7 Mental imagery in psychopathology: from the lab to the clinic

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Mental imagery is increasingly recognized as having an important role in relation to autobiographical memory and psychopathology. Autobiographical memories frequently take the form of mental images (Conway & Pleydell-Pearce, 2000; Tulving, 1984) and, as mentioned in Bernsten (Chapter 9) can be recalled both voluntarily or involuntarily as a normal part of everyday life (see also Berntsen, 1996; 2010). Autobiographical memory for most individuals demonstrates a positivity bias. For example, more positive memories are recalled than negative ones; individuals perceive a greater number of positive events than negative events as occurring in their lives; and the emotional affect of negative memories fades faster than for positive ones (Walker et al., 2003b). However, in psychopathology this bias can be disrupted. After trauma, involuntary mental images and memories, for example, of an intrusive image of a car crash or assault, can be distressing and disruptive. In depressed individuals it can become difficult to recall positive memories, creating an automatic bias toward more negative information and increasing negative affect. Mental imagery offers a possible route to alleviating distress in psychopathology by reducing the occurrence of negative imagery or boosting positive imagery and biases toward positive imagery and information.

Mental imagery, emotion, and autobiographical memory

Mental imagery has been described as the phenomenon of "seeing with the mind's eye," "hearing with the mind's ear," and so forth, by accessing sensory information from memory rather than from direct perception (Kosslyn et al., 2001). Neuroimaging studies have revealed that performing the same task either perceptually or via mental imagery activates predominantly the same brain regions, suggesting a high degree of overlap between these two systems (Ganis et al., 2004). In a sense, mental imagery can act as a substitute for perceiving real stimuli, to recollect past events and to simulate situations that have not yet happened. It even allows us to imagine situations that would be impossible to experience in real life.

Mental imagery can have a powerful impact on emotion (for a review, see Holmes & Mathews, 2010). Research into mental imagery suggests several reasons why this may be the case. First, mental imagery can evoke the same physiological reactions as experiencing an event itself, including increased heart rate, breathing rate, and skin conductance (Lang et al., 1993). Second, as discussed, visual mental imagery recruits similar brain areas as visual perception (Ganis et al., 2004). For example, when emotional faces are imagined, brain areas involved in emotion processing (e.g., the amygdala) are activated in the same way as when emotional faces are visually perceived (Kim et al., 2007). Third, autobiographical memories typically take the form of images (Rubin, 2006; Tulving, 1984) and there is a large overlap between the neural systems involved in recalling an autobiographical memory and those involved in imagining events (e.g., Schacter et al., 2007). Neural investigations of autobiographical memory show increased activation in emotion-related areas of the brain for autobiographical memory recall compared with semantic memory recall (Greenberg et al., 2005), and the extent of this activity has been positively correlated with self-reported levels of emotional intensity (Daselaar et al., 2008). Mental imagery can reactivate autobiographical memories containing similar content that bring with them the initial emotional response. Figure 7.1 provides an illustrative overview of the way in which imagery can impact on emotion. It suggests that relative to verbal processing, imagery has a greater overlap with perceived events and leads to heightened emotional states.

The involuntary recall of an autobiographical memory is often more emotional than voluntarily recalling an autobiographical memory (Rubin et al., 2008). A notable example in psychopathology is imagery-based flashbacks in posttraumatic stress disorder (PTSD; Ehlers et al., 2004; Hackmann et al., 2004). In PTSD the term "flashback" is sometimes used to describe an intense period of dissociation where the patient feels as though he or she is reliving a traumatic event. In clinical practice, however, these experiences are rare. We note that the new DSM-5 (American Psychiatric Association, 2013) makes a distinction between "recurrent, involuntary, and intrusive distressing memories of the traumatic event(s)" (Criterion B1) and "dissociative reactions (e.g., flashbacks) in which the individual feels or acts as if the traumatic event(s) were recurring" (Criterion B3). We use the term "flashback" throughout this chapter in an experimental psychopathology context (see Clark et al., 2014), that is, as an experimental analog of a broader clinically relevant memory phenomenon to encompass non dissociative intrusive memories of psychological trauma. Flashback-type mental images have also been identified in other psychological disorders. We refer the reader to Moulds

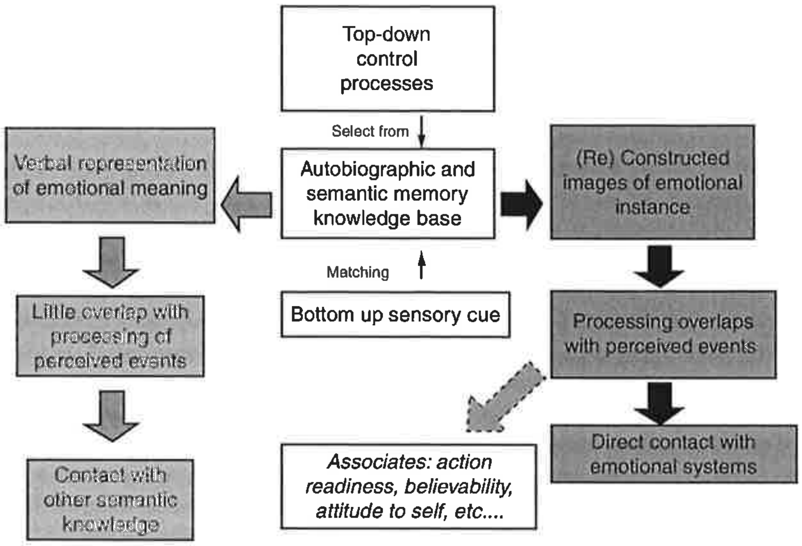

Figure 7.1 Pathway via which mental images of autobiographical memories, in comparison to verbal representations, can affect emotion (adapted from Holmes & Mathews, 2010; Pictet & Holmes, 2013).

and Krans (Chapter 8) for detail on intrusions across psychological disorders, but examples of psychological disorders with involuntary mental imagery include agoraphobia (Day et al., 2004), other phobias (Hackmann et al., 2000), bipolar disorder (Holmes et al., 2008b), and depression (Holmes et al., 2007a; Williams & Moulds, 2007). These involuntary mental images may be autobiographical, as reported in PTSD; may be of the future; or may have no time basis (e.g., Holmes et al., 2007a). They can also be positive for the individual as well as negative; in suicidal imagery an image of an event that might typically be constructed as negative is often perceived as being positive (Hales et al., 2011). Clinically, such involuntary mental images are thought to hold an important etiological role in psychopathology through their effect on emotion and behavior. As such they are a potential target for treatment.

Within the last decade there has been an expansion in translational research and clinical innovation targeting mental imagery in psychopathology. Imagery rescripting is an increasingly used technique within cognitive behavioural therapy and has been successfully used to target mental imagery in a range of psychological disorders (Giesen-Bloo et al., 2006; Hackmann et al., 2011; Holmes et al., 2007b). Within our research group we use an experimental psychopathology approach to develop interventions targeting mental imagery. Here we provide examples of two lines of research that aim to bridge cognitive science with clinical applications: flashback development and cognitive bias modification. We believe that this approach may help to develop evidence-based treatments for the future and can inform our theoretical understanding of autobiographical memory and mental imagery.

Flashbacks in the laboratory

A large body of research investigating flashbacks and flashback-type memories has been conducted in the context of patients with PTSD. Risk factors for PTSD consistently suggest that the subjective experience at the time of the trauma (i.e., peritraumatically) is important for predicting PTSD development (Brewin et al., 2000; Ozer et al., 2003). However, the very nature of a traumatic event makes real-world trauma difficult to study in controlled settings, particularly peritraumatically. Experimental designs using analog trauma offer an opportunity to investigate the development of flashbacks in controlled laboratory settings.

One way to study flashbacks in the laboratory is using the trauma film paradigm; a laboratory-based analog of trauma and its sequelae (for review, see Holmes & Bourne, 2008). On arrival at the laboratory, healthy volunteers complete questionnaires concerning their current moods and various participant characteristics (e.g., current depression levels and trait anxiety). Participants then watch a film with traumatic content designed to relate to the PTSD diagnostic criteria for a traumatic event, such as graphic scenes of human surgery, death, and real injury (DSM-5; American Psychiatric Association, 2013). Participants are asked to immerse themselves in the film and to imagine that the events being depicted are happening to them right at that present moment. During and after film viewing, questionnaires and tasks can be administered to study mood change, trait vulnerability, and other factors. Over the following week, participants are asked to record any flashbacks of the film in a simple diary, similar to those given to PTSD patients undergoing therapy (Grey et al., 2001; Holmes et al., 2004). In the diaries, participants record features of each flashback memory, including content (allowing it to be matched back to the film), emotion, and vividness. After one week participants return to the laboratory to perform a surprise memory test of the film content (see Figure 7.2 for an overview of the general procedure).

As an experimental analog of trauma, the trauma film paradigm is used across a variety of research groups (e.g., Dunn et al., 2009; Morina et al.,

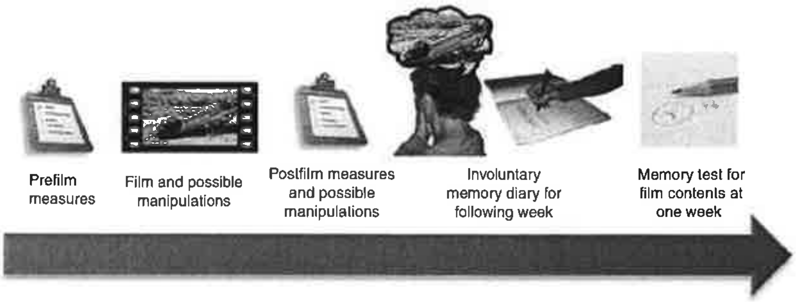

Figure 7.2 The general trauma film paradigm procedure used across studies.

2013; Verwoerd et al., 2011). The following section describes a series of experiments from our group that used the trauma film paradigm to systematically investigate the effect of cognitive tasks on subsequent flashback memory development for an analog trauma. It goes on to describe two broad approaches that seek to explain how cognitive tasks may help to influence negative memory development.

Memory encoding: cognitive tasks during a trauma film

Initial studies investigated whether playing a cognitive task during film viewing (i.e., memory encoding) could reduce flashback frequency. A series of trauma film paradigm experiments found that completing visuospatial cognitive tasks (such as practicing a complex, predetermined tapping sequence on a keypad held out of sight or modeling clay into geometric shapes) decreased flashback frequency after film viewing relative to no-task control conditions (Deeprose et al., 2012; Holmes et al., 2004; Stuart et al., 2006). In contrast, certain nonvisuospatial tasks (such as counting backward in 3s or 7s) when performed concurrently with film viewing did not decrease flashback frequency relative to a no-task control condition, and in some instances even *increased* flashback frequency (Bourne et al., 2010; Holmes et al., 2004).

Memory consolidation: cognitive tasks soon after a trauma film

Performing tasks to reduce flashback frequency during traumatic events is not practical in terms of real-world application. Memory formation, however, is not an immediate process, suggesting there may be a window of opportunity to affect flashback formation *after* the traumatic event has occurred. Following memory acquisition the brain undergoes a time-dependent process of stabilization (a cascade of molecular processes involving protein synthesis and the development of new synaptic connections) necessary for the memory to persist, referred to as "consolidation" (McGaugh, 2000). The neurobiology of memory suggests there is up to a six-hour time frame while memory consolidates, during which memory is labile and vulnerable to modification (Nader et al., 2000; Walker et al., 2003a). Performing cognitive tasks up to six hours posttrauma may therefore still reduce flashback frequency.

A series of experiments were performed to test this prediction. In the first experiment, playing the visuospatial computer game "Tetris" thirty minutes after watching a traumatic film reduced flashback frequency over one week compared with a no-task control condition in healthy volunteers (Holmes et al., 2009a). This finding was replicated in a second experiment, which also found that a verbal-based computer pub quiz game *increased* flashback memories despite being rated as equally enjoyable and challenging to play (experiment 1; Holmes et al., 2010). A third experiment extended the time frame between film viewing and game play to show that the protective effects of Tetris were still apparent when played four hours following film viewing (experiment 2; Holmes et al., 2010).

These experiments, by systematically building on previous laboratory work, were able to demonstrate that (1) ecologically valid tasks, such as Tetris, with visuospatial properties can be successfully exploited to reduce the buildup of flashbacks following (analog) trauma and (2) the effectiveness of such tasks is apparent when harnessed up to four hours following an event, consistent with the idea that memory is still labile and undergoing consolidation. Emerging research into memory *re*consolidation – the idea that a previously consolidated memory may become transiently labile, and therefore modifiable, following memory retrieval (Lee et al., 2006; Nader et al., 2000; Schiller et al., 2010) – offers a possible extended time frame for clinical intervention.

Mechanisms of flashback reduction

Models of memory differentiate between distinct memory systems in the brain (Henson & Gagnepain, 2010). Baddeley's model of working memory suggests a visuospatial system (the visuospatial sketchpad), a verbal system (the phonological loop), and a governing central executive (Baddeley, 1986; 1990; 2003). Studies using dual-task paradigms indicate that these systems are indeed modality specific (Cocchini et al., 2002) and have limited cognitive capacity to process information (Marois & Ivanoff, 2005).

Accordingly, findings from trauma film paradigm studies suggest that visuospatial cognitive tasks *selectively* compete for those resources needed to generate sensory-perceptual flashback memories, resulting in fewer flashbacks being experienced over the subsequent week (e.g., Holmes et al., 2010). Furthermore, nonvisuospatial (verbal-based) tasks may be ineffective at reducing flashback memories because they fail to occupy the type of image-based resources involved in flashback development. Such a shift toward more sensory-perceptual processing following a traumatic event is implicated in cognitive theories of PTSD for the development of reexperiencing symptoms (Ehlers & Clark, 2000). Subsequently, during flashback formation, reducing the power of mental imagery by occupying visuospatial cognitive resources may help to reduce flashback frequency.

These findings may be placed in the context of the model of mental imagery and autobiographical memory in Figure 7.1. We may hypothesize that using visuospatial cognitive tasks offers a "bottom up" approach to reducing flashbacks by occupying visuospatial resources, reducing the construction of emotional mental images of autobiographical events. This is in contrast to therapeutic approaches such as talking therapies, which may offer a more "top down" approach to reducing flashbacks.

However, there is also opposing evidence to such a "modality specific" hypothesis. An alternative theory is a "distraction hypothesis" (Bourne et al., 2010), which suggests that cognitive tasks may reduce flashbacks through a task's capability to sufficiently tap the resources of the central executive of short-term working memory, rather than a modality-specific subsystem. Thus, any task that sufficiently competes with the resources needed for an unpleasant memory to be held in mind will result in the degrading of that memory image (Gunter & Bodner, 2008; 2009).

In keeping with a distraction hypothesis, task complexity can also influence subsequent negative memory development. Complex tasks (e.g., complex tapping sequences) performed concurrently while holding a negative memory in mind are more effective at reducing later vividness and emotionality of the memory compared with performing more simplistic cognitive tasks (e.g., single key tapping; Engelhard et al., 2010; Gunter & Bodner, 2009). However, if the task is too complex, beneficial effects are no longer observed, possibly due to the task preventing the memory from being held in mind (Engelhard et al., 2011).

Thus an interesting dilemma exists as to whether it is the visuospatial properties of a specific task or the attentional demand of the task at a central executive level of working memory that impacts flashback memory development. However, it would seem that within the trauma film paradigm literature there is a consistent effect of visuospatial imagery-based tasks on reducing the frequency of flashback memories. Additionally, a modest relationship has been found between the vividness of emotional memories and participants' ratings of the memory emotionality after cognitive task performance (Engelhard et al., 2011). Theoretically, we can hypothesize how this may be placed in the context of the model in Figure 7.1; greater vividness of the memory, that is, stronger mental imagery, increases the overlap in processing with the original perceived event and increases emotion. Subsequently, reducing this relationship, either directly, by using visuospatial tasks to occupy resources in the visuospatial sketch pad, or possibly indirectly, by using complex tasks to occupy resources in the central executive, may help to reduce the imagery and frequency of the memory.

Clinical implications and future directions

Laboratory and analog studies provide a foundation for understanding the development of involuntary mental images in psychopathology and for developing novel interventions to treat, or even prevent, these symptoms. The next step is to begin translating these laboratory paradigms to clinical populations and clinical settings. We note that within PTSD there are already successful treatments for the full-blown disorder: eye-movement desensitization and reprocessing (EMDR; Shapiro, 1989) and trauma focused cognitive behavioral therapy (CBT; Ehlers & Clark, 2000; Foa & Rothbaum, 1998). The research in our laboratory aims to complement these successful treatments.

Studies are currently underway with the aim of translating treatment approaches for flashbacks from the laboratory to more clinical settings. Lilley et al. (2009) investigated the effects of a visuospatial task on mental images of trauma in patients with PTSD. They tested the effect of an eye-movement task in comparison to a verbal counting task or a no-task control on image vividness and emotionality, while participants held a traumatic mental image in mind. Consistent with studies using a trauma analog with healthy volunteers, a visuospatial eye-movement task reduced the vividness and emotionality of the image relative to both the verbal task and the no-task control condition. This provides preliminary evidence for the beneficial effect of visuospatial tasks in alleviating traumatic imagery in a clinical population, at least within the therapy session itself. Longer term effects remain to be explored. The current findings also support the possibility that the eye-movement techniques used in EMDR are effective due to their use of visuospatial resources, which reduces available resources for image-based memory formation. This is being examined further in an elegant body of experimental work by van den Hout and colleagues (2010; 2011; 2012).

Laboratory studies using the trauma film paradigm have also opened up new possibilities for preventing the development of posttraumatic stress symptoms in the immediate aftermath of trauma. At present, preventative treatments for PTSD are lacking (Roberts et al., 2009; Rothbaum et al., 2012). Critically, early reexperiencing symptoms (such as flashbacks) may predict later PTSD (O'Donnell et al., 2007). Findings from laboratory studies (as described above) showing that Tetris reduces flashbacks in the week after traumatic footage may hold potential as a preventative intervention after real-world trauma. Our team plans to test whether Tetris can be used with patients in an emergency department to reduce the development of flashbacks and posttraumatic stress symptoms after a road-traffic accident. If successful, further work may begin to develop this approach as a low-intensity, language-free preventative intervention to deliver in the immediate aftermath of trauma. For a discussion of other psychological interventions for PTSD, we refer the reader to Ehlers (Chapter 6).

Adaptations to the trauma film paradigm

The trauma film paradigm was recently adapted for use with functional magnetic resonance imaging (fMRI) to investigate the brain activity involved at the time of flashback memory encoding (Bourne et al., 2013). Brain activation was compared between "flashback scenes" (scenes remembered involuntarily in the seven-day diary), "potential" scenes (scenes that caused flashbacks in others, but not in that individual), and "control" scenes (scenes that never caused flashbacks). A widespread increase in activation was found for flashback scenes compared with both potential and control scenes, in regions including the amygdala (emotional processing), rostral anterior cingulate cortex (threat detection and attentional salience), and ventral occipital cortex (visual processing and mental imagery). Additionally, decreased activation for potential scenes compared with both flashback and control scenes was found in the left inferior frontal gyrus, an area typically associated with language processing, but also with selective attention, emotion, and autobiographical memory (see Figure 7.3). These results provide the first prospective evidence that the brain may react differently when encoding emotional memories that are later recalled involuntarily compared with emotional and nonemotional memories that are recalled only deliberately.

Not all involuntary images in psychopathology are negative. Individuals with bipolar disorder are thought to have an excess of positive

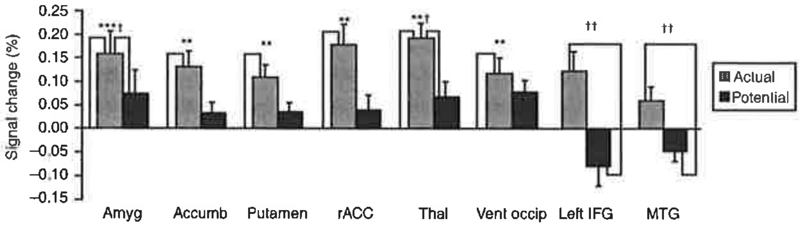

Figure 7.3 Mean percentage blood oxygen level dependent (BOLD) signal change for each brain region for flashback and potential scenes relative to control scenes. Actual scenes were those recalled as a flashback by that individual. Potential scenes were those scenes that caused flashbacks in other participants, but not in that individual. Mean value significantly different from that for the control scenes: ** $p < 0.01$, *** $p < 0.001$. Mean value significantly different from that for the potential scenes: † $p < 0.05$, †† $p < 0.01$. Amyg, amygdala; Accumb, accumbens; rACC, rostral anterior cingulate cortex; Thal, thalamus; Vent occip, ventral occipital cortex; IFG, inferior frontal gyrus; MTG, middle temporal gyrus.

(involuntary) mental imagery during (hypo)manic stages (Holmes et al., 2008b). Recently, the trauma film paradigm was adapted to look at responses to elated mood (as a result of viewing a positive film) and the occurrence of subsequent involuntary memories (Davies et al., 2012). Scenes included the excitement of a rollercoaster ride and the jubilation of finishing university final examinations. As with negative involuntary memories, playing Tetris reduced the occurrence of involuntary memories following the positive film. Further work suggests that positive involuntary memory frequency is associated with the individual's emotional response at the time of viewing the positive footage (Clark et al., 2013). Understanding positive imagery may be useful not only for disorders such as bipolar disorder, where the presence of positive images can facilitate hypomanic symptoms, but also for understanding how to increase positive imagery, for example, in depression, where positive imagery is lacking (Werner-Seidler & Moulds, 2011).

These adaptations to the trauma film paradigm continue to support the relationship between mental imagery, autobiographical memory, and emotion. Further, the relationship may be bidirectional: heightened emotions leading to more frequent involuntary autobiographical memories and flashbacks (Clark et al., 2014). Tailoring treatments to target mental imagery components of autobiographical memories in psychopathology may therefore help to reduce their effects on emotion.

Cognitive bias modification

Flashbacks to trauma provide a concrete target for mental imagery in autobiographical memory. However, across most psychological disorders there is not a distinct memory that can be targeted. Manipulating mental imagery even without an index event can still be effective. Cognitive bias modification (CBM; Koster et al., 2009) is designed to target information processing biases to investigate their direct effects on emotion and behavior. It has long been established that cognitive biases exist in autobiographical memory and typically do not represent a problem. However, there are some clinical disorders where certain cognitive biases may represent a causal factor. For example, biases in autobiographical memory have been implicated in clinical anxiety (Burke & Mathews, 1992), social phobia (Hirsch & Clark, 2004), social anxiety (Morgan, 2010), and depression (Kuyken & Dalgleish, 1995). Given that autobiographical memories often take the form of images and that mental imagery has a strong effect on emotion (Holmes & Mathews, 2010), targeting cognitive biases in autobiographical memory with mental imagery may be an avenue for treatment development within cognitive therapies for emotional disorders.

In depression, maladaptive appraisals are thought to maintain negative involuntary memories and depressive symptoms. Recent work adapted the trauma film paradigm to use a depressive film to induce involuntary images of an analog depression-related event. The study investigated the effect of altering an individual's cognitive bias toward involuntary memories on involuntary memory frequency (Lang et al., 2009). Participants were trained using cognitive bias modification to have either maladaptive appraisals about involuntary memories, for example, "Having an involuntary memory means *something* is wrong with me," or positive appraisals, for example, "Having an involuntary memory means *nothing* is wrong with me." In the week following film viewing, participants in the positive appraisal group experienced fewer involuntary memories of the depressive film compared with the negative appraisal group. These results suggest that maladaptive appraisals of involuntary memories may be a maintaining factor for depression and that promoting more positive, normalizing appraisals using simple computerized techniques may help to alleviate involuntary memories and other depressive symptomatology. Thus, by targeting cognitive appraisals we may be able to alter individuals' cognitive thinking styles and biases toward more positive information and memories.

How can we most effectively alter cognitive appraisals? Using mental imagery within cognitive bias modification has been shown to have stronger effects compared with using just verbal thinking. Holmes and Mathews (2005) asked participants to listen to initially ambiguous events that were resolved negatively under either imagery instructions (participants were asked to imagine the event happening) or verbal instructions (participants were asked to focus on the meaning of the words). In the imagery group, state anxiety scores significantly increased over the course of the experiment, while in the verbal group they did not. These results are not unique to negative emotions. When participants were given ambiguous sentences that resolved positively, those in the imagery group showed a greater increase in positive affect than those in the verbal group (Holmes et al., 2006; 2009b; Nelis et al., 2012).

A possible limitation of using ambiguous verbal sentences is that emotional differences may be due to the recruitment of additional cognitive resources in the imagery condition (imagery plus verbal resources) compared with the verbal condition (verbal resources only). To overcome this, picture–word pairs have been used in replacement of ambiguous sentences. Participants are asked to combine a picture and a word presented to them, therefore using equal imagery and verbal resources regardless of condition. When no specific instructions were given to participants concerning how to combine negative picture–word pairs, reports of imagery use positively correlated with the resulting emotional intensity, while no association was seen for verbal combinations (Holmes et al., 2008a). Additionally, when participants were given explicit instructions about using verbal or imagery techniques, imagery instructions led to greater increases in anxiety following negative picture–word pairs and greater reductions in anxiety following benign pairs. Further, positive picture–word pairs have been found to increase positive mood in dysphoric participants and their performance on a motivational behavioral task (a fishing game; Pictet et al., 2011).

The imagery and verbal distinction may be considered similar to that of "concrete" and "abstract" definitions of thinking styles as defined by Watkins et al. (e.g., Watkins et al., 2008). When a concrete thinking style is used, participants are instructed to focus their attention on the experience of their feelings, similar to when participants experience imagery. When using an abstract thinking style, participants are asked to think about the causes, meaning, and consequences, similar to that of a verbal condition. Interestingly, concrete thinking styles have been found to have a stronger effect on emotion than abstract thinking, similar to imagery and verbal conditions (Rimes & Watkins, 2005; Watkins & Moulds, 2005). For more details we refer the reader to Watkins (Chapter 10). Overall, it may be suggested that targeting appraisals using mental imagery has a greater effect than using more verbal thinking styles.

Cognitive bias modification and the clinic

The use of mental imagery in CBM has recently been extended to clinical studies. Blackwell and Holmes (2010) conducted a case series with seven patients with depression to test the effect of a CBM paradigm promoting positive imagery. Participants were asked to complete seven sessions of CBM over a one-week period with the first session guided by a researcher. The training involved repeated presentation of ambiguous scenarios, presented aurally through headphones, which were resolved positively. Crucially, participants were required to imagine themselves in the scenarios as they listened. Four of the seven participants showed improvements in interpretation bias and mood after one week, and improvements in depression symptoms were maintained at two weeks. Of the three participants who did not show improvements, one did not fully engage with the sessions and the other two reported using a verbal processing style, continuing to suggest that the use of mental imagery (as opposed to verbal processing) is important.

Lang et al. (2012) extended Blackwell & Holmes's (2010) study to a larger sample. Twenty-eight participants with depression completed a positive imagery-focused CBM condition or a control condition daily for one week. Participants in the positive imagery condition showed significant improvements in depression symptoms and interpretation bias compared with participants in the control condition. These studies therefore provide early clinical evidence for the potential of an imagery-based CBM paradigm as a novel computerized intervention for depression.

The next step in developing positive imagery-based CBM as a treatment for depression is to evaluate the intervention in a larger randomized controlled trial. In addition further experimental work is warranted. It is not yet clear how training positive imagery might improve mood and cognitive bias and thus reduce symptoms of depression (Browning et al., 2013). Future laboratory studies may begin to elucidate the mechanism of this emerging intervention. Nonetheless, it seems that cognitive bias modification using mental imagery may help train individuals to restore their positivity bias and improve their mood, offering a more "top down" approach to target emotions (see Figure 7.1).

Discussion and conclusions

This chapter has focused on the effects of mental imagery and autobiographical memories in psychopathology. Concentrating on two paradigms, we have reviewed work from our group progressing from the laboratory to more clinical settings. The trauma film paradigm has been used as an analog of trauma to further our understanding of flashback development and possible intervention approaches. Cognitive bias modification has been used in small-scale studies to demonstrate the potential of CBM to improve mood in depression, and it is hoped that larger scale clinical trials will be able to add to this evidence base.

Manipulating mental imagery has consequences for autobiographical memory and emotion in psychopathology. Figure 7.1 presented at the beginning of this chapter suggests that recalling an autobiographical memory in the form of a mental image leads to direct contact with emotional systems and increases in emotional processing. The research presented here focusing on flashbacks after trauma demonstrates that by directly engaging systems implicated in mental imagery we can reduce the frequency of emotional involuntary-based memories via a simple "bottom up" method using visual interference. On the other hand, rather than reducing images, we can seek to boost imagery in the context of depression via CBM. Using CBM we can encourage individuals to focus more on the (positive) emotional response to a situation or memory in repeated imagery exercises. Although these techniques are working in opposite directions – reducing negative imagery flashbacks versus boosting positive imagery in depression – they both harness the power and potential of mental imagery to manipulate emotion within the individual, demonstrating the strength and flexibility of mental imagery as an avenue for treatment for a range of psychological disorders.

Psychological science may be able to help answer clinical questions in regard to the treatment of psychological disorders. Understanding which treatments work, when they work, and how they work is essential for effective intervention (e.g., McNally et al., 2003; van den Hout et al., 2012). Further, psychological treatments for many disorders, including both anxiety and depression, have reached a plateau. The application of cognitive neuroscience to clinical treatments may help elucidate the active mechanisms of therapy and enhance current psychological treatments (e.g., Browning et al., 2010; McNally, 2007).

This chapter has restricted itself to two strands of work from our laboratory. The reader is strongly encouraged to look at the wider literature surrounding these topics, including other chapters in the current book and recent journal special issues (Hagenaars & Holmes, 2012; Holmes & Hackmann, 2004; Krans, 2011). Mental imagery in clinical autobiographical memory is a young and emerging field, and the future holds promise for exciting developments, especially those bridging basic and clinical science.

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