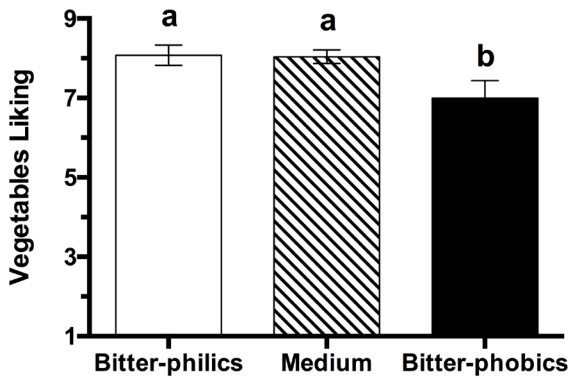


Figure 2: Vegetable liking divided into *Bitter-philic*, *Medium* and *Bitter-phobic* consumers

However, the general liking for vegetables was very high, even among people who declared disliking bitter tastes (average value: 7.00 ± 0.438).

Regarding food item liking, there are only eight foods for which there was a significant difference ($p < 0.05$) between *bitter-philics* and *bitter-phobics*, such as broccoli, common radish, mustard, red chicory, beer, bitter liqueurs and rocket salad (Table 1).

Food item	LIKING OF FOOD ITEM			
	Bitter-philic consumers		Bitter-phobic consumers	
Broccoli	2.96 ± 0.04	a	2.40 ± 0.19	b
Beer	2.88 ± 0.07	a	2.50 ± 0.16	b
Bitter liqueurs	2.65 ± 0.13	a	2.06 ± 0.21	b
Common radish	2.83 ± 0.08	a	1.92 ± 0.26	b
Mustard	2.67 ± 0.13	a	1.77 ± 0.23	b
Red chicory	2.67 ± 0.13	a	1.93 ± 0.18	b
Rocket Salad	2.86 ± 0.10	a	2.21 ± 0.26	b

Table 1: Average liking for food items for which there was a statistically significant difference. Values in the same row with different superscripts are significant different Fischer's LSD ($p < 0.05$).

Foods that showed significant differences between *bitter-philic* and *bitter-phobic* consumers were mostly vegetables, especially those

that contain isothiocyanates. Probably, the results obtained could be partially explained taking into account that a possible interaction between bitter and pungency (due to the isothiocyanates content) perception could occur. Moreover, among vegetables that do not differentiate between the two groups, there were probably some that were very frequently consumed and whose bitter taste could be misestimated precisely because of their common use. Surprisingly, liking for coffee and others drinks did not discriminate between *bitter-philic* and *bitter-phobic consumers*, except for digestive liqueurs ($p < 0.05$). However, liking depends on many variables such as society, culture and food traditions, thus it is important to contextualize it according to these variables.

From the comparison of the mean values of estimated intensity of bitterness calculated for the three consumer groups for every food item, we observed a significant difference between *bitter-philic* and *bitter-phobic consumers* only for one product. In particular, the first group remembered bitter liqueurs to be significantly bitterer than the latter. We wonder whether this result is due to the fact that digestive liqueur is actually more bitter or the fact that is imagined as the most bitter, perhaps because of the link between the name “digestive liqueurs”, “bitter liqueurs” and “bitter digestive”.

To summarize, there was no evidence of relevant associations between liking for bitter taste in general and the estimated bitterness intensity.

FOOD PREFERENCES AND ESTIMATED BITTER INTENSITY

Results of the ANOVA performed independently on liking and bitter intensity scores given by the *Bitter-philic* and *Bitter-phobic* groups of consumers are reported in Table 2 and 3.

LIKING						
	Bitter-philic consumers			Bitter-phobic consumers		
1	Broccoli	2.96 ± 0.04	a	Orange juice	2.75 ± 0.11	a
2	Orange juice	2.91 ± 0.06	a	Dark chocolate	2.63 ± 0.20	bc
3	Green salad	2.91 ± 0.06	a	Green salad	2.63 ± 0.18	bc

DO YOU LIKE IT BITTER?

4	Beer	2.88 ± 0.07	a	Artichokes	2.56 ± 0.18	acd
5	Rocket salad	2.86 ± 0.10	a	Grapefruit	2.56 ± 0.20	acd
6	Common Radish	2.83 ± 0.08	ab	Brut sparkling wine	2.50 ± 0.16	abde
7	Artichokes	2.83 ± 0.10	ab	Beer	2.50 ± 0.18	abde
8	Grapefruit	2.83 ± 0.10	ab	Broccoli	2.40 ± 0.19	abde
9	Brut sparkling wine	2.83 ± 0.12	ab	Tea	2.31 ± 0.20	abde
10	Dark chocolate	2.71 ± 0.14	ab	Liquorice	2.31 ± 0.22	abde
11	Mustard	2.67 ± 0.13	abc	Rocket salad	2.21 ± 0.26	abdef
12	Red chicory	2.67 ± 0.13	abc	Citrus Peel	2.07 ± 0.22	bdef
13	Digestive liqueurs	2.65 ± 0.13	abc	Digestive liqueurs	2.06 ± 0.21	bdef
14	Tea	2.65 ± 0.13	abc	Common Radish	2.00 ± 0.24	cdef
15	Citrus Peel	2.50 ± 0.16	bcd	Tonic water	1.93 ± 0.18	def
16	Tonic water	2.48 ± 0.16	bcd	Red chicory	1.92 ± 0.26	cef
17	Liquorice	2.33 ± 0.18	cd	Mustard	1.77 ± 0.23	df
18	Coffee	2.17 ± 0.20	d	Coffee	1.69 ± 0.22	e

Table 2: Average liking scores for *Bitter-philic* and *Bitter-phobic* consumers. Values in the same column with different superscripts are significant different Fischer's LSD ($p < 0.05$).

ESTIMATED INTENSITY OF BITTERNESS						
	Bitter-philic consumers			Bitter- phobic consumers		
1	Coffee	7.29 ± 0.36	a	Coffee	7.19 ± 0.50	a
2	Citrus Peel	6.46 ± 0.39	a	Digestive liqueurs	7.00 ± 0.36	a
3	Dark chocolate	6.08 ± 0.47	a	Citrus Peel	6.62 ± 0.37	a
4	Grapefruit	6.04 ± 0.45	a	Red chicory	6.00 ± 0.37	a
5	Tonic water	6.04 ± 0.37	a	Dark chocolate	5.94 ± 0.51	a
6	Red chicory	6.00 ± 0.39	a	Tonic water	5.93 ± 0.43	a
7	Rocket salad	6.00 ± 0.36	a	Mustard	5.93 ± 0.74	a
8	Digestive liqueurs	5.74 ± 0.37	b	Common Radish	5.92 ± 0.65	a
9	Beer	5.58 ± 0.27	a	Liquorice	5.69 ± 0.49	a
10	Common Radish	5.48 ± 0.44	a	Rocket salad	5.60 ± 0.51	a
11	Tea	5.38 ± 0.38	a	Beer	5.44 ± 0.43	a
12	Mustard	5.21 ± 0.43	a	Grapefruit	5.38 ± 0.59	a
13	Liquorice	4.92 ± 0.38	a	Tea	5.25 ± 0.36	a
14	Artichokes	4.91 ± 0.33	a	Brut sparkling wine	5.00 ± 0.41	a
15	Brut sparkling wine	4.70 ± 0.39	a	Artichokes	4.56 ± 0.58	a
16	Orange juice	4.21 ± 0.40	ab	Orange juice	3.06 ± 0.47	b
17	Broccoli	3.25 ± 0.37	a	Broccoli	3.06 ± 0.32	a
18	Green salad	3.17 ± 0.36	a	Green salad	3.06 ± 0.48	a

Table 3: Average values of estimated bitter intensity for *Bitter-philic* and *Bitter-phobic consumers*. Values in the same column with different superscripts are significant different Fischer's LSD ($p < 0.05$).

We noticed that *Bitter-philic* consumers generally liked almost all products to a similar extent and that very few products were discriminated. On the other hand, *bitter-phobic* consumers were more

discriminative in their preferences and like orange juice, dark chocolate and green salad significantly more than tonic water, red chicory, mustard and coffee.

We observed that the least liked foods were not necessarily the most bitter, so it seems that a liking for bitter in general, and a liking of bitter foods were not necessarily related: not only can a *bitter-philic* consumer like a particularly bitter food, which is very likely, but a *bitter-phobic* consumer can also have a similar liking.

From these data, it seems that being *bitter-philic* or *bitter-phobic* does not depend so much on the intensity of bitter taste perception, but varies from food to food, confirming the difficulty of enclosing bitter taste in a precise and regular pattern.

PERCEIVED BITTER INTENSITY

In the last part of our study, we wanted to see whether there was an association between liking for bitter in general and bitter perceived intensity. In other words, we wanted to know whether *bitter-philic* and *bitter-phobic* consumers perceived the bitter taste of some food products differently during their tasting.

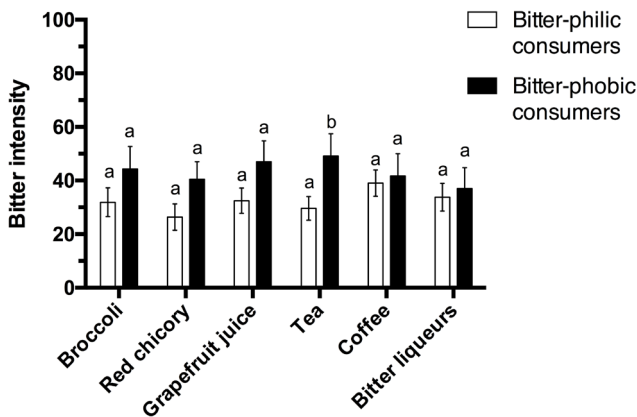


Figure 3: Perceived bitter intensity for six foods tasted for *Bitter-philics* and *Bitter-phobics*

As can be seen from the graph in Figure 3, there is a statistically significant difference only for tea ($p < 0.05$), where *bitter-phobic* consumers perceived it to be more bitter than *bitter-philic* consumers,

perhaps because of the difficulty of tasters separating two very strong sensations in this product, such as bitter and astringency, or maybe because of a real influence of astringency towards the perception of bitter taste; however, in our sample of tasters, we cannot say that *bitter-phobics* are more sensitive to bitter than *bitter-philics*, at least for the majority of foods.

Regarding tea, since the estimated intensity (i.e. remembered) was not statistically different between *bitter-philics* and *-phobics*, we expected that it would not be different, even during tasting. However, since the sample was made with a small amount of black tea without sugar (meaning that it is very bitter), it may be that the idea of bitter in tea is an average of the different types of tea tasted and that bitter remembered is some of the bitter tasted in this circumstance. Also, we thought that bitter liqueurs were discriminating between the two groups, as they were when the intensity was estimated; however, contrary to our expectations, this did not happen.

Besides, we set a new method of administration for PROP using cotton swabs (see Materials and Methods). We looked for possible associations between scores of bitter intensity of PROP and liking, estimated and perceived intensity for foods; however, also in this case, no data have shown any associations with real statistical significance ($p > 0.05$). Interestingly, tasted bitter intensity of PROP for the three groups *Bitter-philic*, *Medium* and *Bitter-phobic* consumers was the same on average, as if all consumers were medium-tasters. (Figure 4)

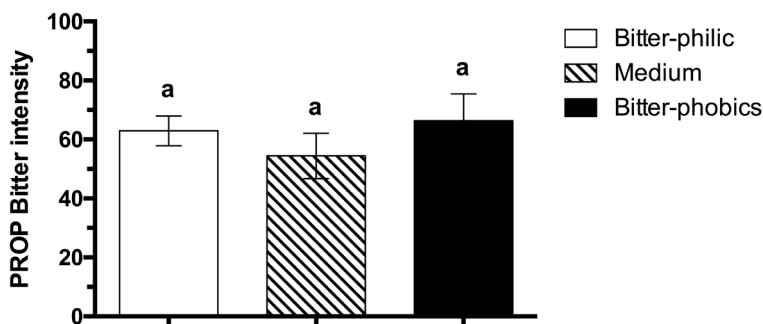


Figure 4: Perceived bitter intensity for PROP for *Bitter-philics*, *Medium* and *Bitter-phobics*

The lack of any kind of association between the score given when

PROP was tasted with other factors such as liking for bitter, the estimated intensity and perceived intensity when tasted make us think that we need to review the use of PROP as a standard (unofficially recognized) for sensitivity to bitter taste. Its usefulness to identify people who are completely “blind” to this type of stimulus (non-tasters) and persons for which it is unbearably strong (super-tasters) is certainly clear, but being a molecule that acts on the single T2R38 receptor, it would be inappropriate to generalize sensitivity to it to the whole bitter taste.²³ There are receptors with known ligands, such as receptors that are still “orphans” and unquestionably bitter molecules that apparently do not work on any T2R receptor known to date.

CONCLUSIONS

We performed an investigation into a group of young consumers, homogeneous for age and sex but with a very heterogeneous geographic origin, to investigate their liking for bitter foods and the perception of bitter taste intensity either generally or associated with 20 specific foods, using a questionnaire and sensory analysis to evaluate the perceived intensity to 6 chosen foods.

Liking results showed that the majority of consumers declare appreciating bitter tastes. Relying on memory, liking for vegetables is significantly higher among those who like bitter taste (defined *Bitter-philics*) than those who do not like it (defined *Bitter-phobics*) and is still very high, even among individuals who do not like it. In general, it seems that *Bitter-philics* are less “selective” than *Bitter-phobics* towards all considered food products.

In many cases, we noticed that it is not so much the bitter taste *per se* that discriminates against groups, as the intensity of the sensation of taste in general. Consumers hardly distinguish bitter from other “intense” stimuli such as astringency and hotness. This phenomenon could have a molecular basis, because bitter receptors and other receptors involved in gustation (e.g. some TRPs ion channels), despite having different structures and functions, can share cellular pathways. This, therefore, remains a work area where further studies are required.

There are no significant associations between likings for bitter

23 Roura et al. 2015: 40 (6), 427-35

in general and estimated bitter intensity, except for digestive liqueurs. It is not clear whether these are actually considered bitterer than other foods or if they are only imagined (remember) as such, perhaps because of the link between the name “digestive liqueurs”, “bitter liqueurs” and “bitter digestive”. This might be the case, since this association was not found when tasted.

Instead, we found a significant association for tea, which *Bitter-phobics* perceive bitter more intensely than *Bitter-philics*. Therefore, black tea could be a useful indicator to distinguish the two groups compared to digestive liqueur or other foods. Also in this case, we cannot exclude that astringency in some way affects the perception of bitter taste.

We observed that less liked foods are not necessarily the most bitter, so it seems that liking for bitter, expressed as a general concept, and liking of individual foods are not necessarily related. It thus seems that being *Bitter-philic* or *Bitter-phobic* does not depend as much on the intensity of the bitterness perceived in general, but that varies from food to food, and is probably modulated by other factors.

A new method for the administration of PROP was set up, which is more practical and simple, to classify non-taster tasters, medium tasters and super-tasters, and to evaluate their sensory perception in relation to food choices and preferences expressed through the questionnaire. What has emerged, however, is the lack of any kind of association between the score given when PROP was tasted with other factors such as liking for bitter, bitter estimated and perceived intensity. Under these considerations, we think it would be necessary to review the use of PROP as standard (unofficially recognized) for sensitivity to the bitter taste in general.

In addition, we believe it is simplistic to classify people into generic categories for the appreciation of the bitter as “*super-taster*”, “*medium-taster*” and “*non-taster*” based on the PROP-test only: as said, it is useful to classify people according to the functionality of the single receptor T2R38, but cannot, by extension, contain and classify all other receptors and their ligands. Moreover, T2R38 receptor is activated by synthetic substances and/or by substances such as glucosinolates, which are also active on TRPs receptors: these molecules often bring bitter tastes together with chemesthetic sensations, thus making them not very representative for this classification. Future research should look for new tests and selective substances for other bitter receptors that are more representative

of food choices.

It would be interesting to use the same approach as that outlined here as a starting point for a study on the impact of preferences for bitter taste on lifestyles and health, which provides, among other things, sampling of DNA from tasters to the ability to genotype them in relation to their bitter receptors, trying to determine whether there is a direct correlation between taste sensitivity and food choices and how genetics plays a role in these choices. It would also be interesting to investigate the potential correlation between sensitivity to bitter taste and other consumer behaviors (e.g., alcohol consumption, smoking habits, etc.) and between genotype, clinical parameters and possible pathologies.

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