Published book chapter, *The Cambridge Handbook of the Imagination*:

Blackwell, S. E. (2020). Emotional Mental Imagery. In A. Abraham (Ed.), *The Cambridge Handbook of the Imagination* (pp. 241-257). Cambridge University Press.

Emotional Mental Imagery

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Emotional Mental Imagery

If you were to ask someone to describe the thoughts that went through their mind over the course of a typical day, and specifically those that took the form of mental images, you would discover that many of these had some kind of emotional tone. For example, someone might describe daydreaming about an upcoming holiday and enjoying the anticipated pleasure as they do so, replaying an argument with a friend and imagining how they wished they had responded, or being haunted by an image they saw on the television the previous evening. The idea that mental imagery, which can be defined as "representations and the accompanying experience of sensory information without a direct external stimulus." (Pearson, Naselaris, Holmes, & Kosslyn, 2015, p. 590), can have a powerful emotional impact will seem intuitive to many people: for most, the experience of emotional mental imagery will be a ubiquitous part of everyday life, and many emotional thoughts include the experience of mental imagery.

This chapter considers scientific research into the emotional nature of mental imagery, and why mental imagery can evoke emotion so strongly. It then considers the possible functions of such emotional mental imagery in daily life, before addressing how dysfunctions in emotional mental imagery may become problematic, for example in the context of depression and anxiety disorders. The ways in which we can make use of emotional mental imagery, for example in psychological therapy, are then discussed.

The chapter ends by returning to the broader topic of imagination. First, the question of what the scientific study of emotional mental imagery means for our understanding of the imagination is addressed, followed by a reflection on how considerations of emotional mental imagery can inform interdisciplinary research into the imagination. Finally, the chapter concludes by considering some of the major challenges for the current field of emotional mental imagery research.

Mental Imagery and Emotion

Although not all mental imagery is emotional, mental imagery is a form of thought that can have a particularly strong impact on emotion (Holmes & Mathews, 2005). The relationship between mental imagery and emotions has long been both the subject of scientific investigation (e.g., Golla, Hutton, & Walter, 1943), and capitalized on in psychological therapies (e.g., to reduce fear responses via imaginal exposure; Wolpe, 1961). However, it is only more recently that the assumption of a 'special relationship' between mental imagery and emotion has been systematically investigated (Holmes & Mathews, 2005). In an initial experimental study, Holmes and Mathews compared the impact on emotion of imagery-based processing of negative emotional stimuli (brief descriptions of situations that started ambiguously and ended negatively) to verbal processing of the same emotional stimuli. Imagery-based processing of the negative stimuli led to greater increases in state anxiety compared to verbal-based processing of the same stimuli, supporting the hypothesis that imagery has a greater impact on emotion than non-imagery (in this case verbal) based thought (Holmes & Mathews, 2005). This basic effect has since been replicated for both negative and positive emotional material and using several different experimental paradigms (e.g., Görgen, Joormann, Hiller, & Witthöft, 2015; Holmes, Lang, & Shah, 2009; Mathews, Ridgeway, & Holmes, 2013).

Why might mental imagery have the capacity to evoke emotions so strongly? A plausible explanation for this phenomenon comes from considering the cognitive and neural operations involved in the generation or retrieval of a mental image (Pearson et al., 2015). Image generation or retrieval can occur deliberately, for example if we want to mentally rehearse an upcoming job interview, or involuntarily, for example if a song playing on the radio evokes a special memory. Generation of mental imagery (for example, picturing an

interview room with a panel sitting across the table from you) involves the retrieval of the relevant sensory representations from memory, which may be simply re-experienced (e.g., when retrieving a memory of a specific instance), or re-combined with other representations and knowledge to produce an image of a scene or object that has never been experienced. In the case of preparing for a job interview, picturing the interview room with a panel sitting across the table from you may involve retrieving visual representations of specific faces, rooms, and furniture, to create a scene of a room with a panel of people whom one has never in fact seen or met. The sensory representations in the image may also involve senses other than vision, for example 'hearing' the panel posing a question and your own answer, 'feeling' the chair underneath you, and perhaps experiencing some of the bodily sensations associated with anxiety, such as tensed muscles. Other aspects of the scene in your imagination may include your inferences of the panel's reactions to your answers, and your own subsequent emotional responses.

Interestingly, imagining this scene and experiencing the sights, sounds, and other sensations in imagination will involve very similar patterns of neural activation as if the scene was being perceived and experienced in reality. The neural representation of mental imagery has been shown to be very similar to that of actual perception, even in relatively low-level areas of the visual cortex (Pearson et al., 2015; see also the chapter by Pearson, this volume). Evidence from both neuroimaging and behavioural experiments indicating the similarity of imagery and perception representations has led to the idea that mental imagery can be thought of as like a 'weak' form of perception (Pearson et al., 2015).

This overlap of representation is likely to account for one of the particular characteristics of mental imagery, that it can feel 'real' and even be confused with reality (Mathews et al., 2013); thus when imagining an emotional scene, the same emotions may be evoked (albeit generally with weaker intensity) as if the scene was actually being

experienced. The ‘realness’ of mental imagery is elaborated in Lang’s bio-informational theory of emotional mental imagery (Ji, Burnett Heyes, MacLeod, & Holmes, 2016; Lang, 1979), according to which the experience of a mental image activates an associative network of information as if the actual object or scene was being experienced. This information, which is automatically retrieved and activated, can include not only perceptual information (e.g., sights, sounds, smells), but also semantic information (e.g., factual knowledge), emotional responses (e.g., anxiety, with accompanying bodily reactions such as sweating or raised heart rate), and even preparatory motor responses (e.g., tensed muscles characteristic of the ‘fight or flight’ response). Emotional mental imagery can therefore be thought of as a simulation of reality (Ji et al., 2016). From this perspective, the idea that mental imagery has a special relationship with emotion could be seen as self-evident: mental imagery of emotional events often contains representations of emotional states, resulting in an experiencing of these states as part of the experience of emotional imagery. However, it is also possible to imagine emotional events without representing or experiencing any of the relevant emotional states.

Functions of Emotional Mental Imagery in Everyday Life

The idea that mental imagery allows us to simulate events in our imagination, and the properties of imagery-based thought, is key to understanding the functional roles that emotional mental imagery plays in everyday life (Blackwell, 2018). Mental imagery is often a core part of what is termed ‘mental time travel’, the process by which we replay in our minds events from the past, or play out possible events in the future. Such mental time travel, and simulation of the past and future more broadly, is thought to play an important role in everyday functioning, for example in planning and decision-making (e.g. MacLeod, 2017), and the processes of projecting oneself into the past or future appear to share many common

neural processes (e.g., Schacter, Addis, & Buckner, 2008; see also Chapters by Schacter & Addis, and by Suddendorf & Bulley, this volume). The 'as-if reality' nature of mental imagery (cf. Ji et al., 2016) and its tendency to evoke emotions means that we can not only re-experience events from the past when we recall them, including our mental state and emotional response at the time, but also 'pre-experience' possible events in the future. That is, by simulating a potential event via mental imagery, we can 'test out' in our mind the potential emotional consequences, for example how rewarding or anxiety-inducing it may be. This 'preview' can then inform our decision-making, and also contribute to our motivation to work towards ensuring the event occurs. For example, when thinking about different holiday options we might imagine ourselves already on holiday in the different locations; how enjoyable each holiday 'feels' in our imagination may influence our eventual decision. Similarly, if when we imagine an upcoming social event it feels enjoyable in our imagination, we may be more likely to make the effort required to attend. How easy or how difficult it is to imagine a specific event occurring, and the qualities of the image such as vividness or detail, may also influence our judgement about how likely the event is to occur (cf., Kahneman & Tversky, 1982); if we struggle to imagine something happening and the image we produce is only vague and dim, we may find it less plausible that the event will actually take place.

Recall and re-experiencing of past events may not only play important roles in guiding future behaviour (for example, by reminding us how enjoyable or unpleasant a particular activity was), but may also provide broader functions such as contributing to and reinforcing our sense of identity as a person (e.g., Conway, Singer, & Tagini, 2004; Stopa, 2009). Given the link between imagery and emotion, re-experiencing past events, or generating imagery of future events or other scenes can also be used to regulate mood and motivation. For example, recalling a positive memory can help improve someone's mood when feeling low, or imagining a soothing scene might help reduce anxiety.

Observational studies find that such ‘mental time travel’ is indeed common in everyday life, and often involves the experience of mental imagery (e.g., Berntsen & Jacobsen, 2008; D’Argembeau, Renaud, & Van der Linden, 2011). For example, one study investigating future-oriented thoughts found that participants on average experienced 59 (SD = 21) in one day (D’Argembeau et al., 2011). A similar study specifically investigating emotional future-oriented thoughts, that is those thoughts accompanied by an emotion, found that participants recorded on average 28 (SD = 18.7; range = 2 to 83) emotional future-oriented thoughts over a three-day period (Barsics, Van der Linden, & D’Argembeau, 2016). Although in both these studies the thoughts recorded were not exclusively image-based, on average they tended to have a substantial imagery component. Mental time travel can occur both deliberately – for example, one can deliberately try to recall a conversation and replay it in one’s mind – and involuntarily, as in the example of experiencing a memory triggered by hearing an old song on the radio (Berntsen & Jacobsen, 2008). Consistent with theoretical accounts of the functions of emotional mental imagery in daily life, people report perceiving emotional future-oriented thoughts as serving a purpose, such as helping plan actions, setting goals, emotion regulation, and decision-making (Barsics et al., 2016). Further, the emotions associated with future projections may have an important functional impact; for example, some studies have found the emotions experienced when anticipating an action to be related to the subjective probability that the action will indeed be performed (Barsics et al., 2016; Carrera, Caballero, & Muñoz, 2012).

In addition to these observational data, there is also evidence from experimental data for a functional role of imagery in relation to goal-directed behaviour. This evidence comes from a range of areas including social psychology (e.g., Libby, Shaeffer, Eibach, & Slemmer, 2007) and health psychology (Conroy & Hagger, 2018), and indicates that imagining engaging in a course of action can increase someone’s intention to perform that course of

action and even the likelihood that they do in fact later carry it out (e.g., Gregory, Cialdini, & Carpenter, 1982). Taken together, both the observational and experimental data support theoretical accounts that posit important roles for emotional mental imagery in goal-directed behaviour (e.g., Conway, Meares, & Standart, 2004; Kavanagh, Andrade, & May, 2005).

Dysfunctions in Emotion Mental Imagery

Given that mental imagery can have a strong impact on emotion, and emotional mental imagery appears to play an important role in daily life, it is perhaps unsurprising that dysfunctions in the experience of emotional mental imagery are often associated with severe emotional problems and functional impairment.

One way in which dysfunctional mental imagery often occurs is in the experience of intrusive distressing mental images, and such intrusions characterise a number of mental disorders. For example, people who have experienced a traumatic event may go on to develop post-traumatic stress disorder (PTSD), a hallmark symptom of which is the experience of recurrent intrusive memories of the traumatic event. These memories tend to be image-based and rich in sensory detail, and in their extreme form as ‘flashbacks’ are associated with the experience that the trauma is happening right now in the present moment. Intrusive memories of trauma are not only distressing in their own right, but can also contribute to other aspects of PTSD such as avoidance (for example of situations that may trigger intrusive memories) and dysfunctional coping strategies (such as excessive use of alcohol or other substances to regulate negative emotions). Intrusive memories of past events are also common in depression, and are typically memories that bring a sense of shame or humiliation (Reynolds & Brewin, 1998). Such memories can have a profound impact on the person’s mood, and also reinforce a negative sense of themselves, for example as worthless.

Intrusive negative imagery can also be of the future, for example ‘seeing’ a negative event happening to oneself or loved ones. Perhaps due to the ‘as-if reality’ nature of mental imagery, such future-oriented images (or ‘flashforwards’) can feel like a premonition, increasing anxiety and leading to (potentially maladaptive) behaviour designed to prevent the event from occurring (see e.g. Hales et al., 2014). The occurrence of such future-oriented intrusive imagery has been associated with higher levels of anxiety and lower levels of functioning across a range of mental disorders including anxiety disorders, depression, and bipolar disorder (e.g., Di Simplicio et al., 2016).

One particularly concerning kind of future-oriented imagery has been described in the context of depressed mood, and involves imagining the act of suicide or self-harm (e.g., Hales, Deeprose, Goodwin, & Holmes, 2011; Weßlau, Cloos, Höfling, & Steil, 2015). While on the surface the content of such imagery is negative, the imagery may be experienced by the individual in a positive way, for example as comforting or as presenting a solution to a problem, and participants in the research studies often report that the images feel particularly compelling. However, although the individual may experience a rewarding emotional response in the short-term, continued engagement in and elaboration of such imagery could potentially have harmful consequences. Particularly given the literature indicating that imagining an act can increase the likelihood of carrying it out, it is possible that repeatedly engaging in imagery of suicide could increase the risk of carrying out a suicidal act; consistent with this, suicidal ‘flash-forwards’ appear to be especially common in the context of bipolar disorder, which is associated with a relatively high rate of suicide (Hales et al., 2011).

Other kinds of dysfunctional emotional mental imagery include the experience of distorted mental imagery that can feel real and be interpreted as a reflection of reality, and such imagery appears across a range of anxiety disorders . One example is in the context of

social phobia, which is characterised by extreme anxiety in social situations and the fear that others are judging one negatively. While engaged in conversation, someone with social phobia may see in their mind's eye an image of themselves as they fear other people see them, perhaps shaking, blushing, and sweating. Such images not only increase anxiety and likely feed the individual's negative evaluation of how the interaction is going, but can also have negative impact on the quality of the social interaction (e.g., Hirsch, Mathews, Clark, Williams, & Morrison, 2005). People with phobias of specific objects or situations may also experience distorted imagery; for example someone with spider phobia may see, in their mind's eye, a spider as being much larger than in reality and even having sharp teeth (Pratt, Cooper, & Hackmann, 2004). Such distorted emotional imagery will increase the sense that the phobic object or situation is dangerous, increasing anxiety and further driving avoidance and escape behaviour.

While the above paragraphs have considered dysfunctional negative emotional mental imagery, dysfunction in positive imagery can also occur. Depression is associated with deficits in the quality of positive mental imagery (Holmes, Blackwell, Burnett Heyes, Renner, & Raes, 2016). For example, people who are depressed may tend to experience imagery from what is called the 'observer perspective', seeing themselves in the image from the outside, which appears to be associated with a reduced emotional quality of the image or memory. When people who are depressed or suffering from low mood imagine possible positive events in the future, the images they generate tend to be less vivid than those generated by people who are not depressed (Holmes et al., 2016). If emotional mental imagery makes an important contribution to how we evaluate the future, for example in trying to predict the outcome of a situation, or whether engaging in an activity will be enjoyable or not, a selective inability or difficulty in generating vivid positive mental images could contribute to

pessimism and hopelessness about the future, and reduce motivation to engage in potentially enjoyable activities – all of which are characteristic of depression (Holmes et al., 2016).

The *presence* of 'positive' mental imagery can also be problematic in certain circumstances, for example in the case of an imagined positive or otherwise attractive outcome that may drive maladaptive behaviour. For example, when people with bipolar disorder experience elevated positive mood, this can be associated with particularly attractive imagery of achieving desired goals (Ivins, Di Simplicio, Close, Goodwin, & Holmes, 2014), which can further drive goal-directed behaviour that may contribute to mood escalation into hypomania or mania. In substance abuse disorders, imagery of the desired substance (e.g., tobacco, alcohol, or another drug) can also feel attractive and compelling, and thus may also drive craving and attempts to seek out the substance (Kavanagh et al., 2005).

Individual Differences in Emotional Mental Imagery

In the same way as there is a large variation in how vividly people can imagine non-emotional scenes or objects, or how often such imagery comes to mind, there is also a large inter-individual variation in terms of the tendency to experience emotional mental imagery and its qualities. Interestingly, individual differences in the experience of emotional mental imagery can be specific to imagery of a particular valence. As indicated in the previous section, depression and depressed mood are associated with reduced vividness of positive future-oriented imagery, but this does not appear to be a general deficit in imagery vividness, as negative imagery may be equally vivid or even more vivid than that experienced by people whose mood is not depressed (Holmes et al., 2016). Conversely, people who are particularly optimistic about the future tend to generate particularly vivid positive future-oriented imagery, but optimism does not show such a clear relationship with vividness for negative imagery or general experience of non-emotional imagery (e.g., Ji, Holmes, & Blackwell,

2017). Individual differences in imagery perspective can also be observed, for example with low mood being associated with a greater tendency to use observer perspective imagery (Nelis, Debeer, Holmes, & Raes, 2013). It is not currently clear whether individual differences in the experience of emotional mental imagery are simply reflections of, for instance, depressed mood, or whether they do in fact represent risk factors for development of certain disorders (Holmes et al., 2016). However, given the roles of emotional mental imagery in everyday life, it seems plausible that individual differences in the extent to which someone can vividly imagine positive or negative events, or their tendency to experience such imagery in daily life, could have an impact on processes contributing to risk or resilience, such as optimism.

Making Use of the Properties of Emotional Mental Imagery

While much of the emotional mental imagery we experience occurs involuntarily, we can also use such imagery deliberately for a number of purposes. In fact, many people do deliberately use emotional mental imagery in daily life, for example reliving positive memories to improve their mood, or 'pre-living' events to which they are looking forward to enjoy the anticipatory pleasure. Within the clinical field, emotional imagery has been used in a number of ways across a range of psychological therapeutic approaches (Edwards, 2007). For example, within a cognitive-behavioural tradition, imaginal exposure to feared events or objects has long been used to reduce fear responses (e.g., Wolpe, 1961). Imaginal exposure can also be applied to memories, for example via reliving of trauma memories in the context of PTSD to reduce their emotional impact and change maladaptive appraisals of the event (e.g., Ehlers, Clark, Hackmann, McManus, & Fennell, 2005). Imaginal exposure makes use of the 'as-if reality' quality of imagery, and can lead to fear responses in much the same way as actual exposure would. Other imagery-based approaches make use of our ability to

recombine information from memory and novel information to create images of events that have never taken place. For example in ‘imagery rescripting’ the dysfunctional meaning and emotion of a distressing event are modified via re-imagining the event from different perspectives or with alternative endings (Arntz, 2012).

Approaching the problem of distressing negative mental imagery from another angle, it may be possible to reduce the occurrence or distress caused by such imagery by capitalising on the sensory representation of such imagery in memory. Due to the primarily visual nature of recurrent distressing images (such as those that characterise PTSD), interventions to reduce the occurrence of such memories can make use of the modality-specific limited processing capacity of our memory systems (Baddeley & Andrade, 2000). Thus, engaging in an activity that engages visuo-spatial working memory, such as directed eye movements, while recalling a distressing memory can reduce the vividness and emotional impact of that memory (e.g., Leer, Engelhard, & van den Hout, 2014). This is thought to be the working mechanism of one effective psychological intervention for PTSD, Eye Movement Desensitization and Reprocessing. Because memories of an event take a few hours to be ‘consolidated’, engaging in a visuo-spatial task, such as the computer game *Tetris*, shortly after witnessing distressing scenes can reduce the occurrence of intrusive memories of those scenes in the subsequent week (e.g., Holmes, James, Kilford, & Deeprose, 2010). There are preliminary indications that an intervention including playing *Tetris* may be able to reduce intrusive memories of a traumatic event, such as a road traffic accident (Iyadurai et al., 2017), and that benefits may even be experienced by patients with long-standing PTSD (Kessler et al., 2018). While this may seem surprising, these clinical applications represent a logical extension of theoretical ideas concerning mental imagery and corresponding experimental work. However, they are currently still in the early stages of development and evaluation.

Several recently developed approaches use systematic practice in imagery generation or retrieval to change maladaptive biases in information processing (Hitchcock, Werner-Seidler, Blackwell, & Dalgleish, 2017). For example, a number of different approaches have been developed that involve repeated rehearsal of specific kinds of memories to increase the ease with which helpful memories can be retrieved (e.g., autobiographical memory flexibility training; Hitchcock et al., 2016; competitive memory training; Korrelboom, de Jong, Huijbrechts, & Daansen, 2009; memory specificity training; Raes, Williams, & Hermans, 2009). From a future-oriented perspective, repeated rehearsal of a positive vision of oneself in the future has been investigated as a means to increase general optimism about the future (e.g., Meevissen, Peters, & Alberts, 2011). Furthermore, computer-guided repetitive practice in imagining positive outcomes for ambiguous situations has been investigated as a method to train a more positive cognitive bias in the context of depression (e.g., Blackwell & Holmes, 2010) or dysphoria (e.g., Pictet, Jermann, & Ceschi, 2016). Such methods are under development, but appear promising in terms of the potential to develop simple low-cost treatments, or treatment modules to be added to existing interventions, that capitalise on the properties of emotional mental imagery (Hitchcock et al., 2017). .

Emotional mental imagery may also deliberately be used to enhance motivation or help support changes in behaviour. The use of imagery to enhance healthy behaviour has been explored across a range of areas, for example in relation to healthy eating (e.g., Knäuper et al., 2011) or physical activity (Chan & Cameron, 2012). Repeated practice in imagining rewarding outcomes from everyday activities may also help overcome the lack of motivation and behavioural inactivity that characterises depression (e.g., Linke & Wessa, 2017; Renner, Ji, Pictet, Holmes, & Blackwell, 2017). Such imagery-based techniques, which often include an emotional component such as imagining the rewarding outcome of the behaviour, appear promising, but the factors that influence whether they are effective or not require much

further investigation (Conroy & Hagger, 2018). For example, simply imagining the rewarding outcomes of a course of action may in fact act as a substitute for the actual achievement and reduce motivation, and thus it may be useful to simulate via imagery not only desired goals but also obstacles to reaching them and how they may be overcome (e.g., Fritzsche, Schlier, Oettingen, & Lincoln, 2016). Theories of imagery from sports psychology differentiate different types of imaginal rehearsal (e.g., imagining achieving the desired goal vs. detailed imaginal rehearsal of a specific movement), which may have different functions and impacts on factors such as motivation and actual performance (e.g., Cumming & Williams, 2012). Similarly, many professional dancers report using different kinds of mental imagery for a wide variety of purposes in both training and performance (Hanrahan & Vergeer, 2001). Given the complexity of the cognitive operations involved in generating mental imagery, and the range of different kinds of responses – from emotional to behavioural and physiological – that emotional mental imagery may elicit, it seems likely that different applications of emotional mental imagery will benefit from specific tailoring, and this may vary greatly across different areas of health or types of everyday behaviour.

Implications for our Understanding of the Imagination

Consideration of emotional mental imagery has a number of implications for our understanding of the imagination. While the idea of the imagination as something that may be a vehicle for highly charged emotions has a long history outside of psychological research and treatment (e.g., in literature), the scientific study of emotional mental imagery provides a framework for understanding this phenomenon. Both theoretical accounts of emotional mental imagery and scientific investigations support the idea of mental imagery and emotion being tightly linked, and of emotional mental imagery providing a powerful route to experiencing and changing emotions. The scientific literature indicates that the experience of

emotional mental imagery will automatically activate representations of linked memories and emotional states, and even behavioural responses. Further, the 'as-if real' nature of mental imagery and its neural representation help to explain the potential impact of events that have only ever existed in the imagination. Indeed, experimental studies have shown that people can have intrusive memories of traumatic events that have never been actually experienced, only imagined (Krans, Näring, Holmes, & Becker, 2009), and intrusive images of feared future events (e.g., oneself or a loved one having a serious accident) can have a dramatic influence on behaviour (e.g., taking steps to reduce the risk, including superstitious behaviour).

It would therefore be helpful for studies of the imagination to consider whether the content or process studied is likely to involve the generation or retrieval of mental imagery, particularly when the content of the imagination is emotional. The potential impact of basic individual differences in the capacity to generate imagery of different valences, or in the qualities of emotional imagery could also be considered, as these may have a broader impact on the imagination. For example, people differ in their capacity to generate vivid images of positive or negative events (e.g., Di Simplicio et al., 2016; Ji et al., 2017), and this basic individual difference may then have a widespread impact in determining the content of their imagination and its emotional tone. The literature showing the effects of visuo-spatial tasks on emotional memory also has interesting broader implications (particularly given that people are often engaged in multiple concurrent tasks in daily life), as it could be the case that tasks engaging visuo-spatial working memory have a broader impact on dampening certain aspects of the imagination. Interestingly, there are lines of research that have drawn on broader links between emotional mental imagery and other aspects of imagination, for example the extent to which reading fictional texts elicits automatic retrieval of episodic memories and

accompanying emotion (Oatley, 2011), but there is clearly much more such interdisciplinary research to be done.

Implications for Interdisciplinary Research

From the perspective of the emotional mental imagery literature, a key implication for interdisciplinary research in imagery and imagination is the importance of considering whether the specific imagery under investigation is emotional or not. An extensive body of research into mental imagery, from a variety of disciplines including neuroscience, cognitive psychology and clinical psychology, has investigated the sensory experience of mental imagery or procedural aspects of its generation or manipulation, but much of this has either focussed on non-emotional imagery or has not differentiated between imagery that may be neutral, emotionally positive, or emotionally negative. However, there appear to be many important individual differences relating to the generation or experience of mental imagery of specific emotional valence (e.g., positive imagery amongst individuals with depression or low mood). Not differentiating between mental imagery of different emotional valences and intensity misses a key facet of the experience of such imagery, and risks drawing erroneous conclusions. For example, it may be concluded that there is a lack of influence of mental imagery ability on the subject of investigation when in fact the influence is valence-specific. Similarly, not attending to the potential valence characteristics of the questions in mental imagery questionnaires or other measures may result in conclusions being drawn about mental imagery in general that are in fact driven by emotional items in the measures.

A second key implication is that when asking a research participant about their thought processes or contents (e.g., in a questionnaire or interview), it is important to specify or enquire about the form that the thoughts take, for example whether they involve mental imagery or not. People may not spontaneously report mental imagery, particularly if the

content is emotional (cf. Blackwell, 2018; Hales et al., 2014), or may not indicate that a thought took the form of an image, unless they are specifically asked to do so. Differentiating between imagery and non-imagery based thoughts is necessary to avoid missing out on a potentially important individual difference with relevance for emotional experience.

A third and final implication to be drawn here concerns the observation that much of the mental imagery experienced in daily life occurs involuntarily, and that involuntary emotional imagery is common across many mental disorders such as PTSD, depression and bipolar disorder. Thus, although much research into imagery, across scientific disciplines, is conducted via asking people to deliberately generate mental images, consideration of imagery in imagination also needs to include imagery that comes to mind spontaneously, and to differentiate between deliberately generated and spontaneous emotional imagery.

Major Challenges in the Investigation of Emotional Mental Imagery

A long-recognised challenge in investigating emotional mental imagery is demonstrating that any effects found are specific to the image-based representation of the thought or memory under investigation, rather than generic effects of emotional thoughts or stimuli. While there are experimental studies that through careful construction of stimuli and instructions have tried to differentiate between imagery and non-imagery processing of the same stimuli (e.g., Görgen et al., 2015; Holmes & Mathews, 2005), many studies do not do this satisfactorily. This is in part because it can often be difficult to find a non-imagery equivalent processing mode for participants to use, and also because if another comparison (e.g., emotional valence) is of primary interest, adding in non-imagery versions of each manipulation doubles the number of experimental conditions and participants required. Further, even when instructed to engage non-imagery (e.g. verbal) processing of experimental stimuli many participants will automatically experience some (albeit reduced) amount of

imagery (e.g., Holmes et al., 2009), which makes a 'pure' imagery vs. non-imagery manipulation difficult to achieve. However, researchers always need to ask themselves whether a set of results can really be interpreted in terms of a specific effect of mental imagery, and, if not, how such a specific effect could in fact be demonstrated.

A second long-recognised challenge in mental imagery research is the desire to go beyond subjective report in assessing the quality of imagery generated or experienced. The development of neuroimaging methods has provided one means of doing this (e.g., Pearson et al., 2015), and if one is specifically interested in the emotional impact of imagery, then physiological measurement has long been used to this end (e.g., Golla et al., 1943; Mathews, 1971). However, simple behavioural measures are also desirable, and although objective behavioural indices of the vividness of emotionally neutral mental imagery have been developed (Pearson, 2014), similar objective performance-based measures isolating specific valences of imagery, or the emotional impact of imagery, would be extremely useful. Furthermore, such a measure should ideally be able to differentiate between imagery of different valences, and between imagery and non-imagery processing.

A third challenge concerns the investigation of involuntary mental imagery. While much of the mental imagery experienced in daily life is involuntary, studies investigating mental imagery and its effects often use measures or procedures relying on deliberate generation of imagery. Some lines of research have focussed on the experience of involuntary mental imagery (generally in the context of autobiographical memories) in both laboratory and everyday life settings. These may be of personal events (e.g., Berntsen & Jacobsen, 2008; Cole, Staugaard, & Berntsen, 2016) or standardised experimental stimuli (e.g., Holmes et al., 2010). However, these methods as currently implemented do not necessarily allow strict experimental control over whether the involuntary thought experienced at a specific moment is imagery or non-imagery based. Causal inferences are thus harder to draw than in studies

investigating deliberately generated imagery, in which someone can be instructed to use an imagery or non-imagery processing style in a particular moment. Developing methods to induce and elicit involuntary images and non-image based thoughts derived from standardised stimuli and observe their effects on relevant emotional and behavioural outcomes would be extremely helpful in this regard.

A final challenge to be mentioned here is reconciling theoretical predictions and statements about the important role of emotional mental imagery in everyday life, and the fact that the experience of mental imagery lies on a continuum, with some people experiencing little imagery in everyday life, or none at all. A simplistic interpretation of the emotional imagery literature might lead to the conclusion that a lack of mental imagery would lead to a life devoid of emotion, particularly past- or future-oriented; however, instances of people who are 'aphantasic' and experience no mental imagery at all show that this is not the case (e.g., Zeman, Dewar, & Della Sala, 2015; see also the chapter by Zeman, this volume). Further, although some studies find associations between general use or vividness of imagery and specific aspects of psychopathology (e.g., in relation to psychotic-like experiences; Aynsworth, Nemat, Collerton, Smailes, & Dudley, 2017), it is often the case that measures of non-emotional imagery use or experience show no relationship with aspects of psychopathology such as depression or anxiety (e.g., Di Simplicio et al., 2016). It may be that the relevance of emotional mental imagery for individuals is dependent on the extent to which they experience mental imagery at all, or that it is the relative accessibility and experience of positive or negative imagery (or perhaps functional versus dysfunctional) that is important for psychological health. Exploring the function and impact of emotional mental imagery across the range of individual differences in the general tendency to experience mental imagery in daily life could provide valuable insights.

Conclusions

For most of us, imagery is a frequent aspect of our mental experience in daily life, and much of this mental imagery is emotional. Emotional mental imagery appears to play a role in a number of important aspects of daily life, such as anticipating the future, decision-making, and planning. Conversely, dysfunctional experience of emotional mental imagery is associated with a range of problems from depression to anxiety. The properties of emotional mental imagery can be used for beneficial purposes both in everyday life, and in treatment of disorders such as PTSD and depression. Despite the explosion of research into emotional mental imagery in the last decade or so, there is a huge amount of work to be done in tying together a number of disparate research lines and overcoming some of the challenges in studying emotional mental imagery. However, emotional mental imagery is a fundamental aspect of imagination and this research can shed light on some of the richest aspects of human experience.

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