

# Examining Tensions in the Past and Present Uses of Concepts

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## Abstract:

Examining tensions between the past and present uses of scientific concepts can help clarify their contributions as tools in experimental practices. This point can be illustrated by considering the concepts of mental imagery and hallucinations: despite debates over their respective referential reliabilities remaining unresolved within their interdependent histories, both are used as independently stable concepts in neuroimaging experiments. Building on an account of how these concepts function as tools structured for pursuit of diverging goals in experiments, this paper explores this tension by re-examining the continued reliance of each concept on inverse characterisations inherited from the nominally-discarded 'mediator-view' of *sensory-like mental phenomena* (SLMP). In doing so, I seek to demonstrate how examining unresolved tensions can help highlight that entrenched associations can remain both integral to, and obscured by, the uses of concepts as goal-directed tools within experimental practices.

**Keywords:** *Conceptual tools; Epistemic goals; Inferential associations; Neuroimaging practices; Mental imagery; Hallucinations.*



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## Introduction

The concepts of mental imagery and hallucinations are each used, independently of the other, to individuate discrete forms of *sensory-like mental phenomena* (SLMP) for further investigation. These uses sit in tension with the unresolved debates over the reliability of distinguishing discrete forms of SLMP. While identified in earlier research (Smith 2018a), this tension has not been fully examined. To explore this tension further, I revisit one of the connections between the histories of these two concepts. This connection is the ‘mediator-view’ of SLMP – an expectation that SLMP function as a midpoint between perception and abstract thought (Smith 2018b). In re-examining the ongoing relevance of the mediator-view of SLMP, I seek to demonstrate that this tension reveals how entrenched associations can be both integral to, and obscured by, the structured uses of these two concepts as goal-directed tools in experiments.<sup>1</sup>

Mental imagery and hallucinations are both concepts that have received considerable attention, especially within histories of conceptual developments as relevant to specific disciplinary and social contexts.<sup>2</sup> While occasionally contrasted with each other, the primary concept of interest tends to be either mental imagery or hallucinations. Taking a more symmetrical approach, I built on these studies to compare how mental imagery and hallucinations are each used as a scientific concept in neuroimaging experiments (Smith 2018a; 2018b; 2019). Within this context, I used SLMP as an analytic category for any wakeful and endogenous mental phenomena experienced ‘as if’ perceived in one or more sensory-modality. For instance, visual SLMP are experienced ‘as if’ seen, auditory SLMP are experienced ‘as if’ heard, and so on for any sensations occurring in the absence of relevant perceptual stimuli.

At this point, familiarity with the ordinariness of mental imagery and the distress associated with hallucinations may suggest that these are distinct *experiences* of ordinary and pathological SLMP; I don’t dispute that. Instead, my aim is to explore how mental imagery and hallucinations are

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<sup>1</sup>This narrow focus is intended as a partial contribution to a specific field of research (on concept-use within experimental practices). I value methodological pluralism within historical and philosophical and sociological approaches to studying scientific practices – also see, Camilleri (2015), Chang (2014), Janet Vertesi (2015). My approach could be complemented by additional perspectives – from specialised historical and sociological studies that could enrich or challenge my descriptive account, to detailed philosophical and metaresearch interrogations of the various normative implications of this account.

<sup>2</sup> Many of these will be mentioned later. For a review of experimental approaches to investigating mental imagery more broadly, see Ganis and Schendan (2013). For an overview of neuroscientific investigations of hallucinations more broadly, see Jardri et al., (2013). As an example of exceptions to the trend, where concepts of mental imagery and hallucinations are used alongside each other, see Pearson and Westbrook (2015).

each *used* as scientific concepts in experimental practices. This exploration will therefore draw upon, and extend, my earlier argument that interrogating entrenched associations can contribute to understanding the structured uses of concepts as goal-directed tools within experimental research practices (Smith 2018a; 2018b). As such, while describing the uses of two neuroscientific concepts, the foundations of my approach are drawn from historical and philosophical studies of a wide range of scientific practices. Likewise, while my analysis is specific to individual neuroimaging experiments, it contributes to a broader collection of descriptive studies. As a collection, these highlight the philosophical importance of studying the diverse uses of scientific concepts in experiments more generally. However, given my aim of extension, I will not consider implications for more general accounts of scientific concepts at this time. Likewise, engaging in debates around the normative implications of accounts such as this are beyond the present scope.<sup>3</sup> Instead, to illustrate how localised descriptive accounts can contribute to broader normative questions, I will briefly outline how my account might converge with concerns expressed about the appropriate uses of concepts in neuroscientific practices.

My approach to studying concepts builds upon diverse accounts of conceptual practices that intersect via their descriptions of experimentally generated knowledge (Smith 2018a; 2019). As part of this, I adopt several views that extend our understanding of concepts beyond the more familiar questions of meaning and reference. Two of these are worth emphasising at the outset. First, concepts can function as more than simply mental or linguistic representational vessels for knowledge (Kindi 2012; MacLeod 2012; Nersessian 2012). In addition, concepts can be used productively regardless of whether there is ongoing disagreement about their referential stability (Bloch 2012b; Bloch-Mullins 2020; McCaffrey and Machery 2012). Viewed in these ways, concepts have been shown to contribute to the generation of knowledge in a variety of ways: concepts can mediate the interplay between theoretical and experimental practices (Bloch 2012a; Feest 2012); concepts can be theoretically polyvalent and still contribute to experimental practices (Arabatzis and Nersessian 2015; Schmidgen 2014); and concepts interact within the unpredictably emergent

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<sup>3</sup> As I discuss in Smith (2018a) section 1.1., my approach is positioned within a broader understanding of scientific knowledge as simultaneously contributing to robust accounts of real phenomena and contingent upon the situated practices within which individual knowledge-claims emerge. As such, it converges with those accounts of scientific concepts that support normative commitments requiring engagement in the situated contexts of scientific practices. For example, see Bloch-Mullins (2020) p.24. for a discussion of pluralistic realist views of concepts that do not assume natural kinds can be read off the world.

dynamics between human, material, and conceptual elements of investigative practices (Chang 2014; Pickering 2006).

These diverse accounts on the *uses* of scientific concepts each offer important insights. In addition, I found consistent themes to build upon in my comparative analysis of the concepts of mental imagery and hallucinations. In this, I developed a view of concepts as accrued bodies of shared knowledge that helped me to examine their uses as tools for individuating instances of a type of phenomena for pursuing specific goals within a given area of investigative practice (Smith 2018a). Trained in integrated approaches to historical and philosophical studies of scientific practices, I began by considering how the concepts of mental imagery and hallucinations each came to be used independently of each other in neuroimaging experiments (Smith 2018b). This historical context helped, in turn, to explain how equivalent findings about the neuroanatomical correlates of SLMP can be reported from experiment that nonetheless generate first-order knowledge claims that diverge depending on whether these SLMP were conceptualised as mental imagery or hallucinations (Smith 2018a). In this paper, I provide a more detailed exploration of a specific tension that is evident, yet not adequately examined, in these earlier accounts.

This tension emerges between the history of unresolved attempts to reliably differentiate discrete forms of SLMP, and contemporary uses of mental imagery and hallucinations as if each reliably refers to a discrete form of SLMP. For example, the concepts of mental imagery and hallucinations are each used independently of the other in neuroimaging experiments; uses that take for granted the reliability of each concept for individuating instances of SLMP specifically relevant to their divergent goals. This tension draws attention to the interdependent sets of characteristics that uses of these concepts simultaneously rely upon and obscure. On the one hand, when used to individuate SLMP of interest, these characteristics reinforce entrenched mediator-view associations about the distinction between functional and dysfunctional SLMP. At the same time, each set of characteristics can be applied flexibly to obscure the continued reliance on the mediator-view associations thought to have been discarded. By appreciating these dynamics, this tension can be understood in relation to the goal-directed uses of each concept: investigating the role of SMLP in normal cognitive function or cognitive dysfunction, respectively.

As this paper builds on existing accounts of conceptual practice, I begin by outlining the key descriptions of scientific practices supporting my examination of concepts as goal-directed tools. Having reprised my analytic approach, Section 2 describes contemporary uses of two concepts as goal-directed tools for investigating SLMP in individual neuroimaging experiments. As part of this, I



outline the inverse characterisation of the forms of SLMP conceptualised as mental imagery and hallucinations. These inverse characterisations highlight friction between two aspects of conceptual practice: uses of mental imagery and hallucinations as stable concepts for individuating experiences of SLMP for further investigation; and unresolved questions about the referential stability of any specific conceptualisation of SLMP. While not necessarily problematic itself, this friction draws attention to an unresolved point of tension between the past and present conceptualisations of SLMP. Therefore, Section 3 revisits some of the historical conditions within which inverse characteristics emerged to help individuate instances of those SLMP conceptualised as mental imagery and hallucinations.<sup>4</sup> Leaving aside the details, I focus on re-examining how these characterisations reflect the mediator-view associations I previously identified as connecting these two concepts (Smith 2018b). I will then sketch two additional historical developments: unresolved disputes over how to characterise discrete forms of SLMP; and uses of the concepts of mental imagery and hallucinations that explicitly discarded the mediator-view of SLMP.

In Section 4, I examine this tension with a more nuanced appreciation of the ongoing relevance of the mediator-view of SLMP. As part of this, I describe how entrenched mediator-view associations provide a limited yet flexible array of possible sequences for the complementary inferential components of each concept when used in individual experiments with distinct goals. Extending my earlier account, I propose that examining the inferential role of a concept can help reveal how entrenched associations structure the uses of that concept for specific goals. In doing so, I seek to illustrate how examining unresolved tensions can help highlight that entrenched associations can remain both integral to, and obscured by, the uses of concepts as goal-directed tools within experimental practices.

## **1 Descriptive Accounts of Concepts as Goal-Directed Tools**

This paper draws upon, and extends, my earlier account of how entrenched associations help structure the uses of hallucinations and mental imagery concepts as goal-directed tools within neuroimaging research practices (Smith 2018a; 2018b). This earlier account built upon a wide range of existing literature on the dynamics of conceptual practices. Therefore, while detailed elsewhere, key insights from this area of scholarship are worth reiterating. Firstly, I am drawing on Uljana

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<sup>4</sup> It is important to note that, in focusing on one connection, I am obscuring the rich tapestries of sociological and technological contexts required to understand the broader historical developments that gave rise to each concept.

Feest's (2010) description of concepts as *tools* that can be used for individuating instances of a given type of phenomena for further investigation. In this context, to individuate something is to single it out by distinguishing it from other phenomena of the same (broader) kind. For example, Feest (2010, 173) describes scientific concepts as individuating a type of phenomena for further investigation by delineating instances of that phenomenon from other classes of phenomena within an available body of knowledge. Likewise, in examining the characterisation of different forms of SLMP, I follow Corinne Bloch (2012a, 215), who highlights how the process of individuation involves articulating the characteristics that delineate the phenomena of interest from potentially related types of phenomena.

This process of individuation is able to be based on the reference, inferential role, or epistemic goal of a concept – or any combinations thereof (Bloch-Mullins 2020, 10). This view builds on Ingo Brigandt's (2002, 4) proposal that concepts need to be analysed in terms of three distinct components of semantic content: a reference (the kinds of entities, properties, or processes a concept refers to); an inferential role (connecting beliefs about *how a concept can be used* to support the inferences and explanations between the concept and other concepts within a given language community); and an epistemic goal (the standards that set what a concept can be *used for* within a given investigative context). In addition to helping account for conceptual change, articulating these components of concepts aids our understanding of contemporary conceptual practices. As Brigandt (2012, 78) details, the inferences made possible by a concept embody the conceptual relationships supporting the use of that concept to investigate and explain the target phenomena of interest. In addition, the epistemic goal of a concept functions as the standards by which any changes to the referential and/or inferential components of a concept are deemed epistemically warranted in a given context (Brigandt 2010, 24).

To understand *how* concepts are used, the inferential role of a concept should therefore be considered relative to the context-specific epistemic goals the concept is used *for*. This distinction highlights the potential variance in the relationships between debates about the referential stability of a concept, the inferences and explanations supported by a concept as used in practice, and the epistemic goals that set the standards for what can be investigated by using these concepts in different contexts. As detailed later, tensions between these aspects of conceptual practice can contribute to our understanding of how concepts can function as stable tools within experimental

practices even while debates over referential reliability remain unresolved within the broader discourse.<sup>5</sup>

In addition to these specific insights, I also draw on several broader areas of existing research: studies on how scientific concepts can be used as tools that *enable* scientific practices (Bloch 2012a; Boon 2015; Feest 2010; 2012); studies of the historically situated epistemic goals that certain scientific concepts were appropriate for pursuing (Brigandt 2012; Steinle 2012; MacLeod 2012); accounts of the structured associations between concepts (Andersen 2009; 2012); and studies highlighting how associations accrue as sediment that can structure the uses of concepts during the dynamics of investigative practices (Chang 2014; Pickering 1995; Steinle 2010). In previous approaches to building on these areas of scholarship, I developed an account how the concepts of mental imagery and hallucinations are structured for use as tools in investigative practices with specific epistemic goals (Smith 2018a). As part of this approach, I examined the past and present uses of the concepts of mental imagery and hallucinations. In doing so, I found that the current independent uses of these two concepts sit in tension with the longer history of unresolved disputes over how to reliably differentiate between discrete forms of SLMP within the broader literature.

Now, to re-examine this tension, I draw on existing accounts of conceptual practice and their integration into my own approach. In addition, I seek to draw on the specific insights outlined here to extend my earlier approach by exploring how entrenched associations structure the space of inferential possibilities within which a concept can be used even when the referential component remains in doubt. As outlined earlier, this extension will be detailed in Section 4. First, it is important to appreciate the uses of the concepts of hallucinations and mental imagery as goal-directed tools in contemporary experiments (Section 2), and revisit some of the historical context for these practices (Section 3).

## **2 Using the Concepts of Hallucination and Mental Imagery as Independent Tools**

Experiences of SLMP correlate with changes in neural activity localised to specific brain regions, with many of these correlations being reported regardless of whether an experiment investigated

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<sup>5</sup> Note that, while used as stable tools in individual experiments, there are longer-term processes of epistemic iteration through which different components of the concepts of hallucinations and mental imagery each changed piecemeal – a process through which each has been modified by their contributions to investigative practices, as I have detailed previously (Smith 2018a).

experiences of mental imagery or hallucinations. Given this, findings from contemporary neuroimaging experiments often support knowledge-claims that implicate the same brain-regions in experiences of both mental imagery and hallucinations (Smith 2018a).<sup>6</sup> This overlap is not surprising in and of itself. The usual explanation is that these overlaps are due to similarities in low-level sensory processing common to both mental imagery and hallucinations; typically some, as-yet unidentified, top-down regulatory mechanism is then proposed to explain the expected distinction between mental imagery and hallucinations (Allen et al. 2008; Hill and Linden 2013). However, in examining a decade of published neuroimaging experiments that used the concepts of either mental imagery or hallucinations, I found that brain regions implicated in both types of SLMP were never recognised as such at the time (Smith 2018a). Instead, even when reporting findings about regions previously implicated in multiple types of SLMP, the findings were taken to support diverging knowledge-claims about the unique mechanisms underlying either the functions of mental imagery, or a specific dysfunction responsible for hallucinations.<sup>7</sup>

Two fMRI experiments offer an example of how an equivalent finding can support diverging knowledge-claims: one claim in an investigation using the concept of mental imagery and another claim in an investigation using the concept of hallucinations. When published, each experiment reported an equivalent finding in terms of SLMP: that an increase in *superior temporal gyrus* (STG) activity occurs during auditory SLMP experiences (compared to non-SLMP experiences). However, in reporting these findings, neither article acknowledged the potential that the correlation between SLMP and the change in STG activity might be relevant to low-level sensory processes shared by both mental imagery and hallucinations in the auditory modality. Instead, in the mental imagery experiment, the finding contributed to a claim that functional mechanisms of auditory imagery are distinct from the mechanisms underlying imagery in other sensory modalities. Meanwhile, in the hallucinations experiment, the finding contributed to the claim that auditory hallucinations are due to dysfunctions in processing auditory perception. In each article, additional data contributed to

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<sup>6</sup> While there are various types of knowledge-claims, here I am exclusively referring to *first-order* knowledge claims – those ‘unit contributions... of scientific development’ that, if incorporated into the structure of the relevant scientific discipline, can become accepted as scientific facts – see Leydesdorff (1991) p.75.

<sup>7</sup> Note that ‘mechanism’ here can be understood as the causal account of how neurocognitive processes might explain the mental phenomena under investigation. There are other uses of the concept of ‘mechanism’ in biology, see Nicholson (2012). There are also a range of philosophical questions raised by the role of mechanistic-approaches to investigative practices – for examples, see Colaço et al. (2015) and Machamer et al. (2000).

these contrasting knowledge-claims. Even so, after examining many such examples this was the pattern that emerged – equivalent findings supported diverging knowledge-claims (Smith 2018a).

Examining this pattern in more detail, I found that the uses of each concept carried a range of assumptions and expectations that played crucial roles throughout the design and implementation of individual experiments (Smith 2018a). In examining the contributions of these concepts to the documented experimental practices, I drew on several accounts of conceptual practice. In doing so, I described how these concepts function as tools for individuating discrete types of SLMP for further investigation; a function that contributes to the ways that data is generated in alignment with different epistemic goals. Firstly, experiments investigating mental imagery contributed to the broader goal of understanding the role of ordinary experiences of SLMP in neurocognition. Meanwhile, the concept of hallucinations was always used with the goal of investigating SLMP as dysfunctional neurocognitive processes; with a range of ordinary functions put forwards as candidates for this disruption.

While differing goals may reflect contextual factors, this alignment persisted across disciplinary divides, publication contexts, differing theoretical commitments, and various technical considerations. This suggests that, while these two goals were typically pursued independently of each other, the entrenched associations carried-along by each concept cut across the semi-permeable disciplinary boundaries within the broader investigative context of the wide range of neuroscientific researchers using fMRI techniques to investigate SLMP. Taking these variables into account, examining the epistemic goals associated with each concept provides a way to study the uses of that concept within a given investigative context; rather than simply explaining the role of the concept when tied to the theoretical dynamics within a given discipline.

To highlight the value of recognising the uses of concepts within specific investigative contexts, I want to draw attention to the typical characteristics associated with each concept. As outlined in Table 1, mental imagery SLMP are typically characterised as what SLMP conceptualised as hallucinations are not, and vice-versa. Mental imagery conceptualises those SLMP characterised as being deliberate experiences, located ‘inside the head’, with a degree of vividness that sufficiently resembles perception without being confused for it. Hallucinations, in contrast, are characterised as those spontaneous and abnormally-vivid SLMP, experienced as persistent and external (originating within perceptual space), that tend to be attributed to a non-self-source.

As highlighted by Table 2 and Table 3, the inverse sets of characteristics attributed to those SLMP conceptualised as either mental imagery or hallucinations have proven unreliable at

differentiating between ordinary and pathological forms of SLMP (Smith 2018a). Despite these challenges, the concepts of mental imagery and hallucinations continue to be used, independently of each other, to investigate ordinary and pathological SLMP respectively (Smith 2018a). This leads to friction when these different aspects of conceptual practice intersect. However, rather than critique this current friction, I instead seek to examine the longer-term tension it draws attention to. This tension is best understood by contextualising current uses of mental imagery and hallucinations as stable concepts by positioning them in relation to historical failures to establish the referential stability of any specific conceptualisation of SLMP. Therefore, in the next section, I revisit some of the historical conditions within which the inverse characterisations of mental imagery and hallucinations emerged.

### **3 A Past of Interdependent Conceptual Associations**

There are many accounts of the historical development of the concept of mental imagery (Bower 1984; Cocking 1991; MacKisack et al. 2016; Roেকেlein 2004; Waller et al. 2012). The concept of hallucinations has also received considerable attention (Aleman and Larøi 2008; Berrios and Marková 2012; Peyroux and Franck 2013; Sarbin and Juhasz 1967). When examined together, these histories can be seen to intersect in ways that remain relevant to the current uses of each concept – including the influence of the ‘mediator-view’ of SLMP (Smith 2018b).

This mediator-view also has a long history that pre-dates these two concepts: attempts to differentiate discrete types of SLMP within classical Greek works drew on mediator expectations of SLMP; similar accounts of SLMP can be found within a range of Arabic and Christian philosophies; while empiricist philosophical traditions of the nineteenth century present the mediator-view in its most recognisable form (Smith 2018a). As outlined above, this mediator-view positions SLMP as a midpoint between perception and abstract thought. This view of SLMP rests upon a series of associations about the ability of a reasonable person to make accurate judgements about, and regulate, bodily sensations. According to this series of associations, experiences of SLMP that are more persistent or vivid are assumed to be more difficult to control. In addition, characteristic types such as location, insight, and attribution, all position pathological SLMP as the result of an individual’s inability to recognise their ordinary SLMP as such and/or their failure to appropriately regulate these sensory experiences. Given this series of associations, ordinary and abnormal SLMP can be differentiated by the presence or absence of various typical characteristics (Table 1).

It was these mediator-view associations that provided the dominant body of knowledge about SLMP seen within early scientific investigations using the concepts of mental imagery or hallucinations (Smith 2018b). In the case of mental imagery, some early studies documented individual variability in SLMP descriptions – including a sizeable minority not reporting imagery experiences at all (Betts 1909). Despite this variability, memory and imagination were nonetheless considered to require SLMP (Bower 1984; Roewecklein 2004; Faw 2009). This approach reflected the established characterisations of valued forms of SLMP within the dominant philosophical and religious traditions of the time. For example, the resemblance to perception of vivid imagery was proposed to underlie memory, while the manipulable and dismissible control over such imagery was taken to explain how imagination could adequately serve abstract thought. Meanwhile, following Jean-Etienne Esquirol’s proposal of hallucinations as a concept for over-excited memories and imaginations in the late 1800s, undesirable SLMP were increasingly investigated in relation to failures in judgement during cerebral over-excitation (rather than as false perceptions or damage to the senses) (Esquirol 1845). As this approach developed, these inverse sets of characteristics provided a justification for conceptualising those SLMP found in clinical contexts as dysfunctional mental imagery. In short, the inverse characteristics provided proxy criteria for explaining how a required element of thought could come to threaten our ability to judge the validity of our perceptions in socially acceptable ways.

Although continuing within some philosophical traditions, the mediator-view of SLMP was effectively abandoned by scientists using the concepts of mental imagery or hallucinations during the 20<sup>th</sup> century (Smith 2018b). On the one hand, scientific uses of the concept of hallucinations shifted away from investigating abnormal SLMP as dysfunctional forms of mental imagery. Instead, investigations shifted towards exploring whether SLMP are caused by disruptions of a range of other ‘normal’ functions – sensory-processing, language pathways, executive-functions, and so forth. Along the way, the concept of hallucinations was increasingly used without any reference to that of mental imagery at all.

Meanwhile, scientific uses of the concept of mental imagery that had started out framed by their necessary role in thought were later demoted, with mental imagery even being dismissed as an unnecessary or childish pastime during the imageless-thought debates that culminated in the

1930s.<sup>8</sup> Along the way, the mediating position between perception and abstract thought was subtly replaced, with behavioural responses emerging in roles previously given to mental imagery. For example, investigations of mental experiences – and terms such as mental states, mind, and imagery – were all discarded in favour of analyses of behavioural stimulus and response as habit formation (Watson 1994, 250).

When eventually revived for use as a scientific concept within cognitive psychology, mental imagery came to be regarded as merely one of the many forms in which sensory-data can be represented in thought (Smith 2018b). During this revival, the concept of mental imagery was primarily used to investigate ordinary SLMP. For example, investigations on the role of imagery in cognition often focused exclusively on *visual* imagery. This contributed to distancing the SLMP of interest from those SLMP conceptualised as hallucinations (which were primarily being used to investigate the pathologies of SLMP in the *auditory* modality at that time).<sup>9</sup>

In this way, inverse characterisations of these two concepts continued to help individuate the specific SLMP of interest and there was little appetite for reviewing their reliability. These characteristics therefore remained part of the inferential component of each concept even as the mediator-view was dismissed as irrelevant to the independent investigations into functional and dysfunctional SLMP, respectively. In addition, the inherited assumptions justifying these inverse sets of characteristics became entrenched, with the relevant set of characteristics implicitly providing key phenomenological descriptions when defining each concept (Smith 2018a).

As each concept stabilised for use in investigations that were independent of the other, additional attempts to characterise the boundaries of the SLMP-of-interest generated a range of proposals for in-between conceptualisations of SLMP (Table 2). Drawing on Hanne Andersen (2012), each of these proposals can be understood as a ‘graded’ SLMP concept: a conceptualisation of anomalous SLMP that combines features of both mental imagery and hallucination while nonetheless remaining distinct from both of these more established concepts.<sup>10</sup> For example, in

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<sup>8</sup> For a more detail, see Smith (2018a). Also note the broader interconnected factors contributing to this ‘fallow’ period of research on mental imagery: rejections of introspective techniques as subjective; behaviourism in psychology; a ‘turn to language’ within analytic philosophy; and increased scepticism of quasi-perceptual experiences in philosophical phenomenology. Also see: Holt (1964) pp.259-259; Kind (2001) pp.85-86; and Pearson (2014) pp. 178-179.

<sup>9</sup> Given this, I was sensitive to SLMP modality during comparative analyses in Smith (2018a) and it should note that, despite some interest in modality-specific mechanisms, expectation of modality-independent mechanisms persist with claims about one modality were sometimes generalised to all modalities.

<sup>10</sup> Hanne Andersen (2012) describes how ‘graded structures’ are used by different members of the scientific community to explain why anomalies in the ‘no-overlap rule’ do not challenge a given conceptual structure. I detailed how the notion of ‘graded concepts’ fits within my account in Smith (2018a).

attempts to clarify the disputed definitions of ‘true’ pathological hallucinations during the twentieth-century, competing proposals for ‘pseudohallucinations’ were introduced (Walker 2013). One such proposal, by Kurt Jaspers, clumped together all those SLMP experienced as abnormally vivid (like hallucinations) even if those SLMP were located ‘inside the head’ (like mental imagery) (Peyroux and Franck 2013; Taylor 1981). Another proposal, by Alvin Goldstein, tried to account for those subjects who retained insight (about the unreality of SLMP) despite these phenomena otherwise having all the characteristics of ‘true’ hallucinations (Walker 2013). Meanwhile, there were reports of abnormally vivid visual SLMP experienced as projected into perceptual space despite being voluntary, controlled, and recognised as distinct from actual perceptual stimuli (Gray and Gummerman 1975). Treated as a childish oddity, this type of phenomena came to be referred to as ‘eidetic imagery’ – a new conceptualisation of SLMP considered distinct from *ordinary* mental imagery.

As these examples suggest, the typical characteristics relied upon to distinguish between mental imagery and hallucinations (and other conceptualisations of SLMP) are neither sufficient nor necessary for distinguishing between desirable and undesirable SLMP (Smith 2018a, sec. 3.3). Despite this, mental imagery and hallucinations continue to be used for investigating discrete types of SLMP. Meanwhile, additional graded-concepts continue to be proposed for those SLMP that fail to fit into the dominant binary provided by the concepts of (benign) mental imagery and (pathological) hallucinations (Table 3). These attempts echo earlier overlapping descriptions of proposed in-between forms of SLMP such as pseudohallucinations and eidetic imagery. For example, there have been various attempts to differentiate the non-pathological (benign) hallucinations reported within ‘normal’ populations from those hallucinations diagnosed in clinical contexts (e.g., Copolov, Mackinnon, and Trauer 2004; Faccio et al. 2013).<sup>11</sup> Likewise, there are ongoing attempts to distinguish between ordinary (benign) mental imagery and various intrusive or otherwise unwanted imagery identified as distressing within clinical populations (e.g., Beaman and Williams 2010; Brewin et al. 2010). In each case, the concepts of mental imagery and hallucinations tend to be used independently of each other; with the graded-concepts providing a buffer-zone for containing the threat presented by the wide range of SLMP that fail to align with typical distinctions between the ordinariness of mental imagery and the abnormality of hallucinations (Smith 2018a, sec. 3.3).

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<sup>11</sup> For an example of the earlier studies these echo, see Parish (1902).

While it made sense to characterise the concepts of mental imagery and hallucinations as the inverse of each other when positioned within the mediator-view of SLMP, these characterisations are unreliable for differentiating between ordinarily benign and distressingly clinically-relevant SLMP in practice. Despite this, the inverse characterisations of the concepts of mental imagery and hallucinations persist in the practices of individuating instances of ordinary or abnormal forms of SLMP for the goal of investigating either functional or dysfunctional neurocognitive processes.

The unresolved ambiguities in the relationship between the concepts of mental imagery and hallucinations are obscured by these graded-concepts. With the interdependent relationship obscured, the mediating-role associations about SLMP continues to contribute to the structure within which the concepts of mental imagery and hallucinations are routinely used, independently of each other, as goal directed tools in neuroimaging experiments (Smith 2018b). Structured in this way, the concepts of mental imagery and hallucinations can be simultaneously delineated in relation to each other and used independently of each other.

#### **4 Independent Uses Structured by Interdependent Associations**

Recent attempts to conceptualise experiences of SLMP that resist the characterisations of both mental imagery and hallucinations, such as intrusive-imagery and non-pathological hallucinations, highlight unresolved questions about distinguishing between benign and distressing experiences of SLMP. Viewed in this way, graded-concepts highlight areas of potential evolution in the referential targets for the concepts of mental imagery and hallucinations. For example, a range of approaches have investigated the possibility that the distress of hallucinations may be caused by the co-presence of SLMP with another factor, such as childhood trauma, rather than the SLMP itself (e.g., Andrew, Gray, and Snowden 2008; Longden, Madill, and Waterman 2012). Likewise, while extending the concept of mental imagery to include intrusive and uncontrolled SLMP, these are similarly considered in terms of biopsychosocial contexts rather than as necessarily pathological in and of themselves (e.g., Brewin et al. 2010; Speckens et al. 2007). When these overlapping accounts of individual variability and the context-dependence of ordinary and distressing experiences of SLMP are positioned side-by-side they prompt questions about the referential stability of the concepts of both hallucinations and mental imagery (Table 2 and Table 3).

However, whether or not researchers were aware of these unresolved debates in this broader context, questions about the referential stability of the concepts of mental imagery and hallucinations did not penetrate the published accounts of any of the individual experiments I

examined (Smith 2018a). Instead, the concepts of mental imagery and hallucinations were used independently of each other to pursue divergent goals: understanding the role of ordinary experiences of SLMP in neurocognition or investigating SLMP as dysfunctional neurocognitive processes, respectively. These goals treat the target SLMP of each concept as reliably individuated from other forms of SLMP. While this practice may not require stable referents, it relies on the phenomena of interest being distinct enough to warrant independent investigation. Each concept is used *as if* reliably individuating a discrete form of SLMP relevant for different epistemic goals.

Used in this the, these two goals provide the set of standards by which any changes to the referential and/or inferential components of each concept is deemed epistemically warranted (Brigandt 2010, 24). For example, assumptions about referential stability can be seen in the use of each concept as a stable tool in neuroimaging experiments that rely upon routine practices for individuating the phenomena of interest. These routines include disciplined associations that align the experimental aims, methods, and results with the specific goal embodied by each concept (Smith 2018a). During this alignment, the referential component of each concept is treated as stable – the concept of hallucinations is used as if reliably individuating distinctly pathological SLMP, while the concept of mental imagery is used as if necessarily referring *only* to the distinctly benign SLMP that all healthy people are expected to experience. In each case, the concept functions in relation to the standard of reference provided by the goal of investigating functional or dysfunctional SLMP, respectively. For instance, the difficulty of distinguishing between those SLMP experienced as functional or dysfunctional SLMP is not considered relevant when responding to unexpected outcomes within a given experiment. Instead, the responses that emerge reflect the limited yet flexible array of possible conceptual sequences provided by the shared set of associations each concept inherits from the mediator-view of SLMP (Smith 2018a).

Given the standards set by the epistemic goals, the inferential component of each concept can be understood as providing the constrained possibilities available for response to the emergent interactions within experimental practice. As detailed earlier, the inferential components of these two concepts share an entrenched set of associations inherited from the mediator-view of SLMP. That the constraints and opportunities that the entrenched set of mediator-view associations provide contributions to the inferential components of each concept can be illustrated with some examples. Firstly, in one experiment, an unexpectedly high level of neural activity was found within language-related regions while the subject was supposed to be experiencing visual mental imagery (Kana et al. 2006). This unexpected finding was explained away by relying on the sedimented

association that mental imagery is effortful and, as such, verbal memory might be required to generate mental imagery from language cues.<sup>12</sup> In another experiment, an unexpected mismatch was reported between the timing of acute hallucinatory experiences and the timing of changes in neural activity (van de Ven et al. 2005). This difference in timing was dismissed as inconsequential by inferring, in line with the entrenched mediator-view associations, that people who hallucinate cannot be relied upon to accurately report their experiences. In each case, there was no published consideration of the possibility that these unexpected results might indicate something of interest about either the type of phenomena investigated, and/or the measurement tools involved. Instead, the disciplined performances of using each concept were structured by routine associations appropriate for the goal each concept was used to pursue.<sup>13</sup>

These routine associations reflect how the mediator-view of SLMP provides the body of knowledge within which inverse characterisations of mental imagery and hallucinations contribute to the space of possible inferences supported by each concept.<sup>14</sup> Integral to this implicit set of associations is the justification provided by the mediator-view of SLMP for why some SLMP can be regarded as ordinary while other SLMP should be treated as pathological. That is, while the philosophical context for the mediator-view of SLMP was rejected in the twentieth-century, nineteenth-century assumptions inherited via these distinguishing characteristics continue to inadvertently contribute to the design and implementation of the methodological procedures reported for the fMRI experimental investigations investigating either mental imagery or hallucinations.

These contrasting assumptions, and the fixed yet flexible array of possible conceptual sequences they reflect, can also be found in the way that each of the concepts used for investigating SLMP sets the standard for the experimental tasks intended to isolate an aspect of the SLMP of interest – a standard that directs research towards the relevant goal associated with that concept. Two types of experimental tasks help illustrate this point: tasks requiring subjects to make an external-judgement (about perceptions) and tasks requiring subjects to make an internal-

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<sup>12</sup> See Steinle's (2010) adaptation of Husserl's notion of sedimentation for describing how concepts that emerged in a specific context can later come to appear as solidified and stable 'natural' categories (if not as facts).

<sup>13</sup> See Pickering (1995; 2006) for more on how 'machine-like' human performances can become disciplined routines that structure conceptual associations in ways that become institutionalised – carried along by collective actions in ways that persist regardless of human intention.

<sup>14</sup> Note that, rather than a theory attempting to explain these phenomena, the mediator-view of SLMP can be understood as a set of entrenched associations that subtly contribute to the investigation of SLMP *across multiple conflicting theoretical and experimental contexts*. For more detail, see Smith (2018a).

judgement (about remembered or imagined perceptual experiences). Both types of tasks were used in experiments investigating SLMP regardless of whether these mental phenomena were conceptualised as mental imagery or hallucinations.<sup>15</sup> However, the specific expectations about how these tasks helped to individuate the phenomena of interest aligned with different goals depending on the conceptualisation of SLMP used (Smith 2018a). Firstly, when investigating mental imagery, the external-judgement experimental tasks were expected to identify the role of mental imagery in either emotional judgement during perceptual processing or language comprehension. For example, in the experimental task described by Kana et al. (2006, 2487), subjects were presented with sentences on a computer screen and asked to judge whether each sentence presented was true or false. The sentences were simple statements: such as, “Oranges, pineapples and coconuts are all triangular in shape” and “Addition, subtraction, and multiplication are all math skills” (Kana et al. 2006, 2486–87).

Two conditions were used to analyse how these sentence-comprehension tasks correlated with changes in neural activity: condition one consisted of sentences categorised as high-imagery (i.e., those that normal subjects would require imagery to comprehend); the second condition consisted of sentences classified as low-imagery (i.e., those that normal subjects would not require imagery to comprehend) (Kana et al. 2006, 2487). Of these two example sentences, the first was of the high-imagery condition based on the expectation that healthy people would need to visualise an orange or a coconut in order to ‘see’ that they are not triangular.<sup>16</sup> The other example sentence provided a low-imagery condition based on the expectation that healthy people would be able to judge the truth of the statement based on semantic information alone.<sup>17</sup> In both of these examples any actual mental imagery involved in the judgement tasks was inferred from the ability to perform the task (rather than requiring confirmation of SLMP experiences during the fMRI scan). This example illustrates the continued expectation that mental imagery is a necessary experience during tasks thought to mediate between perception and the cognitive functions of language and emotional judgement. This expectation is consistent with the mediator-view of SLMP, yet is at odds

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<sup>15</sup> As task-analysis is a disputed process among neuroimaging practitioners, establishing the technical similarity of these tasks is beyond the present scope. Instead, I take the degree of task-similarity in the reported uses (for assessing the ability of subjects to make specific kinds of judgements) to illustrate my point. For more detail, see Smith (2018a).

<sup>16</sup> This expectation ignores the possibility of people completing this task by relying purely on semantic information that oranges and/or coconuts are not triangular – for example, see Bill Faw (1997).

<sup>17</sup> The expectation aside, being able to judge the truth-value of a sentence without imagery does not mean not also experiencing imagery in relation to the sentence (perhaps ‘seeing’ the symbols for each mathematical operation).

with the individual variability in documented experiences of mental imagery (Betts 1909; Faw 1997; 2009; Kozhevnikov and Blazhenkova 2013).

As a contrasting illustration, in experiments using the concept of hallucinations with experimental tasks requiring subjects to make a judgement about perceived stimuli, there was an expectation of dysfunction within perceptual processes and/or language comprehension. For example, in Escartí et al. (2010, 33) an external-judgement task was intended to “replicate those emotions related to hallucinatory experiences” by having subjects listen to aurally presented words (pronounced with a tone matching the associated emotion) and later score the level of anxiety each word provoked in them. Similarly, in Korsnes et al. (2010, 612), an external-judgement task involved asking subjects to listen to specific speech syllables (that were presented differently to each ear) while attending to the sound with either their left ear, right ear, or neither. This task, used to help investigate hemispheric differences in schizophrenia, reflects an association between the concept of hallucinations and the expectation that experiencing these mental phenomena indicates an inability to make reliable distinctions between SLMP and actual perceptions. In these cases, external-judgement tasks can be seen to reflect an expectation that hallucination indicate a pathological tendency to misattribute perceptual stimuli – a view that relies on the implicit characterisations of abnormal SLMP during attempts to explaining this confusion in contrast to ordinary SLMP.

A similar pattern emerged for the internal-judgement experimental tasks. Rather than investigating ordinary *experiences* of SLMP, the internal-judgement tasks in experiments investigating mental imagery conflated experiences of SLMP with the ability to accurately recall perceptual information. Likewise, rather than investigating dysfunctional experience of SLMP directly, the internal-judgement task reported in experiments investigating hallucinations conflated SLMP with a combination of mental experiences (including delusions) considered to be the ‘positive symptoms’ of psychosis. For example, Bien and Sack (2014) expected that ability on an internal-judgement task reflected the role of mental imagery as a required element of memory, while Wible et al. (2009) expected difficulty on an internal-judgement task to be indicative that dysfunctional memory and language processing are involved in producing hallucinations.

Researchers were able to use both external-judgement or internal-judgement tasks in experiments investigating mental imagery due to the expectation that carefully regulated SLMP are crucial to the ability to make judgements based on remembered/imagined perceptual experiences. As the inverse of this, experiments investigating hallucinations routinely include inferences that

assume that external-judgement or internal-judgement tasks measure aspects of SLMP in ways that align with the goal of investigating the relationship between hallucinations and dysfunction in memory and/or language comprehension. Positioned side-by-side, these experimental judgement tasks can be seen to rely on the use of each concept as typically characterised – even when these characteristics were not explicit.

The types of assumptions in each of these examples illustrate a pattern consistent across a decade of articles documenting neuroimaging experiments using the concepts of either mental imagery (to investigate the role of functional SLMP in neurocognition) or hallucinations (to investigate the dysfunctional role of SLMP in neurocognition) (Smith 2018a, sec. 7). This pattern is the reliance on the inverse characterisation of ordinary and abnormal SLMP within multiple aspects of experimental practices using the concepts of either mental imagery or hallucinations. The appropriateness of these concepts was never questioned or justified; each concept was used as a stable tool that carried routine expectations about neurocognitive processes that would (eventually) explain the type of SLMP of interest.

Drawing on the literature supporting examinations of goal-directed concept-use outlined in Section 1, one way to understand the ongoing reliance on these characterisations is by recalling how mediator-view associations became routine expectations about the relationship of SLMP to reasonable behaviour. Taken for granted in this way, these associations can structure the uses of concepts as tools for investigating specific epistemic goals (Smith 2018a). This practice is made possible, in part, by the continued reliance on typical characteristics throughout experiments that use the concepts of either mental imagery or hallucinations, despite the failure of these characteristics to reliably individuate discrete forms of SLMP within the broader literature.

This practice highlights how mental imagery and hallucinations are used for pursuing discrete goals in neuroimaging experiments by relying on the presumed stability of their referential target SLMP, and then drawing on a limited yet flexible array of inferential possibilities for explaining the role of SLMP in neurocognition. In this way, the goal-directed uses of each concept can persist at the level of individual experiments even when questions of reference remain unresolved within the broader literature. The tension remains, with entrenched associations carried-along by the overlapping inferential components of the concepts of mental imagery and hallucinations. This suggests that these entrenched associations structure the space of inferential possibilities within which these concepts can be used even when their referential component remains in doubt. Viewed in this way, the inferential component of these concepts offers another element in our

understanding of how the concepts of mental imagery and hallucinations are each structured as tools for pursuing the diverging goals of explaining SLMP in terms of either functional or dysfunctional neurocognitive processes.

## 5 Conclusion:

The tension I have focused on in this paper is the way that mental imagery and hallucinations are both used as independently stable concepts despite the unresolved debates over their referential reliabilities. The existence of this tension was demonstrated by outlining the friction between the broader debates over how to conceptualise discrete forms of SLMP, and the goal-directed uses of mental imagery and hallucinations as stable tools within individual experiments. Within this broader context, the failure of the typical characteristics to reliably differentiate between discrete forms of SLMP is well documented. Nonetheless, the concepts of mental imagery and hallucinations are each used independently of the other when individuating the SLMP of investigative interest within individual experiments.

In examining the tension these practices reveal, I hope to have demonstrated that there are entrenched mediator-view associations that structure the limited yet flexible array of possible sequences available for the inferential role of the goal-directed uses of each concept as tools within individual experiments. On the one hand, mental imagery is used as a concept for investigating those ordinary (benign) SLMP experiences that resemble perception in ways that can aid in various neurocognitive functions. On the other hand, hallucinations provide the dominant concept for investigating abnormal SLMP that are so (distressingly) like perception that they indicate dysfunctional neurocognition. Each concept is used within experiments where the goal is to find a unique mechanism to explain how the discrete type of SLMP being investigated contributes to functional or dysfunctional neurocognitive processes. That the concepts of mental imagery and hallucinations can be used independently of each other in this way is usually taken for granted. However, this practice obscures that each concept stabilised as a tool for individuating discrete types of SLMP through a series of unsuccessful attempts to characterise the inverse relationship between functional and dysfunctional SLMP. As such, the connection between how mental imagery and hallucinations each came to be characterised draws attention to the inferential roles and epistemic goals involved in investigating functional and dysfunctional SLMP as distinct phenomena. As evident in their respective historical developments, both the inferential roles and epistemic

goals of the current uses of the concepts of mental imagery and hallucinations reflect a shared set of deeply entrenched associations about SLMP.

As outlined in Section 3, this shared set of associations can be traced back to the mediator-view positioning of ordinary SLMP as mental phenomena for capturing perceptions in the aid of abstract thought – phenomena that, if not carefully regulated, can cause confusion over the difference between perceptions and thoughts. During the nineteenth-century, this mediator-view of SLMP provided the available body of knowledge within which the concept of mental imagery began to be used to investigate the role of ordinary SLMP in memory and imagination, as well as for the proposed concept of hallucinations as a description of how memories and imaginations could become ‘over-excited’ and lead to failures in reason or judgement. In the following debates, inverse sets of characteristics considered typical of either functional or dysfunctional SLMP were proposed to explain how something required for thought (mental imagery) could lead to failures to correctly reason or judge perception (hallucinations). Despite unresolved questions about their reliability, these inverse characterisations became routine, carrying-along the interdependent associations connecting ordinary and dysfunctional SLMP even after the mediator-view of SLMP itself was abandoned during the early twentieth-century. As the examples from contemporary neuroimaging practices in Sections 2 and 4 illustrate, these interdependent characterisation of ordinary and abnormal SLMP have persisted long after the initial available body of knowledge justifying them was abandoned.

This brings the discussion back to the tension originally identified: the concepts of mental imagery and hallucinations are used as independently stable concepts despite debates over the referential reliability of each concept remaining unresolved. In exploring this tension further, my account of how concepts contribute to investigative practices has acquired additional details. Despite a failure to reliably individuate discrete forms of SLMP, the nominally-discarded mediator-view of SLMP that once justified the inverse characterisations of mental imagery and hallucinations remains evident in the ways that these characteristics are implied throughout experiments that use the concept of either mental imagery or hallucinations.

In examining this tension, I have focused on highlighting one of the ways that the inverse characterisation of mental imagery and hallucinations sedimented as each concept stabilised independently of the other for use as goal-directed tools in neuroimaging experiments (despite continued debates elsewhere over how to reliably characterise discrete forms of SLMP more generally). In addition, this account could be complemented by considering those questions I put

aside earlier about whether the concepts of mental imagery and hallucinations are being used *appropriately* in individual experiments. However, to do justice to these normative questions several additional areas of literature would need to be explicated – including, discussion of the conceptual challenges recognised by neuroscientists (e.g., Poldrack and Yarkoni 2016), views on the how individuation of a concept relates to the mechanistic explanation of the phenomena of interest (e.g., Craver and Darden 2013), and views on the degree of interdisciplinarity neuroscientific practice should support (e.g., Fitzgerald and Callard 2015).

While such normative considerations are beyond the present scope, it is worth drawing attention to some broader implications of descriptions of historically-contingent uses of concepts as goal-directed tools in investigative practices. Of particular note is the possible convergence between my account – of the entrenched associations that structure the uses of concepts as goal-directed tools – and the concerns raised about the conceptual challenges that often go unacknowledged in the context of neuroimaging experiments (Abend 2016; Anderson 2015; Poldrack and Yarkoni 2016). These challenges include the use of cognitive ontologies that, inherited from psychological taxonomies based on behavioural observations, are not being updated in light of neuroscientific knowledge (Bunzl, Hanson, and Poldrack 2010, 54; Lenartowicz et al. 2010, 690). For example, Russell Poldrack and Tal Yarkoni (2016, 591) express concern about knowledge-claims that depend on tacit associations tied to outdated cognitive taxonomies, and call for more explicit justification of the concepts used in formal inferences from neuroimaging data.

One way to identify the tacit conceptual assumptions underlying specific experimental inferences is to examine how each concept came to be used as a goal-directed tool within a given field of investigation. In the case of mental imagery and hallucinations, this examination identifies a shared set of entrenched associations that simultaneously constrain and facilitate the use of each concept independently of the other – including providing tacit assumptions that contribute to experimental inferences that support different investigative goals. Where possible, explicating tacit conceptual and material assumptions can drive further research in areas of epistemic uncertainty (Feest 2016). Given this, I take the view that historically informed philosophical engagement with (potentially) outdated concepts can enrich our understanding of how these concepts are currently used as goal-directed tools in experiments. At the very least, assessments of when a given concept *should* be used would benefit from a range of descriptive accounts detailing the various historically situated contexts for the current uses of that concept as a tool for specific goals.

To conclude, the independent uses of the concepts of mental imagery and hallucinations can be seen to simultaneously reflect and obscure a set of shared-associations that each concept inherited from the otherwise discarded mediator-views of SLMP. In illustrating this, I draw upon, and extend, arguments that there is value in examining how historically-contingent associations can structure the current uses of concepts as goal-directed tools in investigative practices. Within this narrow scope, I demonstrated that examining tensions in scientific practices can help identify how entrenched associations can be both integral to, and obscured by, the goal-directed uses of concepts as tools. Finally, while offering a descriptive account, I also hope to have prompted an interest in examining the past and present uses of scientific concepts in investigative practices – especially when confronted with experiments generating conflicting claims from similar data.

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## Tables

Characteristic Type	Mental Imagery	Hallucinations	Mediator-views of Characteristic
Reported Location	Internal	External	Explains why SLMP are (or are not) able to be judged as distinct from perception
Perceptual Similarity	Vivid Fleeting	Abnormally Vivid Concrete	
Volition and Control	Manipulable Dismissible	Obstinate Absorbing	
Attribution	Self	Other	Measures degree that SLMP are regulated by reason
Insight	Maintained	Lacking	

**Table 1: Characterising concepts in the context of mediator-views of SLMP, adapted from Smith (2018a).**

	Typical Mental Imagery	Eidetic Imagery	Pseudo-hallucinations (Jaspers)	Pseudo-hallucinations (Goldstein)	Typical Hallucinations
Location	Internal	External	Internal	External	External
Perceptual Similarity	Low	High	High	High	High
Volition	Voluntary	Voluntary	Involuntary	Involuntary	Involuntary
Control	Manipulable	Manipulable	Uncontrolled	Uncontrolled	Uncontrolled
Duration	Fleeting	Persistent	Persistent	Persistent	Persistent
Attribution	Self	Self	Variable	Others	Others
Insight	Maintained	Maintained	Lacking	Maintained	Lacking
Subjective experience	Positive	Positive	Variable	Variable	Negative
Impact	Benign	Benign	Benign	Benign	Disruptive
Content	Useful	Useful	not specified	not specified	Unwanted
Frequency	Variable	Frequent	Variable	Variable	Frequent

**Table 2 Additional conceptualisations of SLMP during the early twentieth century - adapted from Smith (2018b).**

	Ordinary Mental Imagery	Intrusive Mental Imagery	Non-Pathological Hallucinations	Clinically Relevant Hallucinations
Location	Internal	Internal	Variable	Variable
Perceptual Similarity	Variable	High	Variable	Variable
Volition	Voluntary	Involuntary	Involuntary	Involuntary
Control	Manipulable	Uncontrolled	Uncontrolled	Uncontrolled
Duration	Fleeting	Persistent	Fleeting	Persistent
Attribution	Self	Self	Variable	Variable
Insight	Maintained	Maintained	Variable	Variable
Subjective Value	Positive	Negative	Variable	Negative
Impact	Benign	Disruptive	Benign	Disruptive
Content	Useful	Unwanted	Variable	Unwanted
Frequency	Variable	Frequent	Variable	Frequent

**Table 3: Emerging conceptualisations of SLMP – adapted from Smith (2018b).**

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