

Restructuring insight: An integrative review of insight in problem-solving, meditation, psychotherapy, delusions and psychedelics

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Abstract:

Occasionally, a solution or idea arrives as a sudden understanding - an insight. Insight has been considered an “extra” ingredient of creative thinking and problem-solving. Here we propose that insight is central in seemingly distinct areas of research. Drawing on literature from a variety of fields, we show that besides being commonly studied in problem-solving literature, insight is also a core component in psychotherapy and meditation, a key process underlying the emergence of delusions in schizophrenia, and a factor in the therapeutic effects of psychedelics. In each case, we discuss the event of insight and its prerequisites and consequences. We review evidence for the commonalities and differences between the fields and discuss their relevance for capturing the essence of the insight phenomenon. The goal of this integrative review is to bridge the gap between the different views and inspire interdisciplinary research efforts for understanding this central process of human cognition.

Keywords: insight, problem solving, meditation, psychotherapy, psychedelics, delusions, schizophrenia

1. Introduction:

“... under the stress of our wish to solve a certain problem – and after our thorough consideration of various parts of the given material – sometimes brain processes tend to assume new forms or structures which, when reflected in our minds, suddenly make us see new relations and thus give us new insights ...” - Wolfgang Köhler

The unique experience of insight has been a subject of interest among researchers for at least over a century (Bühler, 1907; Köhler, 1925). Insight occurs when a new understanding of a situation or the solution to a problem suddenly springs into consciousness, seems correct, and is accompanied by a phenomenological component of surprise and pleasantness, frequently referred to as the “aha” experience (Bühler, 1907; Kaplan & Simon, 1990; Kounios & Beeman, 2015; Bowden & Jung-Beeman, 2003, Topolinski & Reber, 2010; Laukkonen et al., 2021a). There is abundant anecdotal evidence suggesting that insight has played an instrumental role in many fundamental discoveries (Gruber, 1995). For instance, Charles Darwin has remarked in his autobiographical notes that in 1838 while he was reading a book by Thomas Malthus on population growth, “*it at once struck*” him that “*under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species*” (Darwin, 1958).

However, some researchers have been sceptical about the importance of insight (Weisberg, 2006; Anderson, 2015). In textbooks of psychology and cognition, insight is typically given a short-shrift as it is discussed as a specific subprocess of problem-solving (Eysenck & Keane, 2015; Anderson, 2015). Moreover, there is still debate about whether insight has a causal role in generating novel ideas or is merely an epiphenomenon of problem-solving (Weisberg, 2006; Klein & Jarosz, 2011, Laukkonen et al., 2021b). Some researchers have even cast doubt on whether there is a distinct process like insight at all (Chuderski & Jastrzębski, 2018).

Here we propose that insight is a central process underlying many seemingly unrelated phenomena across distinct areas of research. Drawing on literature from a variety of fields, we will show that besides being a common topic in **problem-solving** literature (Bühler, 1907; Ohlsson, 1984; Kaplan & Simon, 1990; Kounios & Beeman, 2015; Topolinski & Reber, 2010), insight is also a core component in **psychotherapy** (Connolly Gibbons, Crits-Christoph, Barber, & Schamberger, 2007; Jennissen et al., 2018), essential for some forms of **meditation** (Lutz, Dunne, & Davidson, 2007; Bodhi, 2011; Laukkonen & Slagter, 2021; Yates et al, 2015; Cousins, 1996), a factor that drives the positive outcomes of **psychedelic therapy** (Garcia-Romeu et al., 2019; Davis et al., 2021; Davis, Barrett, & Griffiths, 2020; Davis et al., 2020; Roseman, Nutt, & Carhart-Harris, 2018; Carhart-Harris & Friston, 2019; Letheby, 2021), and an essential process underlying the emergence of **primary delusions in schizophrenia** (Feyaerts et al., 2021; Mishara, 2010; Uhlhaas & Mishara, 2007; Sips et al., 2020). Our goal is to bridge these different views and research traditions in an attempt to gain a broader more comprehensive understanding of the insight phenomenon and its underlying mechanisms. We propose that insight is not merely a specific subprocess of problem-solving but rather the manifestation of a core process of cognition that accompanies significant changes in mental structures. Furthermore, we discuss what can be gained if we forgo an isolated approach to insight research and consider these perspectives as a unified framework.

1.1. *Insight in different fields of study: an overview*

Our review aims to understand the cognitive and computational mechanisms underlying insight across these different fields of study. We partition our discussion into four sub-sections to provide an overview of how insight has been considered in each field.

1. *Definition*: What is insight in this field? How is insight conceptualized?
2. *Prerequisites*: What are the prerequisites of insight? Which processes and states precede insight?
3. *Event*: What happens during insight? Which processes can be related to the insight experience?
4. *Consequences*: What are the consequences of insight? Which processes take place after insight?

Note that the distinction between prerequisites, the insight event, and consequences of insight, is not always obvious. Nevertheless, we think that this division is a useful exercise to systematically investigate insight and compare it between different fields of study. As we demonstrate in our review, these questions have been studied thoroughly in the problem-solving literature. However, a comprehensive theory of insight should not only be based on problem-solving tasks. The main reason is that in problem-solving tasks it is hard, if not impossible, to arrive at an insight that has significant impact and consequences for the life of the person. Insight is usually investigated through tasks and puzzles which have low stakes and carry little personal relevance for the subject. From this perspective, when limiting oneself to only the problem-solving field, one is forced to conclude that insight is ephemeral and irrelevant. However, as we show here, this inference might be a result of how insight has been (and can be) studied in problem-solving. Considering insight in other research fields like psychotherapy, the onset of delusions, meditation, and psychedelics reveals the broad scope, complexity, and impact of insight. Moreover, we see that it may be unwarranted to expect a simplistic sequence of necessary conditions that always result in insight, rather there may be alternative routes depending on context that can facilitate insight events. In the discussion we highlight the commonalities and differences across these diverse fields, and discuss their relevance for a unified understanding of insight.

2. **Insight in problem-solving**

2.1 *Definition of insight*

There exists a long tradition in psychological research dating back to Gestalt-psychology to study insight in problem-solving (Bühler, 1907; Duncker, 1945; Koffka, 1935; Köhler, 1925, 1947; Wertheimer, 1959). Insights are often contrasted with analytical problem-solving (Weisberg, 2006; Kounios & Beeman, 2015). The main feature of insight is that unlike analytical problem solving which happens gradually, insight solutions appear suddenly and are accompanied by a feeling of certainty and an affective component of relief or pleasure (Danek, Fraps, von Müller, Grothe, & Öllinger, 2014; Kounios & Beeman, 2015). There is some disagreement among researchers regarding whether insight is a distinct type of problem-solving (“special-process” view) or whether it is merely an epiphenomenon of problem-solving

with the same cognitive mechanisms as analytical problem-solving (“business-as-usual” view) (Kounios & Beeman, 2005; Seifert et al., 1995; Weisberg, 2006).

Insight solutions will often arise from non-routine problems, such as riddles or brain teasers, where the solver cannot rely on previous experience with familiar strategies and has to form new associations that lead to novel solutions (Dow & Mayer, 2004; Mayer, 1995). Insight then arises as a clear and sudden understanding of how to solve the problem. The emergence of insight has been associated with the process of restructuring or representational change (Wertheimer, 1959; Ohlsson, 1984; 1992), as the initial problem representation needs to be transformed to reach an insight solution.

Insight in problem-solving has traditionally been studied with specific tasks or “insight problems” which are designed to elicit insight solutions (see table 1 for a list of most common insight tasks). After solving the task, the participant is often asked to make a retrospective forced choice about whether or not they solved the task with insight (e.g., Jung-Beeman et al., 2004), or rate the intensity (Laukkonen et al., 2021a) or degree of their subjective “aha” experience on a multileveled scale (Bowden & Grunewald, 2018). Occasionally, separate rating scales are used to capture different dimensions of the insight experience (e.g., Danek et al., 2014; see also table 2). Notably, when tasks that should elicit insight are analyzed in the laboratory, it is often observed that there is a large variability of insight ratings and that some people solve these tasks without insight altogether (Webb et al., 2016). This has inspired consideration of individual differences in a more trait-like aspect of the insight experience, in addition to differences in episodic insights (Lin et al., 2022; Ovington et al., 2016).

Insight task	Brief description	Examples of use
Remote Associates Test (RAT; Mednick, 1968); Compound Remote Associates task (CRA; Bowden & Jung-Beeman, 2003)	In RAT, the task is to find one word that associates three seemingly unrelated words. The newer CRA task requires solvers to only provide compound words as solutions.	Beeman & Bowden, 2000; Jung-Beeman et al., 2004; Kounios et al., 2006
Anagram tasks	The solver is presented with scrambled words that have to be unscrambled to find a meaningful word.	Aziz-Zadeh, Kaplan, & Iacoboni, 2009; Kounios et al., 2008; Laukkonen et al., 2020a
Riddles, brainteasers	Different riddles and brainteasers where the solver has to “think outside of the box” to arrive at the solution.	Luo & Niki, 2003; Qiu, 2006
Magic tricks	The task is to figure out how different magic tricks were performed.	Danek et al., 2014; Hedne et al., 2016
9-dot problem (Maier, 1930)	Consists of 9 dots that must be connected with 4 continuous lines without lifting the pen.	MacGregor, Ormerod, & Chronicle, 2001; Maier, 1930
8-coin problem (Ormerod et al., 2002)	The solver is required to move 2 coins from a formation of 8 coins in order to find a constellation where each coin touches exactly 3 other coins.	Ormerod, MacGregor, & Chronicle, 2002

Matchsticks arithmetic problems	An incorrect arithmetic statement constructed out of matchsticks in Roman numerals has to be transformed into a correct statement by moving only one single matchstick.	Knoblich, Ohlsson, Haider, & Rhenius, 1999
Number reduction task	A learning task with an implicit rule set that will be figured out during the course of the task.	Haider & Rose, 2007
Visual tasks (e.g., ambiguous or degraded images)	Perceptual tasks where the image is ambiguous (e.g., the necker cube, rabbit or duck image) or degraded (e.g., Mooney images).	Kizilimark et al., 2016; Laukkonen & Tangen, 2017

Table 1. Insight tasks in problem-solving. The table includes a brief description of the task as well as examples of its use in the problem-solving field. Insight is usually measured as the number of tasks solved by insight (occasionally in comparison to solutions to non-insight problems), as well as ratings of the degree or intensity of the subjective “aha” experience.

2.2 Prerequisites of insight

Although insight phenomena are most thoroughly researched in the problem-solving field, it is still not clear which conditions are necessary for insight solutions to emerge (for a review of insight in the field of problem-solving, see van Steenburgh et al., 2012). Not all insight tasks induce insight whereas so-called analytic problems are also occasionally solved with insight (Webb et al., 2016). Additionally, when analyzing reports from naturally occurring insights, it seems that there can be multiple alternative pathways for how one might arrive at an insight (Klein & Jaroz, 2011). Many theories have been proposed to map out the sequence of processes that lead to insight (Ohlsson, 1992; 2011; Wallas, 1926; Weisberg, 2015). While most theories do not agree on all the steps, several common threads can be found.

In problem-solving literature, the sequence of processes that leads to insight always begins with the presentation of a specific problem. A problem can be defined as a situation where a person has a goal but does not know how to reach that goal (Duncker, 1945). The solver then searches for a solution by exploring the problem space and trying out different solutions. As insight problems are often designed to be misleading by initially provoking a false interpretation, the solver might experience repeated failure when attempting to solve the problem. This can lead to a feeling of being “stuck” - a stage referred to in problem-solving literature as *impasse* (Kaplan & Simon, 1990; MacGregor, Ormerod, & Chronicle, 2001; Ohlsson, 1992; 2011). For the impasse to be overcome, the initial representation of the problem needs to be modified or reinterpreted. One can achieve this by elaborating or restructuring the existing knowledge structures or relaxing the problem constraints (Knoblich et al., 1999, Bassok & Novick, 2012; Ohlsson, 1992). However, there is no unified understanding regarding whether or to what degree impasse is necessary for initiating the restructuring of a problem (Weisberg, 2006). Furthermore, evidence shows that an impasse does not always precede insight (Stuyk et al., 2021; Fleck & Weisberg, 2013).

Some theories of a sequence of insight also include an incubation stage (e.g., Wallas, 1926; Gilhooly, 2019; Helie & Sun, 2010) wherein the solver temporarily sets the problem aside and either rests or focuses on something else. It has also been suggested that following an initial period of conscious work, some unconscious work on the problem continues (Poincaré, 1913; Gilhooly, 2019; Hedne et al., 2016; Laukkonen & Tangen, 2017; Salvi et al., 2020). Usually, during insight but not analytical problem-solving, solvers are unable to report the processes that lead up to the insight solution (Sternberg & Davidson, 1995; Smith et al., 1995) or estimate during solving how close they are to the solution (Metcalfe, 1986; Kounios & Beeman, 2014; although sometimes a feeling of impending discovery is reported, Kostic, Booth, & Cleary,

2015), implicating the role of unconscious processing. The solution arises in consciousness suddenly and unexpectedly after unconscious work has proven successful.

While not all problems that are solved with insight necessarily go through an incubation stage (Kaplan & Davidson, 1989; Weisberg, 2006; Gilhooly, 2019), there is some evidence that taking a pause from actively trying to solve the problem might increase the chances of arriving at a correct solution (Smith & Blankenship, 1989; Gilhooly, 2019; Segal, 2004). Studies have shown that mind-wandering (Gable, Hopper, & Schooler, 2019; Zedelius & Schooler, 2015) and looking away behaviour (Salvi & Bowden, 2016) after being unsuccessful at solving a problem increase the chances of arriving at an insight solution. In addition to anecdotal evidence of the effectiveness of “sleeping on the problem”, resting and sleep have also been shown to improve problem-solving (Cartwright, 1974; Walker et al., 2002) and specifically insight problem solving (Cai et al., 2009; Wagner, Gais, Haider, Verleger & Born, 2004; Verleger et al., 2013; however, see Schönauer et al., 2018). During sleep, redundant information such as a misleading problem representation or unhelpful constraints may be forgotten (Smith & Blankenship, 1989; Tononi & Cirelli, 2014), thus getting the person “unstuck” and opening the way for a novel solution. Furthermore, sleep introduces stages of increased synaptic plasticity in the brain (Tononi & Cirelli, 2014), thereby promoting the restructuring of memory representations and enabling the extraction of gist knowledge and insightful behaviour (Friston et al., 2017; Lewis, Knoblich, & Poe, 2018).

Numerous studies have also shown that positive affect or mood improves cognitive flexibility and can facilitate insight solutions (e.g., Isen et al., 1987; Bolte et al., 2003; Sakaki & Niki, 2011; Subramaniam et al., 2009). One possible explanation is that positive affect is linked to broader attentional scope and can thereby improve people’s search of a problem space (Ansburg & Hill, 2003; Fredrickson, 2001; Orita & Hattori, 2019; Rowe, Hirsh & Anderson, 2007; Wegbreit et al., 2012). Additionally, it has been suggested that positive emotional states enhance cognitive flexibility, leading to a more conducive state for achieving restructuring and insight solutions (De Dreu, Baas, & Nijstad, 2008; Hirt, Devers, & McCrea, 2008; Lin, Tsai, Lin, & Chen, 2014). In a similar vein, meditation and mindfulness practices have been shown to improve cognitive flexibility and creative thinking (Colzato, Szapora, & Hommel, 2012; Greenberg, Reiner, & Meiran, 2012; Horan, 2009; Ostafin & Kassman, 2012). Combining evidence from the effects of sleep, positive mood, and meditation techniques on insight, it would appear that a nonspecific state of enhanced flexibility might be a prerequisite for insight.

2.3 Event of insight

A key feature of insight problem-solving, which is present in most theories of insight, is that a change in the initial problem representation is required for the solver to be able to see the problem “in a new light” (Wertheimer, 1959; Ohlsson, 1984; 1992; Öllinger, Jones, & Knoblich, 2014). This change or “restructuring” can occur as the reorganization of prior information, often after being unsuccessful when attempting to solve the problem using more conventional knowledge structures (Knoblich et al., 1999; Ohlsson, 1992). In some cases, the restructuring may take the form of novel connections being created between previously unrelated concepts (e.g., Jung-Beeman et al., 2004). The mental restructuring can also be elicited by relaxing unconstructive constraints or switching attention to crucial elements of the problem (Knoblich et al., 1999; Kounios et al., 2006). These processes usually occur spontaneously without any external cues by rearranging already existing knowledge structures (i.e., fact-free learning, Friston et al., 2017).

However, it is also possible for restructuring to be elicited by acquiring some new information or experiencing a novel event that fits the problem-solver’s goal. An example of this view is the theory of opportunistic assimilation whereby the solution is triggered by a stimulus in the environment which is then assimilated into the prior memory representation of the problem (Seifert et al., 1995). Although the first data to support this view on insight was reported already in a 1931 experiment by Maier (see also Thomas & Lleras, 2009b), this perspective has not

been often considered in the problem-solving literature, as it is relatively hard to create the laboratory conditions for “opportunistic” cues. Cues or hints designed to help switch the solver’s attention towards critical elements of the problem have been studied more frequently and have been shown to increase the chances of producing insights (Grant & Spivey, 2003; Kaplan & Simon, 1990; Thomas & Lleras, 2009a). Additionally, it is possible to elicit insights by revealing the solution to the solver, resulting in an “oh yes” moment (Kizilirmak et al., 2016a; Rothmaler et al., 2017). The latter is referred to as induced insight, as the solution is induced by revealing the solution.

Another defining aspect of the insight solution is its phenomenological component, famously referred to as the “aha moment” (Bowden & Jung-Beeman, 2003, Topolinski & Reber, 2010; Laukkonen & Tangen, 2018). Many researchers believe that this subjectively reported experience most accurately allows us to distinguish an insight solution from other types of problem-solving (e.g., Kaplan & Simon, 1990; Bowden & Grunewald, 2018). The most frequently listed characteristics of the insight experience include suddenness of the solution’s appearance in consciousness, confidence that the solution is correct, its unpredictability, and the positive affect that accompanies the solution (Danek et al., 2014a; Hedne et al., 2016; Shen et al., 2016; Topolinski & Reber, 2010; Webb et al., 2016; Laukkonen & Tangen, 2018; Laukkonen et al., 2021a). The “aha” experience is also sometimes measured by asking the solvers to rate their feelings of warmth leading up to the solution (e.g., Hedne et al., 2016; Metcalfe & Wiebe, 1987). A sudden and rapid rise in feelings of warmth is often reported as the insight solution arrives, whereas analytic solutions are accompanied by a more incremental increase (Metcalfe & Wiebe, 1987; Kizilirmak et al., 2018). The positive affect and judged truth that arise from an insight experience have been linked to processing fluency (Topolinski & Reber, 2010). The ease and speed with which an answer pops into one’s mind increases confidence in the correctness of the solution, regardless of its actual validity (Koriat & Levy-Sadot, 2001; Kelley & Lindsay, 1993; Laukkonen et al., 2021a), and triggers feelings of pleasure (Topolinski, Likowski, Weyers, & Strack, 2009).

2.4 Consequences of insight

Several studies have reported an insight memory advantage wherein solutions that are generated with insight are remembered more accurately than those without a reported “aha moment” (Danek, Fraps, von Müller, Grothe, & Öllinger, 2013; Kizilirmak et al., 2016a, b). Specifically, a study by Danek and Wiley (2020) highlighted a key role of the affective component of insight in supporting better solution memory, as pleasure ratings predicted the memory advantage more than the cognitive component (i.e., restructuring of the problem). This effect is comparable to flashbulb memories, where strong emotions help to retain gist information about events in long-term memory (McCloskey, Wible, & Cohen, 1988; Burke, Heuer, & Reisberg, 1992). Importantly, it has been shown that while the accuracy of flashbulb memories declines over time, the raters’ confidence in the perceived accuracy and vividness of the memory remains high (Kensinger & Schacter, 2006; Talarico & Rubin, 2003).

One of the functions of insight may be to induce one-shot learning - unlike other forms of learning that often require gradual repetition and training, a new idea or solution acquired by insight can be retained in long-term memory after only a single experience (Ludmer, Dudai, & Rubin, 2011). This is exemplified in perceptual tasks using ambiguous images which can be solved by a sudden realization of the interpretation either spontaneously or after a cognitive or visual hint (Kizilirmak et al., 2016a; Rubin, Nakayama, & Shapley, 2002; Mooney, 1957). After the image has been solved, viewers are usually unable to return to the state of “not seeing” the solution (Ludmer, Dudai, & Rubin, 2011).

In another line of research, it has been demonstrated that after an insight solution, participants are less likely to consider an alternative solution to the problem (Hedne et al., 2016). Insight solutions are more likely to be accurate and are rated with higher confidence (Danek et al., 2014; Hedne et al., 2016; Salvi et al., 2016), but they are also more resistant to change (Hedne

et al., 2016). It would seem that insight solutions have particular value to the person, meaning that people are likely to retain the belief or view generated with insight. Consistent with the idea that feelings of insight can entrench beliefs, several recent experiments have shown that (artificially induced) “aha” experiences can shift worldviews even when they are irrelevant but occur at the same time as the belief is presented (Laukkonen et al., 2020a; 2021b). There is also evidence that the feeling of insight can sometimes generate false memories (Dougal & Schooler, 2007), as the confidence experienced during the aha moment can become attached to an inaccurate memory or idea. These findings are consistent with the framework proposed by Laukkonen and colleagues (Laukkonen et al., 2018) who suggested that the feeling of insight acts as a heuristic when solving problems. In other words, the “aha” experience may signal that the suddenly emerged idea is important and likely to be correct given what one knows (Laukkonen et al., 2018). Although the solution fits with the previous knowledge of the problem-solver, the solution itself may or may not reflect intersubjective accuracy and truth-value.

2.5 Summary

As insights have been most thoroughly researched in the problem-solving field, there is a clearly defined understanding of how to recognize one. Namely, it is a sudden realization that involves some new associations or restructuring, and that is accompanied by a phenomenological component of relief and pleasure, or an “aha” moment. Overall, problem-solving literature has been more focused on the prerequisites of arriving at an insight solution as well as the processes that happen during or prior to insight. However, despite the extensive research there is no one clear way to evoke an insight - rather, there are some prerequisites which tend to often, but not always, precede insight events. Hence, it would appear that there are multiple alternative pathways for achieving insights. Traditionally, the insight solution itself has been considered the main consequence of the phenomenon and the potential role of the experienced “aha moment” in entrenching beliefs has only recently become a topic of investigation. As evidenced by the research quoted above, arriving at a solution via insight is associated with important consequences for the cognitive processes that follow. Furthermore, as can be seen below, when it comes to other fields where insight has been studied, the consequences of insight are often the central part of the phenomenon.

Measure	Brief description
<p>1 A rating scale of insight dimensions (e.g., Danek et al., 2014)</p> <p>Dispositional Insight Scale (Ovington, Saliba, & Goldring, 2016)</p>	<p>A self-report scale for quantifying different aspects of the aha experience after an insight solution. For example, the dimensions of suddenness, surprise, happiness, impasse and certainty have been used (Danek et al., 2014).</p> <p>A brief 5-item self-report scale to measure a trait-like propensity toward insight problem-solving.</p>

2	Insight (Morgan, Luborsky, Solomon, 1982)	Rating Crits-Christoph,	Scale Curtis, &	A 9-item scale used by judges to rate segments of a client's speech based on displayed verbal behaviour reflective of insight (e.g., "patient connects two problems that were previously unconnected, or sees their immediate relevance", "patient recognizes habitual patterns of behaviour").
	Patient Cognitive Change Scale (PCCS; Tang & DeRubeis, 1999)			The scale includes seven categories that indicate cognitive change in awareness and cognitive schemas (e.g., "arriving at a new belief on a specific issue", "bringing a schema into awareness"). Each category is rated by classifying on a four-point scale how the patient reported the event - for instance, the highest rating on the scale indicates that a cognitive change with extraordinary personal significance took place.
	The Achievement of Therapeutic Objectives Scale (ATOS; McCullough et al., 2003)			Includes a subscale for insight which categorizes patients on their ability to recognize and understand his or her defensive patterns. In ATOS insight is defined as the degree of 1) "clarity and fullness of verbal descriptions of maladaptive patterns of thoughts, feelings, and/or behaviors", and 2) "ability to state why and how maladaptive/defensive patterns began and are maintained".
	Therapeutic-Realizations Scale (TRS; Kolden, 1991; revised version Kolden et al., 2000)			A scale designed for use in psychotherapy to assess beneficial therapeutic effects (such as gaining insight, feeling encouragement, clarifying a problem) at the session level.
	The Change and Growth Experiences Scale (CHANGE, Hayes, Feldman, & Goldfried, 2007)			A rating scale developed to describe processes related to the client's therapeutic progress. The CHANGE category "insight-processing" aims to capture related therapeutic concepts (such as emotional processing, meaning-making, benefit-finding, assimilation-accommodation, and schema change) that involve new connections, meaning or a perspective shift.

<p>Beck Cognitive Insight Scale (BCIS; Beck et al., 2004)</p> <p>Balanced Index of Psychological Mindedness (BIPM; Nyklíček & Denollet, 2009)</p>	<p>A 15-item self-report scale that measures self-reflectiveness and self-certainty of patients, i.e., the ability and willingness to introspect and acknowledge the fallibility of one's beliefs.</p> <p>14-item self-report scale of "psychological mindedness", i.e., the ability "to see relationships among thoughts, feelings, and actions, with the goal of learning the meanings and causes of his experience and behavior". Includes subscale "Insight" conceptualized as the ability for metacognitive awareness. Used mainly in the context of mindfulness based therapies.</p>
<p>3 Self-Reflection and Insight Scale (SRIS; Grant et al., 2002)</p> <p>Meditative Insight Scale (Ireland, 2013)</p> <p>Minimal Phenomenal Experience Questionnaire (MPE-92M; Gamma & Metzinger, 2021)</p>	<p>30-item self-report scale of private self-consciousness, including a subscale of insight, conceptualized as the clarity of understanding of one's thoughts, feelings and behaviour.</p> <p>4-item self-report scale to measure the extent of fundamental Buddhist insights that one has experienced in meditation. Insight here is defined as an "ongoing cumulative process of cognitive change characterised by an experiential sense of understanding and discernment into the nature of all things as being inherently impermanent, without independent self-existence, and through attachment, the cause of suffering".</p> <p>A 92-item self-report questionnaire about the experience of "pure awareness" in contemplative practices. Also includes a factor "Self-Knowledge, Autonomous Cognizance and Insight" which entails items about insight or experiences of 'knowingness', e.g., "did your experience have a non-visual quality of 'clarity'" or "was there an experience of 'pure knowing' without any object".</p>
<p>4 Psychological Insight Questionnaire (PIQ; Davis et al., 2021)</p>	<p>A 23-item scale designed to investigate <i>acute</i> insight experiences that often occur under the effects of psychedelics. Comprises two subscales: 1) avoidance and maladaptive patterns insights, and 2) goals and adaptive patterns insights.</p>

Psychological Insight Scale	
Psychological Insight Scale (PIS; Peill et al., 2022)	A 6-item scale designed to investigate insights acquired <i>after</i> psychedelic experiences.
Emotional Breakthrough Inventory (EDI; Roseman et al., 2019)	A 6-item scale focusing on the emotional breakthrough phenomenon in psychedelic experiences. Includes items such as “I experienced a resolution of a personal conflict/trauma”.
The Acceptance/Avoidance – Promoting Experiences Questionnaire (APEQ; Wolff et al, 2022)	A 57-item questionnaire that includes subscales “pro-acceptance insights” (e.g., “I learned to better understand certain emotional states”) and “pro-avoidance insights” (e.g., “I learned that it is better for me not to experience certain emotional states at all”).
Hallucinogen Rating Scale (HRS; Strassman et al, 1994; Riba et al, 2001)	A self-report questionnaire with 6 subscales designed to quantify psychedelic effects. Includes items “new thoughts or insights” and “insights into personal and occupational concerns” (Baggot, 2015; Strassmann, 2005).
Mystical Experiences Questionnaire (MEQ30; Barrett et al., 2015; derived from the States of Consciousness Questionnaire, Griffiths et al., 2006)	A 30-item scale which Includes items such as “experience of the insight that ‘all is one’” and “gain of insightful knowledge experienced at an intuitive level”.
Altered States of Consciousness Rating Scale (11D-ASC; Studerus et al., 2010)	Comprises 11 subscales including Experience of Unity, Complex Imagery, and Insightfulness with items “conflicts and contradictions seemed to dissolve” and “I gained clarity into connections that puzzled me before”.
Linton-Langs Questionnaire (Linton and Langs, 1962)	Contains a total of 74 items grouped in 17 subscales. Includes items: “Have you seen new connections between certain events or experiences that you hadn’t seen before?” and “Have you felt that certain things were especially clear to you or that you understood them better?” (Baggot, 2015)

Table 2. A selection of scales developed for measuring insight experiences and propensity to insight, or that include useful subscales or items for insights. The table includes brief descriptions of the scales or subscales relevant for measuring insight. The scales are arranged to reflect the main area of use (problem-solving (1), clinical/therapeutic (2), meditation (3), and psychedelic experiences (4), respectively), although there is some minor overlap, e.g., some scales on mindfulness or self-reflection which can be used both in a therapeutic or meditative context.

3. Insight in psychotherapy

3.1 Definition of insight

Success in therapy is usually measured by some change towards a more positive state, whether it is a change in feelings, thoughts, or actions (Carey et al., 2007). This change may take place gradually by learning and exercising new patterns of thought and behaviour, or it might take the form of a sudden breakthrough in understanding which launches a transformative change (Carey et al., 2007; Castonguay & Hill, 2007; Miller & C'de Baca, 2001). Positive change can be achieved with many different forms of psychotherapy; however, it is unclear what exactly about the therapeutic process induces this change. As it is often observed that different psychotherapies produce comparable results, it stands to reason that these effects result from factors common to various psychotherapies rather than specific factors characteristic of individual therapies (Lacewing, 2014). One such core component underlying the positive change in therapy is insight (Castonguay & Hill, 2007; Jennissen et al., 2018; Johansson, 2010; Kallestad et al., 2010; Lacewing, 2014).

In cognitive behavioural therapy, the concept of insight is discussed in terms of cognitive restructuring or a change in "schemas" (mental representations in long-term memory of themselves, others, experiences, or situations) which in turn may occur in a gradual manner or arrive suddenly, as a "cognitive click" (Mahoney, 1974; Meichenbaum, 1977). From this perspective, insight occurs as a novel understanding when previous problematic mental representations about the self and others are restructured or overwritten by new knowledge structures (Grawe, 2004; Grosse-Holtforth et al., 2007). The change or perspective shift is consciously experienced and verbalized by the client in session (Grosse-Holtforth et al., 2007).

In the field of psychodynamic psychotherapy, insight has been placed at centre stage and is traditionally regarded as a critical feature effecting change (Eissler, 1953; Frank, 1993; Ulberg et al., 2017) or the indication that some therapeutic change has occurred (Messer & McWilliams, 2007). Psychodynamic insight arises as an outcome of therapy when the client arrives at an understanding of the dynamics that manifest maladaptive patterns (Lacewing, 2014). Experiencing insight is described as an abrupt awakening from the darkness of despair, as if a light turning on, when the therapy suddenly begins to make sense (Wong, 2009).

Overall, insight in psychotherapy is most commonly conceptualized following the definition provided by Hill and colleagues (Hill et al., 1992, pp. 548-549): "*A client's expressing an understanding of something about him/herself and articulating patterns or reasons for behaviors, thoughts, or feelings; insight usually involves an "aha" experience in which the client perceives self or world in a new way*". Alternatively, the definition of "a cognitive change characterized by a sense of immediate understanding and discernment" has been used (Haverkamp & Tashiro, 2007, p. 355). In addition to "insight", this process is sometimes referred to as "self-understanding" in the therapeutic context (Crits-Cristoph, Shelton, Hollon, Kurtz, & Barber, 1999).

A difference is drawn between simple or intellectual understanding and insight, as the processing of an experience can take place either by thinking about it conceptually or reliving it through the immediacy of perception and emotion (Ellis, 2001; Greenberg, 2002; Messer & McWilliams, 2007). Although there is some disagreement regarding the defining features of therapeutic insight, attempts have been made to distinguish the core dimensions relevant to insights achieved in a therapeutic setting. For example, Elliott (1984) proposed four major elements of insight: 1) metaphorical vision or seeing with figurative eyes ("It made me see..."); 2) a connection of perceptions, reasons, or parallels (putting together pieces); 3) suddenness or a feeling of surprise (something "clicking"); and 4) a feeling of newness, discovering something that was previously unknown. A schema focused perspective (Grosse-Holtforth et al., 2007) highlighted five dimensions along which therapeutic insights could be considered: 1) the object or content of insight, 2) the complexity of connections, 3) the level of

representation, 4) the intensity of feelings, and 5) the degree of acceleration/suddenness. Both approaches highlight features which are also recognized in problem-solving literature, such as the forming of new connections, suddenness, and accompanying emotions.

Insight in psychotherapy is most frequently studied qualitatively by analyzing session recordings or transcripts, as well as the therapists' and clients' own reflections of the event (Elliott, 1985; Timulak, 2010). Several rating scales have been developed in an attempt to quantify the degree of insight experienced across different therapeutic disciplines (see table 2), however, these tend to focus on the content of the insight and often lack some of the main features of the phenomenological component of insight as described in problem-solving literature, such as confidence or the suddenness of onset.

3.2 Prerequisites of insight

In a meta-analysis of qualitative reports on therapeutic insights Timulak and McElvaney (2013) concluded that reported insight events were preceded by the presence of an internal conflict or unresolved issue for the client. This was typically an interpersonal conflict which they were looking to solve or an intrapersonal conflict of which to gain more self-understanding (Timulak & McElvaney, 2013). The context of arriving at the therapeutic insight entails actively working on that conflict which can culminate with a sudden realization of the core of the problem or highlighting a potential avenue for positive change. Sometimes this is preceded by the therapist probing for alternative interpretations or perspectives on the issue (Hill & Knox, 2008; Timulak & McElvaney, 2013). Importantly, gaining awareness of one's inner conflicts may be an important factor predicting a positive outcome of psychotherapy, as it introduces an element of inner turbulence and vulnerability which is considered a necessary prerequisite for therapeutic insights to occur (Hayes, Feldman, & Goldfried, 2007; Timulak & McElvaney, 2013). A parallel can be drawn with the process of reactivating a traumatic memory and triggering a discrepancy or prediction error in order to destabilize the memory trace opening it up for reconsolidation (Pedreira et al., 2004; Sevenster et al., 2012; Sevenster, Beckers, & Kindt, 2013; Sinclair & Barense, 2018). From a dynamic systems perspective, the destabilization or challenging of a system (i.e. existing knowledge structures) is necessary for change to take place, as old patterns are shaken loose allowing for new configurations to emerge (Hayes & Strauss, 1998; Hayes & Harris, 2000).

Clients also reported some readiness for intervention or a level of vulnerability prior to arriving at the insight and were open to alternative interpretations and reframings introduced by the therapist (Timulak & McElvaney, 2013). For instance, relaxation techniques which are frequently introduced in behavioural therapies are suggested to lower defenses and allow for greater awareness of one's thoughts and feelings, which can help to induce insights (Powell, 1996). Similarly, hypnosis which is occasionally used in cognitive-behaviour therapy (Kirsch, Montgomery, & Sapirstein, 1995) is reported to be an effective way of reducing resistance, leaving the client more receptive to therapeutic techniques which can help to induce insight (Erickson & Rossi, 1979; Dowd, 2000). On the other hand, clients' resistance and distrust in the process can impede experiencing insight in therapy (e.g., Knox, Hill, Hess & Crook-Lyon, 2008). Hence, an open and relaxed state appears to be an important prerequisite for increasing the efficacy of therapeutic techniques and inducing insights.

In psychoanalytic literature, the ability to "bind" mental sensations and representations (also known as "reflective functioning" or Freud's *Bindung*) is thought to be a precursor to developing insight (Lecours & Bouchard, 1997). From a cognitive-behavioural perspective binding can be thought of as self-reflection or metacognitive awareness. This entails an ability to reflect on one's own experiences and affective reactions, as well as utilize knowledge about one's mental states. Self-reflection is viewed as a skill that can be developed by the client in therapy, allowing for insights to occur independently of the therapist between sessions or even after therapy is completed and helping to prevent a relapse (Aron, 2000; Teasdale et al., 2002).

3.3 Event of insight

Insight events in psychotherapy research are defined using different terminology and varying levels of specificity across the various disciplines. However, despite the differences, a common sign of positive change in therapy is when the client gains new understanding about their core issue. Often this realization can be traced back to one specific event that occurs during the process of therapy which is commonly viewed as the insight experience. According to Hill and colleagues (2007), therapeutic insight can most generally be defined as “a conscious meaning shift involving new connections”. These may involve connections between past and present experiences, thoughts and feelings, or motivations and behaviours. In fact, different psychotherapies may place emphasis on different levels of connections (e.g., the psychoanalytic tradition focuses more on connections between past and present, whereas cognitive behavioural therapy puts an emphasis on patterns of thoughts). Overall, insight in psychotherapy involves the restructuring or connecting of existing patterns of thoughts and feelings into a novel understanding of one’s self.

Occasionally, a distinction between intellectual and emotional insight is drawn (Ellis, 1963, 2001; Crits-Christoph, Barber, Miller, & Beebe, 1993; Teasdale, 1993). Intellectual insight can be viewed as a cognitive process where the client gains a better understanding of the causes behind certain problems by making new connections at a conceptual level. Emotional insight, however, involves an additional affective and experiential component wherein the new connections are not only understood intellectually but experienced perceptually or bodily. For example, one client described that he could “visualize the point” of the change, and another said “I could actually hear it” (Carey et al., 2007). Some researchers have suggested that only emotional insight can be seen as “true” insight, as it involves affective arousal which is conducive to inducing significant change, while intellectual insight alone may have little therapeutic value (Ellis, 1963; Greenberg, 1992; Mahoney, 1974; Wachtel, 1997). Others argue that while emotional insight may have greater therapeutic impact, insights without emotion can also be helpful (Holtforth et al., 2007).

In a therapeutic setting, the insight experience will be verbalized in the client’s speech as a novel realization. The client may spontaneously identify or gain awareness of factors linked with their problems, or reach a new understanding of self (Schottenbauer, Glass, & Arnkoff, 2007). For example, a client exclaimed: “*I never realized how deeply these feelings affected me and how strongly I want to experience them again in my life*”, thereby expressing a novel awareness of inner processes as well as an intentionality towards new goals (Schneider & May, 1995). The verbal statement is usually accompanied by an observable expression of emotion, such as surprise (Elliott et al., 1994). Due to the personal nature of the subject matter, therapeutic insights may invoke both positive or negative emotions, however, it is frequently coupled with a sense of relief, newness, and a subjective evaluation of the interpretation as accurate or helpful (Elliott, 1984; Timulak & McElvaney, 2013).

3.4 Consequences of insight

Empirical evidence confirms a positive relationship between insight and the effectiveness of psychotherapy, implicating insight as a relevant factor for the therapeutic outcome alongside therapeutic alliance, positive regard, and empathy (for a review, see Jennissen, 2018). For instance, there is some evidence to support the mediating role of insight in creating a long-term positive effect of transference in psychodynamic therapy (Connolly Gibbons, Crits-Christoph, Barber, & Schamberger, 2007; Johansson et al., 2010). Additionally, greater insight has been linked to more positive affect and behavioural changes (Cummings & Hallberg, 1995; Cummings, Hallberg, & Slemmon, 1994). Insight is frequently cited as one of the most helpful events in therapy by both clients and therapists (Elliott & James, 1989; Llewelyn, 1988; Booth, Cushway, & Newnes, 1997). Experiencing insight events in therapy can also increase the client’s hopefulness and trust in the therapeutic process (Timulak & McElvaney, 2013).

Therapeutic insights can also lead to negative outcomes, for instance as clients may come to a realization of an upsetting or traumatic event that happened in the past which brings about strong negative emotions (Powell, 1995). On the one hand, this can be viewed as an insight into a buried conflict and may be a necessary step towards resolution. Alternatively, such realizations of past events are more often than not the result of false insights or “placebo insights”, where the sudden understanding is not based in reality, yet carries the subjective significance and truth value of veridical insights (e.g., Geraerts et al., 2009; Jopling, 2001). Although placebo insights can in some cases also lead to therapeutic benefits, these would not be considered true therapeutic insights, but rather adaptive or self-serving misinterpretations (Jopling, 2001).

In experiential therapy, insight is considered as an initial step in the process towards change (Pascual-Leone & Greenberg, 2007). The client may begin to question and challenge their previous belief and, with the help of the therapist, construct a new, more coherent narrative account where links between events and their causes are reconstructed (Angus & Hardtke, 2007). The insight experience can bring about motivation and readiness to inflict a change (Carey et al., 2007). Only after insight has taken place can an individual apply their novel understanding and awareness to real life situations and respond differently than previously. The emotional insight experience therefore serves as a catalyst for true change, as the attention rewarded to a problem due to insight makes it accessible to novel inputs and further restructuring (Greenberg, 2002).

3.5 Summary

In the context of psychotherapy, insights occur when the client suddenly achieves a novel understanding that involves some change or reorganization of mental representations. Although in psychotherapy the term “insight” is also used to signify a more analytical process of understanding by reasoning, here we draw the comparison specifically to emotional insights which are recognized as involving an affective component that makes the novel understanding more significant and impactful. Often, such therapeutic insight events are correlated with perceived change and therapeutic progress, as internal conflicts or symptoms that were causing tension for the client are resolved. Achieving such insights is preceded by actively working on the problem and fostering an open and vulnerable state of mind.

4. Insight in meditative traditions and contemplative science

4.1 Definition of insight

Insight is a central concept in most meditative traditions. For instance, Vipassanā meditation which is currently one of the more popular types of meditation (similar to Western mindfulness and Open Awareness meditation, Lutz et al., 2008) is commonly translated as Insight meditation. A primary goal of Vipassanā meditation is to gain an understanding of fundamental Buddhist concepts about consciousness called the three marks of existence (Laukkonen & Slagter, 2021; see also the Four Noble Truths e.g., Burbea, 2014; more detailed conceptualizations also exist: e.g. Analayo, 2012, Sayadaw, 2016). These are that (1) all mental phenomena are impermanent, (2) suffering is an innate characteristic of existence, and (3) the nature of the self is illusory or constructed. While traditionally insight in meditation is considered related to fundamental understandings (which may differ depending on the specific discipline; Analayo, 2012), insights into more mundane personal and psychological matters can also arise (Yates et al., 2015; Brown et al., 2007; Dahl et al., 2015). It is suggested that meditation allows a person to become aware of their mental phenomena by increasing metacognitive awareness (Lutz et al, 2015; Eberth et al, 2019), mental clarity (Lutz et al, 2015; Brown et al, 2007; Eberth et al, 2019), alertness (Britton et al, 2014), and decentering (disidentifying with mental content; Teasdale and Chaskalason, 2011; Lutz et al, 2015).

According to this understanding, if mental phenomena are investigated with concentration and mindfulness, then insight into the “true, illusory nature” of mental phenomena will be achieved (Eberth et al., 2019). It is important to note that in most traditions, meditation is supported by an ethical or religious framework, which is likely to affect the content of insights.

In the context of meditation, insight is also sometimes thought of as an experience characterized by a subjective feeling of deep understanding and by changes in perception, judgement and/or behaviour (Eberth et al., 2019; Dahl et al., 2015). Contrary to intellectual knowledge, insight relates to intuitive realizations that can radically transform our understanding (Yates, 2015). A similar interpretation considers insight to be a “shift in consciousness”, alluding to the idea that in addition to changes in thoughts and behaviour insight can also be related to non-verbal, experiential phenomena (Dahl et al., 2015), such as changes in perception, metacognitive processing, attentional shifting, or implicit belief structures (Full et al, 2013; Eberth et al., 2019; Shapiro et al, 2006).

Alternatively, insight is sometimes thought of as “clear-seeing” which is a state of mind where all phenomena of consciousness are experienced clearly in accordance with reality without habit-based conceptual thought (Brown et al., 2007; Dahl et al., 2015; Laukkonen & Slagter, 2021). This description is also strongly related to a facet of mindfulness called “non-judgemental awareness” and illustrates the overlapping nature of mindfulness and insight (Eberth et al., 2019).

Very little research has so far been conducted that focuses on elucidating insight events in meditation. Thus, only few scales have been developed that capture specific aspects of meditative insights. Rather, more broad concepts such as self-reflectiveness and metacognitive awareness (which can include certain aspects of insights) are most often measured in the context of research on meditative practice and mindfulness therapies (see table 2 for some examples).

4.2 Prerequisites of insight

While there is some disagreement in both meditative traditions (Analayo, 2012) as well as in scientific inquiry (Dahl & Davidson, 2020) on the most effective ways to reach insight, mindfulness is generally believed to facilitate insight (Ireland, 2013; Eberth et al., 2019; Analayo, 2012). One definition of mindfulness as a cognitive process is, “self-regulation of attention to the conscious awareness of one’s immediate experiences while adopting an attitude of curiosity, openness, and acceptance” (Lutz et al., 2015; Bishop et al., 2004; Slagter, Davidson, & Lutz, 2011). Other definitions focus on the non-judgmental quality of present awareness (Kabat-Zinn, 1994), or the inhibiting of mind-wandering and rumination episodes (Mrazek et al., 2012). Mindfulness also evolves with practice and can transition into an effortless non-evaluative monitoring of experience (Lutz et al., 2008; Dunne, 2011). The idea that mindfulness can facilitate insight is also echoed in the problem-solving literature (Colzato et al., 2017; Ostafin & Kassman, 2012; Ren et al., 2011, but see Zedelius & Schooler, 2015). Insights into the three marks of existence (Ireland, 2013) as well as insight in problem-solving tasks have been shown to increase with meditation practice (Colzato, 2017) and higher trait mindfulness (Ostafin & Kassman, 2012). It has also been suggested that mindfulness supports a conceptually more distant search, while mind wandering restricts search to a local solution space (Kudesia et al., 2015 but see Zedelius & Schooler, 2015). While different types of meditation can facilitate different insights and vary in their effect on insight (e.g., Colzato et al, 2012; Colzato et al, 2017), Vipassanā meditation appears to be most focused on generating insights that aim to facilitate enduring changes to cognition (Ireland, 2013; Laukkonen & Slagter, 2021). As other meditation types might focus on concentration or chanting a mantra, Vipassanā is about awareness of the mind’s activity which could be more conducive to insight.

By cultivating mindfulness, one enhances their ability to “look more closely” at their cognitive processes (metacognitive awareness or decentering; Eberth et al., 2019; Lomas et al., 2015, but see Lykins et al., 2012; Chambers et al., 2008) which may lead to insights about how the mind works (Dahl et al., 2015), and may also help one perceive previously unnoticed connections between different thoughts and feelings (Eberth et al., 2019; Dahl et al., 2015). One aspect of mindfulness that has been shown to correlate with insight is decentering (Ireland, 2013), whereby mental activity is “perceived” separately without being absorbed in it (Ostafin & Kassman, 2012; Eberth et al., 2019). Not being absorbed in and not identifying with thoughts may allow one to perceive thoughts from different perspectives (Full et al., 2013) and generate novel insights. Increased metacognitive and interoceptive awareness can also help to pay attention to inner signals which otherwise would be ignored (Yates, 2015), including weak insights.

Research into meditative practices seems to indicate that states with less thought activity could be especially fruitful for attaining insights (Eberth et al., 2019; Gamma & Metzinger, 2021; Full et al., 2013; Vago & Zeidan, 2016, but see Tan et al., 2015; Zedelius & Schooler, 2015). These states of calmness and clarity are characterized by a reduction or lack of discriminating conceptual thinking and an improved perception of mental phenomena. The Buddhist concept of *śamatha* (often translated from Pali as calm abiding or tranquility of the mind) is characterized by effortlessly stable attention, strong mindfulness, joy, tranquility, and equanimity. Reaching a state of *śamatha* regularly during meditation and between sessions is thought to increase the chances for profound insights (Yates, 2015; Kabat-Zinn, 2005; Burbea, 2014). It has been suggested that these states allow meditation practitioners to perceive and take note of activity leading up to specific thoughts, emotions, and actions (Laukkonen & Slagter, 2021; Eberth et al., 2019) which can be helpful in elucidating disruptive or pathological patterns of mental activity. Similarly, the metacognitive ability of self-reflection is also considered a valuable skill in many therapeutic practices (Stedmon & Dallos, 2009). Insight has also been found to correlate with the duration of meditation sessions (Eberth et al., 2019). Longer sessions are more likely to induce deep concentrative states which could be more conducive to insights (Eberth et al., 2019).

Meditation can also lead to a variety of unusual experiences which could require the restructuring of mental models in an attempt to explain these events. Initially, as the intensity of meditation practice increases, hallucinations and unusual sensory and emotional experiences are quite often encountered, especially during retreats or longer meditations (Grabovac, 2015; Lindahl et al., 2017). With further progress, the amount and intensity of such experiences decrease (Gamma & Metzinger, 2021; Yates et al., 2015; Wielgosz et al., 2019; Laukkonen & Slagter, 2021). Emotional experiences can vary from extremely positive and pleasant to negative and painful (Lindahl & Britton, 2019; Britton et al., 2021; Lindahl et al., 2017). During these experiences, a meditator is usually encouraged to develop equanimity and a decentred metacognitive awareness (Lutz et al., 2015) which may lead to the attenuation of emotional reactions and an increase in feelings of peace and deep joy (Eberth et al., 2019; Yates et al., 2015). Deconstructive types of meditation (e.g., mindfulness, Vipassana) are more likely to induce unpleasant experiences but also insight, which might suggest that psychological conflict is part of the arising of insight (Schlosser et al., 2019; Kornfield, 1979; Yates et al., 2015).

According to some meditative traditions, for insight to happen it is necessary to identify and investigate underlying assumptions that do not align with the three core marks of existence (Anlayo, 2012; Yates et al., 2015). For example, the belief that there exists a separate self is an incorrect view according to Buddhist tradition (Fink, 2012) and needs to be deconstructed to achieve the insight that the self is illusory. Deconstructive meditations are centred on deeply exploring elements of subjective experience and trying to reach an experiential understanding of the nature of consciousness and mental phenomena (Dahl et al., 2015). This can be achieved by actively thinking about and questioning the logical consistency between one's

subjective experience and previously held assumptions. The cognitive dissonance experienced from conflicting personal beliefs will often culminate in resolution via insight (Dahl et al., 2015).

4.3 Event of insight

Meditative traditions propose that insight happens in states of strong mindfulness and deep concentration where practitioners come to realize “fundamental truths” through the investigation of mental phenomena. These realizations can be conceptual and verbal as well as experiential and non-verbal (Eberth et al., 2019; Burbea, 2014), i.e. a feeling of insight rather than specific propositional knowledge. The insights range from being able to perceive personal ideas from multiple perspectives to more subtle shifts in consciousness where mental phenomena are perceived with more depth and clarity (Full et al., 2013; Eberth et al., 2019). There is also often a comprehension of interdependencies in incoming perceptual information which can purportedly prompt the understanding of the self being an illusion (Full et al., 2013; Dennison, 2019; Grabovac, 2015; Vago & Silbersweig, 2012). In other cases, experiences may arise that have implications which result in novel insights. For example, non-dual awareness (Josipovic, 2014), or a seemingly direct perception of the automaticity with which phenomena appear and disappear revealing their impermanence (Laukkonen & Slagter, 2021; Full et al, 2013; Sayadaw, 2016). Perception can also become “panoramic”, broader and more inclusive, the number of sensations can increase or enormously decrease (Vago & Zeiden, 2016; Laukkonen & Slagter, 2021; Burbea, 2014). People can experience an improvement of sensory resolution (Grabovac, 2015; Yates et al., 2015) and perceive information from different sensory organs seemingly in parallel (Eberth et al, 2019).

Are meditative insights also ‘sudden and unexpected’ like those that occur during problem-solving? This question has a long history in Buddhism, where some schools of meditation are even distinguished based on whether they aim to achieve sudden or gradual enlightenment (Sharf, 2015). However, insight in meditation is usually defined not based on how but what one discovers, in the same way that a problem can be solved either gradually or suddenly and yet have the same solution (Webb et al., 2018). In other words, the insights are predefined (e.g., impermanence, suffering, and non-self) and one must seek out their experiential discovery, which can unfold in successive stages of sudden or gradual insight (Bodhi, 2011; Sayadaw, 1994; Yates et al., 2015). Although these insights can occur in a flash or be drawn out, in most cases integration takes time (Kornfield, 2001). Thus, insight in meditation may be better seen as a solution to a problem (e.g., suffering) that can sometimes occur suddenly, and some practices may be more likely to induce sudden (e.g., Koan practice in Zen, akin to an “insight problem”) versus gradual discoveries (e.g., Vipassanā in Theravada, akin to an “analytic problem”). As a final note, there may be some insights that always occur following the more traditional format of suddenness and unexpectedness, like those that relate to the non-existence of a persistent self or non-dual awareness (Josipovic, 2009).

4.4 Consequences of insight

While the therapeutic benefits of meditation and mindfulness have been investigated in quite some depth, the role of insight in mediating these benefits has only recently become an object of scientific inquiry (Eberth et al., 2019; Laukkonen & Slagter, 2021; Dahl et al., 2015). There are suggestions of insight being an important facilitator for the realization and reinterpretation of distorted and pathological beliefs (Ireland, 2013; Dahl & Davidsson, 2019; Laukkonen & Slagter, 2021; Eberth et al., 2019), as well as a core mechanism of change in mindfulness and meditative practices (Ireland, 2012). Some theories have suggested that meditative insight leads to changes in the way one relates to the self, personal thoughts and the world, resulting in reduced suffering, enhanced emotion and attention regulation, as well as increasing the possibility of attaining advanced states of meditation (Wallace & Shapiro, 2006; Laukkonen & Slagter, 2021; Vago & Silbersweig, 2012) which could, however, be mediated by the content

of insights (e.g., of fundamental understandings). Research has shown that Buddhist meditators report greater life satisfaction and higher levels of equanimity which are related to their level of insight (Eberth et al., 2019). Moreover, meditative insight, conceptualized as the extent of insights experienced during meditation, has been found to correlate with increases in well-being, life satisfaction, happiness and compassion, and decreases in stress and depression (Ireland, 2013).

Although meditation research has largely emphasized the beneficial effects of meditation, there can also be risks and potential adverse outcomes. Attaining insight into fundamental traditional concepts like the understanding that one's usual sense of self is a mental construct or that everything is impermanent can at times be extremely harrowing. Without proper integration this can lead to negative long-term effects, such as anxiety, depression or suicidal ideation (Yates et al., 2015; Grabovac, 2015; Kornfield, 1979; Lazarus, 1976; Lindahl et al., 2019; Cebolla et al., 2017). Some instances of dissociative states and psychosis onset after intense meditation retreats have also been reported (Kuijpers et al., 2007; Lomas et al., 2015; Lustyk et al., 2009; see also Lindahl et al., 2017; Lutkajtis, 2021). Meditative traditions generally emphasize the importance of an ethical, preparative and integrative framework to support meditative practices to minimize the extent of such debilitating consequences (Lutkajtis, 2021). Finally, as the epistemic value of such fundamental insights is unclear, there is room for debate whether the potential therapeutic benefits outweigh being entrenched with spiritual, possibly false beliefs.

4.5 Summary

In meditative literature, insight is more broadly defined and has been conceptualized based on the content of insight (e.g., fundamental understandings) or more similarly to other domains, based on the experience of deep understanding. Furthermore, insight has occasionally been defined as a specific state of mind wherein novel understandings are more likely to occur, which may be comparable to a prerequisite of insight in other fields. Hence, it is somewhat more challenging to identify the components of insights in meditative literature. Distinguishing a broader state of insight and the more specific insight event may be beneficial for developing a unified understanding of insight. The arising of insight is suggested to be mediated by mindfulness (or its facets, like decentering), decreased conceptual thinking, unusual sensory and emotional experiences, and increased awareness of conflicting personal beliefs. Alterations in perception and conscious experience (e.g., broader attention and clarity) are also common in meditative states and could lead to insights. It is important to note that the role of insight in meditation is often discussed in theoretical models, but empirical research specifically regarding insight is so far limited. Current preliminary research seems to suggest that meditative insight is generally related to beneficial effects, but intense meditation can also rarely lead to the onset of psychosis or dissociative states. More rigorous research is needed to determine the generalizability of those findings and how they relate to a more concretely defined concept of insight.

5. Insight in research into psychedelics

5.1 Definition of insight

Psychedelics are psychoactive substances which induce altered states of consciousness characterized by changes in perception, cognition and mood. "Classical" psychedelics are considered to be lysergic acid diethylamide (LSD), dimethyltryptamine (DMT), mescaline and psilocybin (main psychoactive compound in "magic mushrooms"). The effects of classical psychedelics (non-classical psychedelics, like MDMA or ketamine, can employ alternative neural mechanisms) are thought to be brought about by their agonism at the serotonin 5-HT_{2A}

receptors (Vollenweider et al., 1998; Nichols, 2016). Although research into these substances was halted after their banning in the 1970s (Nichols, 2016), the last 20 years have seen a resurgence of interest among scientists. This is largely due to preliminary research which has indicated promising effects of psychedelics in treating several mental disorders (Nichols, 2016; Nutt & Carhart-Harris, 2021), including depression (Carhart-Harris et al., 2016; Carhart-Harris et al., 2018; Griffiths et al., 2016; Ross et al., 2016), anxiety (Gasser et al., 2015; Ross et al., 2016; Grob et al., 2011) and different addictive disorders (Bogenschutz et al., 2015; Garcia-Romeu et al., 2014; Garcia-Romeu et al., 2019; Garcia-Romeu et al., 2020). Current preliminary evidence suggests that insight (alongside the intensity of mystical experience) experienced during psychedelics use could be one of the main facilitators of their beneficial effects (Bogenschutz and Pommy, 2012; Garcia-Romeu et al., 2019; Garcia-Romeu et al., 2020; Griffiths et al., 2020; Letheby, 2021). Due to a new wave of psychedelic research, multiple rating scales have been developed that capture various aspects of the psychedelic experience, many also including psychedelic insights (see table 2).

Insights in psychedelic research are for the most part conceptualized very similarly to “aha moments” - as sudden new understandings of subjective significance. Psychedelic substances have been used by different ancient cultures for multiple millenia for the purpose of acquiring knowledge and understanding (Richards, 2015; Narby, 1999). Psychedelic insights entail people coming to therapeutic or otherwise beneficial personal, transpersonal, and metaphysical understandings of the nature of the world or consciousness (Garcia-Romeu et al., 2015; Davis et al., 2021; Letheby, 2021; Timmermann et al., 2021).

Additionally, it is hypothesized that psychedelics create an enhanced feeling of meaning and knowing (Preller et al., 2017; Hartogsohn, 2018) or induce certain states (see 5.2), which can be conducive for insight (Amada et al., 2020; Girn et al., 2020). The subjective feeling of insight can accompany trivial and often even banal “understandings”, as well as deeper and more beneficial insights (Baggott, 2015; Hartogsohn, 2018; Carhart-Harris and Friston, 2019; Timmermann et al., 2020; Girn et al., 2020; Mason et al., 2021).

5.2 Prerequisites of insight

Multiple studies have shown that psychedelics can bring about intense insight experiences (Davis et al., 2020; 2021; Gasser et al., 2015; Schmid et al., 2020), however, it is not yet entirely clear which aspects of the psychedelic experience induce insights.

The psychedelic state is characterized by unrestrained and accelerated cognition, hyper-associative, bizarre and unfiltered spontaneous thinking (Carhart-Harris and Friston, 2019; Mason et al., 2021; Girn et al., 2020; Bayne and Carter, 2018). Psychedelics are thought to create a state of relaxed beliefs which allows the person to consider novel ideas and perspectives which can lead to insight (Carhart-Harris & Friston, 2019). This state of relaxation can also make prior beliefs amenable to revision (Carhart-Harris & Friston, 2019). Psychedelics have also been shown to increase primary process thinking – a type of thinking that is automatic, analogical, emotion-driven and often image-based (Carhart-Harris et al., 2014; Kraehenmann et al., 2017a). This is further corroborated by findings that psychedelics cause unusual functional connectivity and increased entropy in the brain and disrupt networks active in default consciousness (Petri et al., 2014; Kuypers et al., 2016; Carhart-Harris and Friston, 2019; Tagliazucchi et al., 2016; Preller et al., 2018). This type of spontaneous and unrestrained mental activity could be instrumental in inducing insights (Mason et al., 2021; Kraehenmann et al., 2017b, Carhart-Harris and Friston, 2019; Girn et al., 2020; Timmermann et al., 2020). It is interesting to note that while the psychedelic state could be conducive for insight by accelerating and unrestraining cognition, psychedelics also lead to states that have minimal phenomenal content (e.g., non-dual or pure consciousness experiences; Milliere et al., 2018; Letheby, 2020). Similar states are considered to be especially beneficial for supporting insight experiences in meditative literature (Eberth et al., 2019; Gamma & Metzinger, 2021; Full et al., 2013; Vago & Zeidan, 2016, but see Tan et al., 2015; Zedelius &

Schooler, 2015), implicating two potential alternative mechanisms via which psychedelics could induce insights.

Studies have shown that the insightfulness of a psychedelic experience is correlated with mystical experiences (Liechti et al., 2017; Pallavicini et al., 2021), as well as reports of ego-dissolution (Kraehenmann et al., 2017b) and oceanic boundlessness (however, note that the oceanic boundlessness subscale of 5D-ASC questionnaire also contains questions related to insight; Roseman et al., 2018). Psychedelic insights have also been correlated with positive mood (Kraehenmann et al., 2017b; Liechti et al., 2017; Pallavicini et al., 2021), changed meaning of percepts (Kraehenmann et al., 2017b), and experiences of unity (Pallavicini et al., 2021) and non-judgementality (Uthaug et al., 2020).

Being able to “let go”, accept and surrender to the experience are likely to be important facilitators of emotional breakthrough and insight (Wolff et al., 2020; Carbonaro et al., 2016; Belser et al., 2017). This means that an open mindset and a supportive environment (also referred to as “set and setting”) in psychedelic therapy is essential and if neglected can result in negative outcomes (Carhart-Harris et al., 2018; Oram, 2014; Hartogsohn, 2017). Notably, a client’s vulnerability and openness to experience are also relevant factors for achieving insights in psychotherapy (Timulak & McElvaney, 2013). Similarly to meditative insights, there is some evidence to suggest that mindfulness (or some facets of mindfulness) might also be an important facilitator of insight in psychedelic experiences (Uthaug et al., 2020; Dahl et al., 2015; Eberth et al., 2019). This is supported by qualitative research by Amada and colleagues (2020), where multiple reports of psychedelic experiences mention decentring (or metacognitive awareness) as a mechanism for gaining insights. Furthermore, studies have suggested that psychedelics enhance mindfulness post-acutely (Qiu and Minda, 2021; Madsen et al., 2020; Soler et al., 2015) and users have also reported amplified mindfulness acutely (Watts et al., 2017; Belser et al., 2017; Amada et al., 2020) which lends some additional support to the link between mindfulness and insight.

Reports of psychedelic experiences often mention that thoughts and visions are dynamic and constantly changing (Kraehenmann et al., 2017b; Belser et al., 2017). Seeing things from multiple perspectives in quick succession (or, at times, even simultaneously; e.g., BigChief, 2008; Navi, 2001) is also reported during psychedelic experiences (Baggott, 2015; Sessa, 2008; Gasser et al., 2015). Similarly, people have reported experiencing the whole spectrum of emotions during psychedelics (Belser et al., 2017) and experiencing “*a number of feelings [...] at approximately the same time which would appear to the rational observer as opposed and contradictory*” (Baggott, 2015). This experience of multiple perspectives and embracing opposites has been speculated to play a part in creativity (Baggott, 2015; Katz et al., 1968) and could also be important for insight.

Psychedelics also sometimes induce “bad trips” or challenging experiences. While these have been more rare in recent research due to the implementation of thorough screening protocols and significant safety measures (e.g., high focus on the “set and setting” of the experience), even experiences that are retrospectively viewed as positive and beneficial quite often contain periods of distress and anxiety (Griffiths et al., 2006; Gashi et al., 2021; Carbonaro et al., 2016; Belser et al., 2017; Dyck and Elcock, 2020). Psychedelics frequently cause ego-dissolution (or ego death), which is an important facet of mystical and peak experiences and one of the proposed therapeutic mechanisms of psychedelics (Milliere et al., 2018; Letheby, 2021). This phenomenon can be preceded by extreme distress (Gasser et al., 2015) with people sometimes even reporting experiences or visions of dying (Gashi et al., 2021; St John, 2018; Dyck and Elcock, 2020). Ego-dissolution entails losing one’s inner narrative, body ownership, bodily awareness, spatial self-location and subject-object distinction (Milliere et al., 2018). Losing the sense of ownership over one’s inner narrative could result in disidentifying with the contents of conscious experience and enabling people to look at themselves from a distance which in turn can induce insights (Letheby, 2021; Amada et al., 2020). For example, a

participant in a study by Amada and colleagues (2020) reported: “Psychedelics help by removing my ego and let me think about my life without its judgement. So I get a much clearer image of my situation. Kind of like a zoom out on life.” One possible interpretation for the phenomenon of ego-dissolution is the disruption of long-term autobiographical memories or the ability to retrieve them (Milliere et al, 2018; Mason et al, 2020; Healy, 2021). Some recent studies have found decreased functional connectivity between brain regions related to memory retrieval, especially in the connections of medial temporal lobe/hippocampus to cortical areas which seem to correlate with ego dissolution (Lebedev et al, 2015; see also Mason et al, 2020; Tagliazucchi et al, 2014) and insightfulness (Kometer et al, 2015).

5.3 Event of insight

Psychedelics often cause people to experience different visions (Cott & Rock, 2012; Wolff et al., 2019; Winkelman, 2017; Winkelman, 2018; Belser et al., 2017). Abstract visions of colours and geometric patterns are the most common, but sometimes (more common with higher doses of psychedelics) visions of creatures, people or places are also reported (Wolff et al., 2019; Cott & Rock, 2012; Winkelman, 2017; Belser et al., 2017). Such visions can occasionally accompany insights and in some cases, insights are “given” by entities in the visions (Wolff et al., 2019). Although there are similarities in the reported visions, the experiences can also have large individual differences and may be symbolic of personal history (Belser et al., 2017). Insights could also arise after the visions in an integration of the experienced sequence (Carhart-Harris, 2018) or even after the psychedelic experience when the concepts shaken loose by this state of relaxed constraints are reorganized in new ways (Carhart-Harris & Friston, 2019).

Insights gathered from psychedelic experiences are often personal (Amada et al., 2020; Wolff et al., 2019; Watts et al., 2017; Belser et al., 2017) or about the nature of reality and consciousness (Cott & Rock, 2008; Wolff et al., 2019; Timmermann et al., 2021). People also often report insights that are experiential, non-verbal or even paradoxical (Garcia-Romeu et al., 2015; Belser et al., 2017; Katz et al., 1968), possibly due to being related to fundamentally experiential, non-conceptual or metaphysical understandings which can be difficult (or potentially impossible) to verbalize. For example, insights from psychedelic-assisted therapy can include: “understandings into the nature of space-time, the foundational role of love in the universe, the interconnectedness of all things, and the importance of experiential understanding” (Belser et al., 2017).

Psychedelic insights are often accompanied by a strong sense of veracity (Belser et al., 2017; Cott & Rock, 2008) and meaning (Carhart-Harris et al., 2015; Preller et al., 2017). This likely amplifies the subjective significance of these experiences and helps motivate people to integrate the new understandings into their everyday life (Hartogsohn, 2018; Belser et al., 2017). Some studies suggest that while psychedelics increase the “feeling” of creativity and insight, this may not be reflected in the actual novelty or quality of ideas generated during the experience (Mason et al., 2021; Baggott, 2015; Laukkonen et al., 2018; 2020a). In other words, during psychedelic use even mundane ideas can seem meaningful (Baggott, 2015; Hartogsohn, 2018; Carhart-Harris and Friston, 2019; Grin et al., 2020).

During psychedelic experiences it is possible that one insight event triggers a sequence of other insights (Masters & Houston, 1966): “I kept having these incredible realizations after realizations about the world and the universe, and myself. It was like every great realization led to another one, but at the end of every realization loop was the incredible realization that nothing I had just thought of made sense, and I was just on acid” (Triptacular, 2012). While psychedelic insights are often deemed important and personally meaningful after the experience (Davis et al., 2021; Letheby, 2016), sometimes people reevaluate their meaningfulness in hindsight. Similarly to metaphysical insights acquired during meditation, the epistemic quality of psychedelic insights is difficult if not impossible to assess. However, they

can be therapeutically beneficial if by proper integration they help to solve a conflict or dissonance for the person or find new meaning (Park et al., 2010).

5.4 Consequences of insight

Recent evidence seems to suggest that insight experiences are not simply a curious byproduct of psychedelic experiences, but rather have been shown to predict positive outcomes of psychedelic therapy (Carhart-Harris et al., 2016; Garcia-Romeu et al., 2019; Garcia-Romeu et al., 2020; Davis et al., 2021; but see Olson, 2020; Olson et al., 2021). Some studies suggest that insight during psychedelic experiences is the key factor driving the therapeutic success of psychedelics (Griffiths et al., 2020; Letheby 2021). Insight has been associated with decreases in depression (Davis et al., 2020), anxiety (Davis et al., 2020) and alcoholism (Garcia-Romeu et al., 2019). It has also been shown that psychedelic insight predicts increases in psychological flexibility following a psychedelic experience (Davis et al., 2020). However, more rigorous studies with appropriate control conditions are required to confirm these results.

Insights acquired during psychedelic experiences have been proposed to mediate beneficial changes in lifestyle: shifts in life priorities from material towards experiential, improved wellbeing and a stronger sense of connection with self, society and the world have been reported (Belser et al., 2017; Carhart-Harris et al., 2018). Specifically, changes to one's narrative self are often viewed as especially impactful and considered one of the main mechanisms behind the transformative potential of psychedelics (Amada et al., 2020; Letheby, 2021), but further research is necessary to confirm these views.

Multiple survey studies have also suggested that psychedelics could impact religious, metaphysical and political beliefs as well as personality (Nour et al., 2017; Watts et al., 2017; Garcia-Romeu et al., 2015; de Wit et al., 2021; Timmermann et al., 2021). Psychedelic experiences have been shown to bring about a significant and persistent increase in trait openness (MacLean et al., 2011; Carhart-Harris et al., 2016b; yet see also Schmid & Liechti, 2018; Griffiths et al., 2017). A few studies have also suggested that psychedelic experiences can lead to more environmentally friendly behaviour (Kettner et al., 2019; Paterniti et al., 2022; Forstmann and Sagioglou, 2017). While it has not been explicitly investigated yet, it has been hypothesized that such psychedelic-induced shifts in beliefs and personality could be mediated by insight experiences (Timmermann, Watts, & Dupuis, 2020). Psychedelic insights seem to generally have a higher likelihood of leading to certain kinds of beliefs (e.g., increases in openness, less materialistic worldviews and more environmental-friendly attitudes; Timmermann et al., 2021) which could be influenced by the commonly reported experiences of reduced self-importance, such as decentring, awe and ego-dissolution (e.g., Hendricks, 2018; Kettner et al., 2019; Kirkham and Letheby, 2022; Forstmann and Sagioglou, 2017). Alas, these studies have so far been conducted on specific subpopulations (clinical populations or naturalistic studies on psychedelic-users), so further studies are necessary to see whether these claims generalize to the whole population and how cultural conditioning could affect these shifts.

There is also some research that suggests psychedelic experiences can lead to psychosis-like symptoms (Carhart-Harris et al., 2016; Wießner et al., 2021; Vollenweider et al., 1998) and may in some cases trigger drug-induced psychosis (Sami et al., 2015; Strassman, 1984; Vardy & Kay, 1983; but see Krebs & Johansen, 2013). It is therefore possible that insights and mystical experiences associated with psychedelic use can be helpful for certain conditions (such as depression, addiction, and anxiety), but may be dangerous for people who are at risk for developing psychosis (Johnstad, 2021).

Similarly to metaphysical insights acquired in meditation, psychedelic experiences can also in some cases induce feelings of anxiety and existential dread or lead to changes to one's narrative self which may be perceived as unfavourable, although these tend to be quite rare

and manifest mainly in unsupervised conditions (Garcia-Romeu et al., 2020; Johnson, Richards, & Griffiths, 2008).

5.5 Summary

Psychedelic insights include personal understandings that can have therapeutic benefits, as well as transpersonal and metaphysical understandings. The experience of insight can be accompanied by a verbal understanding, but is often ineffable, potentially signifying some mental restructuring that eludes conscious awareness. The psychedelic state is also often characterized by enhanced feelings of meaning, which might lead to 'banal' or 'meaningless' insights where something feels meaningful acutely but is retrospectively recognized as trivial. Preliminary research seems to suggest that certain psychedelic-induced alterations in subjective experience (e.g., enhanced decentering/mindfulness or ego-dissolution) could be important mediators of insight, in addition to a chemically enhanced hyper-associative state. However, it is important to note that research in this field is still in early stages and much work needs to be done to verify these ideas.

6. Insight and the formation of primary delusions

6.1 Definition of insight

The phenomenon of insight has been linked to the question of how schizophrenic delusions arise. The idea that the phenomenological component of delusions as they first appear is similar to the experiencing of an insight has a long history (Jaspers, 1963; Conrad, 1971; Arieti, 1955; Fayearts et al., 2021). Delusions much like insights are described as a sudden revelation that is likely to be experienced as highly relevant and meaningful to the patient (Jaspers, 1963; Mishara, 2010; Fayearts et al., 2021). The delusion involves a "fundamental reorganization" of previous thoughts and experiences and often brings relief (Mishara, 2010). Importantly, at the moment of insight the patient is unable to shift perspective to anything other than the current explanation of events which signals the onset of psychosis (Mishara, 2010).

There is no unanimous definition of insight in psychosis, however, attempts have been made to describe this subjective experience based on patient reports. In his textbook, Arieti (1955) proposed that "psychotic insight" occurs when the patient suddenly discovers relationships and meanings between things that previously appeared as disconnected. *"The insight is psychotic because only the patient sees these connections. To use his own words, he "puts two and two together"; he is able "to assemble the various pieces of a jigsaw puzzle." But only he is able to detect the puzzle"* (Arieti, 1955).

A more modern view is echoed in Ulhaas & Mishara, 2007: *"Suddenly, from out of the fragments, the patient has an Aha-Erlebnis, a sudden insight into the situation. This relieves the increasing distress due to the fragmentariness or gaps in the natural successive organization of this experience in time. The seeming "insight" of the delusion imposes a retroactive organization on the collected, non-temporalized fragments. The perceived coincidences seem to restore an illusory continuity of experience"* (Ulhaas & Mishara, 2007; see also Fayearts et al., 2021 who further compare delusions to the "aha" experience).

Most of the scales developed to measure insight in patients with mental illness converge on three dimensions of interest: awareness of illness, ability to relabel mental events as abnormal, and treatment compliance (David, 1990). As a result, there are several scales that measure "clinical insight" as the ability to recognize one's illness and the need for treatment (see Tranulis, Lepage, & Malla, 2008 for a comparison of scales). While it is plausible that such clinical insights may in some instances emerge as a sudden understanding akin to insights as considered in this review, this aspect of clinical insights is rarely considered. Furthermore, to

our knowledge there is no scale developed specifically to study whether delusions might arise with an insight. Most of the researchers have based their claim that the onset of delusions is comparable to insights on their extensive work with patients. In some cases, focus groups or in-depth qualitative interviews have been conducted with people who had experienced psychosis using a semi-structured format (Sips, 2021). Transcriptions of patient reports have also proved useful for analyzing the specific elements of the delusional insight experience.

It is important to note that delusional beliefs and psychotic symptoms can occur within a range of different psychiatric conditions in addition to schizophrenia (e.g., bipolar disorder, delusional disorder, schizoaffective disorder, depressive disorder, etc.). To what extent and under which conditions such delusional beliefs might emerge as an insight is a question that is largely neglected in the literature and deserves to be further explored.

6.2 Prerequisites of insight

Psychotic insights are usually preceded by a more general state, referred to as delusional atmosphere or mood (Jaspers, 1963; or *trema* - Conrad, 1971). Delusional mood is defined as a pre-delusional state of affective tension that often precedes the formation of primary delusions in schizophrenia (Conrad, 1971; Jaspers, 1963; Roberts, 1992; Sass, 1992; Ulhaas & Mishara, 2007; Mishara, 2010; Stanghellini et al., 2019). Delusional atmosphere is characterized by diffuse feelings of conflict, distrust and discomfort without a definitive cause (Bowers & Freedman, 1966; Gozé et al., 2017; Jaspers, 1963; Kapur, 2003). Something appears suspicious, there is a feeling of something impending, but the precise nature of this “something” eludes the patient (Conrad, 1971; Jaspers, 1963; Mishara, 2010; Sass, 1992; Stanghellini et al., 2019). This state bears similarities with other predictive metacognitions, such as the tip-of-the-tongue phenomenon (Collier & Beeman, 2012) or *presque vu* which is occasionally reported prior to the emergence of an insight in problem-solving (Kostic, Booth, & Cleary, 2015).

During this stage the patient also experiences heightened sensory awareness and overly salient fragmented perception, as otherwise mundane and predictable stimuli seem vivid, novel and important (Corlett et al., 2007, 2010; Kapur, 2003; Ulhaas & Mishara, 2007). Rather than witnessing a specific change to an object in focus, this quality often imbues elements in the background or the periphery and invokes false inferences about their significance (Mishara, 2010). The environment is experienced as strangely and indefinably different, as if everything had acquired a new meaning (Jaspers, 1963; Mishara, 2010; Sass, 1992). A patient describes: “*Thoughts spun around in my head and everything—objects, sound, events—took on special meaning for me. I felt like I was putting the pieces of a puzzle together*” (Bowers & Freedman, 1966). These experiences seem incompatible with ordinary beliefs - previous contextual links become loosened or disorganized, allowing for new combinations to emerge. The change appears significant and alarming to the patient, as he or she struggles to make sense of this vague strangeness, experiencing anxiety and impasse (Kapur, 2003). The patient is likely highly motivated to solve the sense of uncertainty and discomfort, desperately seeking a resolution.

Delusional mood can be triggered by a traumatic event or a period of life distress (Berner, 1991). Often patients who experience delusional mood have been suffering from stress due to conflicts in interpersonal relations, work problems, debt, or a societal crisis (Bowers & Freedman, 1966). For example, a patient describes how a doctor delivering the news that her husband was diagnosed with cancer triggered her delusional mood, as she became fixated on the “hopeless grimace” of the doctor which she perceived as insincere and menacing (Binswanger, 1957; cf Ulhaas & Mishara, 2007). This clearly stressful moment marked the beginning of several thematic delusions which eventually culminated with the onset of acute psychosis. It is possible that a homeostatic imbalance (e.g., due to psychological trauma, brain injury or substance abuse) evokes a state of relaxed conceptual constraints before the onset of delusional mood (Brouwer & Carhart-Harris, 2021; Dean & Murray, 2005). While detailed

reports of this aspect of delusional mood are scarce, it has been suggested that the exaggerated quality of delusional perception results from a loosening of conventional contextual constraints and biases, allowing for more physiognomic qualities of objects to be perceived (Matussek, 1952; cf Mishara, 2012).

6.3 Event of insight

A primary delusional experience may emerge suddenly as an explanation to provide a solution to the uncanny experiences of the pre-delusional phase (Arieti, 1955; Kapur, 2003; Mellor, 1991). The patient has spent considerable time ruminating about their experiences with overly salient stimuli and the intense discomfort generated by the delusional atmosphere. For example, Jaspers (1963) writes: “*Delusional atmosphere with all its vagueness of content must be unbearable. Patients obviously suffer terribly under it and to reach some definite idea at last is like being relieved from some enormous burden*”. By reorganizing and restructuring the fragmented experiences into a meaningful narrative, the insight brings about a sense of relief and clarity (Jaspers, 1963; Roberts, 1992; Kapur, 2003). While the general theme of the delusions remains roughly the same across individuals (i.e., most commonly delusions of persecution or grandeur), the specific content of the delusion is likely to take on a form that reflects the personal and cultural context of the patient (Gold & Gold, 2012; Jablensky et al., 1992; Jones, Read, & Wood, 2021; Kapur, 2003)

The psychotic insight can emerge as a delusional belief where an ordinary percept is unequivocally recognized by the patient as carrying a special meaning or message for him or her (Mellor, 1991). For instance, a patient saw people in the street wearing yellow shirts and *knew* that this was meant as a commentary towards his own cowardice (Gipps & Fulford, 2004). Likewise, another man saw a red pickup truck parked on a bridge and suddenly understood that he was John the Baptist whose mission was to introduce the new Messiah to the world (Mellor, 1991). These can be seen as examples of an insight experience that is triggered by a real external stimulus, similarly to opportunistic cues in problem-solving insights.

Alternatively, the insight may occur without any external provocation, as the narrative thread for the primary delusion may be pulled instead from concurrent thoughts or memory. Similarly to the process of spontaneous restructuring (or fact-free learning, Friston et al., 2017) that happens during problem-solving, a delusion might arise seemingly out of nowhere. For example, a patient who was experiencing bizarre delusions and hallucinations in the form of voices commenting on her behaviour suddenly realized that the electrician who had been to her apartment the week before to repair a faulty switch must have installed some monitoring devices (Kendler & Campbell, 2014). Such an insight is comparable to the insights that arise when trying to solve a problem, only in this case the assumptions underlying the problem were fictitious, i.e., there were no monitoring devices in the house.

During psychotic insight, there is a shift from believing something could be the case to believing with certainty that this actually is the case. Sips and colleagues (2021) quote a patient from an interview: “*I had that a few times, especially during my first two psychoses, deep moments of the feeling of all-knowing, aha-moments. Incredible. It is an explosion of truth in your head, and that truth is so simple you can’t explain*” (see Sips et al., 2021 for more examples). Psychotic insight thereby provides content for the formation of more fixed delusions, often marking the beginning of psychosis (Conrad, 1971; Feyaerts et al., 2021; Ulhaas & Mishara, 2007).

6.4 Consequences of insight

The insight experience in the development of primary delusions in psychosis takes place as a revelation, fixing the content of the delusions firmly into the patient’s knowledge structures (Kiran & Chaudhury, 2009; Lyndon & Corlett, 2020). Following the hypothesis proposed by Laukkonen and colleagues (2018), the subjective insight experience (the “aha moment”)

inherently signals the relevance and quality of an idea, directing more attentional resources to its content and providing a strong sense of confidence in its validity. There is also evidence that ideas discovered by insight are more difficult to revise (Hedne et al., 2016). Hence, insights about false propositions are likely to result in persistent and rigid false beliefs which are difficult to overwrite and can give rise to acute psychosis.

Following the onset of psychosis, a more chronic phase of experiencing delusions may follow. During this stage, patients experience repetitive delusions of a central theme, so that each time these delusions are replayed, they are further reinforced and reconsolidated for the patient (Mishara & Corlett, 2009). Such delusions are therefore resistant to contradiction, and may in fact be strengthened by challenging evidence, as the context of the delusions spreads and becomes linked to even more events (Milton, Patwa, & Hafner, 1978; Mishara, 2010).

On the other hand, psychotic insights can serve to benefit the patient's well-being, at least in the short term. During the prodromal phase of psychosis, people experience an extended period of distress, anxiety, and struggle for meaning which is draining for the patient and can lead to depression and self-harm (Bortolotti & Miyazono, 2016; Kirmayer, Corin, & Jarvis, 2004). The formation of delusions provides immediate relief by reducing uncertainty and helping to make sense of the confusing experience, thus relieving the person of the heavy psychological burden brought about by stressful or traumatic life events (Jaspers, 1963; Roberts, 1991; Bortolotti & Miyazono, 2016; Carhart-Harris & Friston, 2019; Gunn & Bortolotti, 2018; Mishara & Corlett, 2009; Ritunnano & Bortolotti, 2021). Hence, it can be argued that psychotic insight can function as an adaptive mechanism or "shear pin" that protects a system from further harm, allowing it to continue functioning, although imperfectly (Lancelotta & Bortolotti, 2019; Fineberg & Corlett, 2009).

6.5 Summary

Although insights in delusion formation have not been thoroughly researched, based on retrospective accounts these tend to be sudden revelations that are experienced by the person as highly relevant and meaningful. Usually, such insights involve a fundamental reorganization in thinking following a period of experienced tension and conflict due to the increased salience of ordinary events. More so than with any other type of insight, primary delusions are perceived with remarkable confidence and are not vulnerable to a process of verification. Hence, delusional insights tend to be rigid and unmalleable.

7. Analysis of findings

Moments of sudden insight are a near ubiquitous human experience (Ovington et al., 2015). However, until now, the experience of sudden understanding has been investigated in domains relatively siloed from each other. In this integrative review, we have brought to light that experiences of insight arise with similar characteristics in diverse areas, including problem-solving, psychotherapy, meditation, psychedelic experiences, as well as in the development of delusional beliefs. It is also evident that in each of these fields insights are considered remarkably significant. Insights can facilitate enduring progress in therapy or in meditative understanding, insights can predict the discovery of a valuable new idea, and they can also be a key precursor in the onset of a psychotic episode. Importantly, we also unravelled some nontrivial differences between various insight events. Considering these differences may prove crucial for inspiring a more comprehensive understanding of insight that fully captures the complexities of this phenomenon. Below we integrate the characteristics of insight that provide a common thread through these diverse fields. For a visual comparison of domains, see figure 1 below.

	Problem-solving	Psychotherapy	Meditation	Psychedelics	Delusions
<i>Specific problem / goal</i>	●●●	●●●	●●	●●	●
<i>Tension / impasse</i>	●●●	●●●	●●	●●	●●●
<i>Altered salience (external / internal)</i>	●	●	●●	●●●	●●●
<i>Increased internal awareness / metacognition</i>	●●●	●●●	●●●	●●●	●●
<i>Openness / relaxed constraints</i>	●●●	●●●	●●●	●●●	●●
<i>Enhanced associations</i>	●●	●●	●●	●●●	●●●
<i>Sudden</i>	●●●	●●●	●●	●●	●●●
<i>Unexpected</i>	●●●	●●	●●	●●●	●●●
<i>Restructuring / new associations</i>	●●●	●●●	●●●	●●●	●●●
<i>Affective response / relief</i>	●●●	●●●	●●●	●●●	●●●
<i>Confidence</i>	●●●	●●●	●●	●●●	●●●
<i>Long-term memory storage</i>	●●●	●●	●●●	●●	●●●
<i>Rigid to change</i>	●●●	●●	●●	●●●	●●●
<i>Open to verification</i>	●●●	●●●	●●●	●●	●
<i>Improved mental health</i>	N/A	●●●	●●	●●	●
<i>Intersubjective accuracy</i>	●●●	●●	●●	●●	●

Figure 1. This figure provides a summary comparison between the five reviewed domains where insight events are most often considered. The goal of this table is not to provide a definitive assessment but rather to give a broad overview of the topics considered in this review. The left column indicates the most relevant features of insight that we distilled from our review, including the prerequisites, event, and consequences of insight. The sections are distinguished with different colours: yellow (prerequisites), pink (event), and blue (consequences). For each domain, we provided an estimation on a three-point scale to propose a tentative assessment of how characteristic that aspect is in the conceptualization of insights in that field. It is important to note that in many areas insight events are not equally diligently researched and therefore some of these estimates are to some extent subjective rather than empirically proven, based on descriptive accounts in the literature. Moreover, since there is a high level of variability in individual insight events (especially during psychedelic experiences, but also during meditation) the listed features may apply in some cases, but not in others. We have marked “N/A” if there has been no mention of these aspects to the best of our knowledge.

7.1 Key similarities of insight across fields

7.1.1 Event of insight

Throughout this review we have observed a common set of features of insight that can be observed across fields. While there are some differences in which features are given prominence in how insight is conceptualized in each field, there are significant commonalities that can be extracted from the descriptions of these events. One of the key properties of insight is that it is perceived as a sudden shift, as if a light-switch was turned on. The steps leading up to the insight are usually not consciously experienced and the solution can feel as if it is being imposed on the person. Insight is tightly linked to a feeling of understanding or grasping a new meaning of the situation. The new idea or perspective in some way involves making new connections or restructuring existing knowledge structures. In addition to an intellectual understanding, true insight is viscerally experienced and often coupled with an affective response. Finally, one central feature of insight is that the idea that arises through insight seems inherently true.

The cognitive aspect of insight is rather clearly defined in literature (Bowden et al., 2005; Garcia-Romeu et al., 2015; Gilhooly & Fioratou, 2009; Hill et al., 1992; Kounios & Beeman, 2014; Laukkonen & Slagter, 2021; Luo & Niki, 2003). During insight there is a change that occurs in existing knowledge structures. Some shift, restructuring or recontextualization takes place wherein new connections are made. A novel solution, belief or understanding then emerges into awareness as an insight. Simply acquiring a new piece of information that fits into and does not significantly change existing mental models seemingly does not result in a subjectively experienced insight. Some theoretical approaches to insight have also explained this process of restructuring as model reduction, where a complex mental model is compressed into a simpler, more efficient one (Friston et al., 2017; see also Schmidhuber, 2010).

While insight is often discussed as coming to new intellectual and conceptual understandings, research into psychotherapy (Carey et al., 2007; Greenberg, 1992; Timulak & McElvaney, 2013), psychedelics (Belser et al., 2017; Wolff et al., 2019; Watts et al., 2017; Garcia-Romeu et al., 2015) and contemplative science (Eberth et al., 2019; Full et al., 2013; Yates et al., 2015; Garcia-Romeu et al., 2015; Dahl et al., 2015) suggests that insight can also be related to ineffable aspects of experience. One can suddenly understand something that one cannot explain verbally: *“It [a self-transcendent experience] gives an understanding that is non-conceptual. There’s something that’s changed that the mind can’t really wrap itself around”* (Garcia-Romeu et al., 2015). Such non-verbal shifts could include changes to perception (Full et al., 2013; Dahl et al., 2015; Amada et al., 2020), implicit sense of self (Garcia-Romeu et al., 2015; Dahl et al., 2015), and emotional reactivity (Vago and Silbersweig, 2012; Eberth et al., 2019).

Insight is also associated with a phenomenological component, the “aha moment”. The suddenness, newness, and relevance of the new idea or belief is not only acknowledged intellectually but experienced as a feeling of clarity (Ellis, 1993; Pascual-Leone & Greenberg, 2007; Sips, 2019). Insight is often accompanied by an affective experience of surprise, relief, and pleasantness (although negative emotions can also occur), as well as a sense of obviousness or confidence (Webb et al., 2016; 2018). The affective component of insight experiences can be understood as an interoceptive signal or heuristic that indicates significant changes to one’s mental models (Laukkonen et al., 2018). Psychotherapy literature even emphasizes that the affective component is a requirement of “true insight”, as an intellectual insight alone is unlikely to lead to significant change (Ellis, 1993; Mahoney, 1974; Wachtel, 1997). Strong insight experiences in psychedelics are also often characterized by an emotional breakthrough or intense affective experiences (Roseman et al., 2018, 2019).

7.1.2 Prerequisites of insight

When reviewing these different areas of research, it becomes evident that there are also common features that precede insight. First, it is apparent that there is often some conflict or tension between representations within the cognitive system. The restructuring that accompanies insight is aimed at resolving the tension. As the previous model is restructured via insight, a subjective experience of tension release or pleasure is often reported. In the literature on psychosis, this state where the affective tension of delusional mood finally finds its resolution is called "insight relief" (Kapur, 2003; Roberts, 1992; Lyndon & Corlett, 2020). In some cases (e.g., solving an anagram task), this tension is small and relatively unimportant, whereas in other cases (e.g. in psychotherapy or during a pre-delusional state) the tension might be considerable and weigh heavy on the person. It has been suggested that only discrepancies of a larger magnitude that cannot easily be assimilated into existing mental models could result in significant global changes to the knowledge structures (Janoff-Bulman, 1992) which will be experienced as a subjectively impactful insight. For example, a traumatic event can lead to the deconstruction of a previously accepted belief (e.g., "I am safe" or "everything will be okay") which triggers significant existential tension. In the problem-solving literature, this tension can arise from a discrepancy between the current problem representation and the lack of a solution. In psychotherapy, the tension may result from intra- or interpersonal conflicts. In some fields of meditation, a conflict is deliberately induced by simultaneously considering seemingly contradictory information (e.g., Zen Koans) or by utilizing questions that one does not have an answer to, such as "who am I?". Challenging experiences and ego-dissolution can be common sources of distress during psychedelic experiences. Furthermore, stressful life events or conflicts may in some instances motivate a person to take up meditation or engender the use of psychedelics (as a therapeutic tool or recreationally) which may then find resolution from an insight event. In an everyday context, tension can also arise from a conflict between a goal state and the ability to achieve that goal.

Research in these diverse fields has demonstrated that insight is preceded by a state of openness and relaxed constraints which allows for more remote associations to be discovered. Such a state is characterized by broadened diffuse attention, enhanced metacognitive awareness, reduced cognitive control, and cognitive flexibility (Hirt, Devers, & McCrea, 2008; Knoblich et al., 1999; Yates et al., 2015). An open plastic state renders existing knowledge structures mutable, relaxing previously held constraints and enabling a significant change to occur. In problem-solving, the role of taking a break or "incubation" is often reported to precede achieving an insight solution (Smith & Blankenship, 1989; Gilhooly, 2019; Segal, 2004). The high motivational intensity in attempting to solve a problem can lead to a narrowing of attentional focus (Gable & Harmon-Jones, 2010) and potentially getting stuck on a misleading problem representation. In that case, a broadening of attention, as well as relaxed cognitive constraints can facilitate more creative solutions. In a therapeutic context, this is also sometimes referred to as vulnerability or acceptance (Hayes, Feldman, & Goldfried, 2007; Timulak, 2013). In some meditative practices, a state of openness is achieved voluntarily by maintaining broad attentional focus and developing equanimity and metacognitive awareness (Eberth et al., 2019; Lutz et al., 2015; Yates et al., 2015). Notably, in meditation practices aiming to attain insight, there is an emphasis on relaxed openness to experience (Lutz et al., 2008). In psychedelic therapy, the role of "set and setting" is crucial for the experience to confer any benefits. Studies have shown that these qualities are more likely to occur after sleep or wakeful rest, meditation, and positive mood (e.g., Colzato, 2017; Davis et al., 2020 Subramaniam et al., 2009; Walker et al., 2002). It has recently been suggested that such states of mind are conducive to insights because they enable the hippocampus to generate spontaneous sequences of activations that can lead to novel combinations of concepts and thus insights (Aru et al., 2022). Alternatively, a state of enhanced neural plasticity can be induced chemically. For instance, psychedelic compounds are suggested to induce a state of neural hyperplasticity by activating the serotonin 5-HT_{2A} receptors which could allow even very firmly held beliefs to be restructured (Carhart-Harris & Friston, 2019). It is also suggested that a

similar neurochemical process is triggered as a result of acute or cumulative stress (Brouwer & Carhart-Harris, 2021), allowing for more extensive rewiring in mental models.

7.1.3 Consequences of insight

Our review unravelled several common consequences of insight. Depending on the context, the insight can have more or less direct impact for the person. For example, insights experienced during psychotherapy can result in a completely new understanding of self and others, or an improvement in mental health (Castonguay & Hill, 2007). Similar effects have been shown for insights achieved through meditation where the person gains an understanding about themselves or into some fundamental aspects of consciousness (Laukkonen & Slagter, 2021). Insights gained under psychedelics can in some circumstances alleviate symptoms of addiction or depression (Carhart-Harris & Friston, 2019; Griffiths et al., 2020) which is also thought to reflect changes to core beliefs about oneself (Dourron, Strauss, & Hendricks, 2022; Letheby, 2021). On the other hand, psychotic insights can shape the course of a psychotic episode and determine the content of ensuing chronic delusions (Jaspers, 1963; Arieti, 1955; Sass, 1992). Such consequential insights mostly do not happen in the problem-solving field, as the problems studied in a laboratory setting are less likely to carry personal relevance. Nevertheless, even if the stakes are not high, it has been shown that solutions and ideas generated through insight are remembered better and seem more correct and important, and even small “aha moments” can shift beliefs and worldviews (Laukkonen et al., 2020a; 2021b). Anecdotal evidence from the history of science demonstrates that certain insight solutions can also lead to significant personal and societal impact (Gruber, 1995), occasionally resulting in complete worldview changes such as religious conversion (e.g. Mahoney & Pargament, 2004). Meaningful understanding can be achieved and new beliefs formed.

Subjective truth-value and rigidity is another consequence of most insight experiences (Laukkonen et al., 2018; 2021b; Hedne et al., 2016). This is most pronounced in delusional insights where the acquired bizarre beliefs are perceived as true and cannot be refuted by evidence (McKenna, 2017; Sass, 1992). In this case, the insights can be considered intersubjectively false as they are not based in reality and yet are highly inflexible which makes these insight events maladaptive. Similarly, psychedelic insights have a noetic quality: they just feel true (Carhart-Harris & Friston, 2019; Girn et al., 2020; Yaden et al., 2017). Even solutions to simple puzzles in the problem-solving setting are less mutable to change when achieved through insight (Hedne et al., 2016). Nevertheless, in most cases the insight experience is followed by a process of verification or implementation where the quality of the new solution or idea is tested against reality or common sense. Psychotic insights, however, are dysfunctional in that the ability to test reality or shift the frame of reference is impaired and the new belief becomes permanently fixed in the patient’s mental structures during the acute stages of psychosis (Conrad, 1957, cf Mishara 2012). Taken together, there seems to be something fundamental about solutions that arrive through insight, which signifies relevance and makes them resistant to change.

7.2 Key differences of insight across fields

We also found that there are differences across the fields where insight is studied. Firstly, in a problem-solving setting in the laboratory, insight is conceptualized as a very brief phenomenon of momentary illumination. On the other hand, when meditating or under the influence of psychedelics one can feel “insightful” for an extended period of time. Thus, at first it seems that there may be a considerable difference in the time-scales of these insight events. However, even during problem-solving the specific “aha moment” tends to be preceded by a more general state of openness and flexibility which is an enabling factor for the emergence of an insight. People sometimes also report increasing feelings of warmth or a subjective feeling of impending discovery prior to the insight solution (Metcalfe & Wiebe, 1987; Kizilirmak

et al., 2018; Kostic, Booth, & Cleary, 2015). Psychedelics and meditation may help to induce this state, and increase sensitivity to perceive and notice such metacognitive signals, but the specific “aha moments” are likely still brief and concrete as they coincide with the emergence of a new idea or understanding.

Secondly, during meditative and psychedelic experiences, the insight might be quite nonspecific. For example, insights can emerge about profound existential questions or ordinary life situations (and in the case of psychedelics, even trivial thoughts can acquire a quality of significance; Baggot, 2015; Girn et al., 2020; Carhart-Harris & Friston, 2019), whereas during problem-solving (but also psychotherapy) the insight tends to be specifically related to the particular problem at hand. However, this is unsurprising as in a problem-solving context the person has been occupied with a specific task or problem that needs to be solved, whereas during a meditative state or under psychedelics the person may not have a specific problem or question in mind. In that case, the experienced tension is not directed at a specific object, instead, every internal or external stimulus can trigger a novel idea or solution in a state of enhanced associative plasticity. Moreover, as the insight tasks used in problem-solving are fairly specific and non-complex (compared to real-life problems), it is unlikely that the solution would be bound to an extensive mental model. Therefore, the insight remains brief and specifically tied to the problem at hand. On the other hand, in a more nonspecific context or when dealing with personal or fundamental questions, the insight solution can trigger a cascade of smaller insight moments that are related to the ideas and perspectives that are being restructured. This also explains why in meditation or psychedelics several insights can be experienced in succession (Masters & Houston, 1966; Yates et al., 2015).

A significant difference between the range of insight experiences is the quality or objective accuracy of the understanding established by the insight. While in all areas of research the new idea that arrives via insight is generally evaluated with subjective confidence and truth-value, its objective (or intersubjective) quality is not equally easy to estimate. In problem-solving research it has been found that insight solutions are more likely to be accurate than non-insight solutions (Danek et al., 2014; Hedne et al., 2016; Salvi et al., 2016). However, it is also possible that inaccurate solutions arrive by insight or that the feeling of insight is falsely linked to an untruth (Laukkonen et al., 2020a). The subjective accuracy of the idea can then be explained as a marker of quality in the context of the person’s prior knowledge. In other words, the truth-value is achieved by solving a discrepancy within the person’s knowledge structures or by providing a better model that more concisely groups together separate pieces of knowledge (Friston, 2017). Thus, the solution that arrives via insight is preferred by the brain because it reduces complexity rather than due to any objective measure of quality. This is especially relevant in instances where no ground truth can be established, such as personal problems or metaphysical beliefs. It is impossible to establish the accuracy of a realization about interpersonal dynamics or a belief that the self is an illusion, however, they serve to benefit the person by solving an inner conflict or creating a more cohesive narrative. Similarly, delusional insights may often be intersubjectively false, but they help to create meaning and decrease uncertainty for an individual’s personal knowledge structures, thereby alleviating stress and anxiety (Gunn & Bortolotti, 2018; Ritunnano & Bortolotti, 2021).

Finally, there are many individual differences in the subjectively experienced magnitude of insight experiences (or “aha moments”) between different fields but also within one area of study. Taking into account the diversity of contexts and the ideas themselves, it is perhaps unsurprising that such variance be reflected in the subjective intensity of the insight experience. We hypothesize that the intensity of the insight may be linked to the processing hierarchy of the affected knowledge models and the relative magnitude of tension resolved. Hence, a more intense insight experience signals a more extensive change related to one’s higher-order beliefs about the world or oneself. In the case of very specific, low-level changes as when the representation of a problem-solving task is restructured, only a small “aha moment” may be experienced, if at all. On the other hand, changes to fundamental concepts

about one's self and the understanding of the world that are linked to more extensive knowledge networks will in turn induce changes at multiple levels and thereby induce the most vivid and intense insight experiences, such as often described in meditation and psychedelics literature (Carhart-Harris & Friston, 2019; Laukkonen & Slagter, 2021). Additionally, it is possible that some aspects of meditative practices (such as focused attention) and psychedelics (such as chemically induced altered salience) could further increase the intensity of the insight experienced, irrespective of its contents. It is therefore not only important to draw attention to the similarities in insight related phenomena, but also the differences which can serve to further our understanding of the nature of insight.

7.3 The future of the study of insight

This review has surveyed the literature on insight experiences from diverse fields, focusing on problem-solving, meditation, psychedelics, and psychopathology. However, there are yet other kinds of insights that could yield further progress if studied in an interdisciplinary way. For example, artists can experience insights when a new poem, a new idea for a painting or composition, or a transformative aesthetic experience occurs (Pelowski, 2015; Pelowski & Akiba, 2011; Muth & Carbon, 2013). Moreover, insight experiences are widely reported to accompany fundamental scientific discoveries (Gruber, 1995) and transformative life changes such as religious conversion (James, 1902; Miller & C'de Baca, 2001). Religious insights and epiphanies (McDonald, 2007) are harder to study in laboratory settings due to their often highly personal content and unpredictable nature, although psychedelic compounds, meditation retreats, or some alternative novel methods may begin to provide opportunities for more rigorous investigations (Milliere et al., 2018; Griffiths et al., 2008; Kometer et al., 2015; Griffiths et al., 2019; Forstmann et al., 2020; Kaup et al., 2022; Laukkonen & Slagter, 2021). Research on meditation may prove an especially valuable source of information as a conducive mental state for the emergence of insights is achieved voluntarily through practice. One possibility is that experiences that we call religious, mystical, or in some cases aesthetic, are unique due to their deep meaningfulness to the self and may be preceded by more existential kinds of tension, resulting in more intensely experienced insights. Thus, although we have focused our review on domains that possess a larger body of research, we recommend future research to continue with this integrative and collaborative effort to derive a better understanding of the many faces of insight.

A very practical way of collaboration would be to use the rating scales of insight developed in problem-solving research to assess the insight experiences of clients in psychotherapy and patients with first-episode schizophrenia. Although there is a long history of considering insight in the setting of psychotherapy (Hill et al., 1992; Castonguay & Hill, 2007; Jennissen et al., 2018; Johansson et al., 2010; Kallestad et al., 2010; Lacewing, 2014) and delusions (Jaspers, 1963; Arieti, 1955; Conrad, 1971; Feyaerts et al., 2021), there has not been much dialogue between the clinical field and the more thoroughly studied problem-solving side (but see Feyaerts et al., 2021; Laukkonen et al., 2018). In particular, over the recent years a number of rating scales have been employed that help quantify several key features of the insight experience, such as suddenness of onset and confidence (e.g., Danek et al., 2014; see also table 2). It would be essential to compare these measures across different areas of research in order to clarify the commonalities and discrepancies of insight phenomena in different fields. Furthermore, clinical fields could benefit from knowledge acquired from research on meditation practices to help patients in session voluntarily induce states that are conducive to the emergence of therapeutic insights. We hope that our review helps inspire more interdisciplinary research efforts.

Finally, although this review focused mainly on the cognitive mechanisms of insight events, we would like to highlight that there is also much to be gained from trying to further our understanding of the neural correlates of insight. While it is still relatively unknown which neural mechanisms correspond to insight, it was recently proposed that aspects related to

tension and openness which tend to precede insights could be related to the changes in 5-HT levels in the cortex and cerebellum (Shine et al., 2022; also Brouwen & Carhart-Harris, 2021). Furthermore, another recent hypothesis has related insights to the cellular plasticity mechanisms happening in the hippocampus and suggested that openness is characterized by the generation of hippocampal sequences, leading to novel combinations of ideas and to insights (Aru et al., 2022). There have also been numerous studies investigating the neural processes related to insight in problem-solving (for reviews see Dietrich & Kanso, 2010; Kounios & Beeman, 2009, 2014), but not much of this work has tried to disentangle the prerequisites and consequences of insight from the insight itself. There is some research suggesting that an increase in alpha power might precede insights in problem-solving (Kounios & Beeman, 2009, 2014), which has been linked to a shift from externally directed attention towards more internal processing. However, the generality of this claim is unknown, as this pattern of results tends to be linked to one particular type of task (i.e., CRA). There has also been a recent surge of research investigating the neural correlates of the psychedelic state and of meditation, yet there have only been a few studies specifically trying to unravel the neural correlates of insight in these states (Mason et al., 2021). An improved understanding of the components leading up to and comprising the insight event will hopefully help target specific neural correlates more efficiently in future research endeavours.

8. Conclusions

In this review, we offered an integrated perspective on the insight phenomenon as it has been discussed across diverse research domains. We have highlighted considerable similarities between insight experiences in problem-solving, meditation, psychotherapy, psychedelic experiences, and the emergence of primary delusions in schizophrenia. We also discussed differences which may be relevant for developing a more exhaustive perspective on insight events. We conclude that insight is not a mere peculiarity of certain problem-solving tasks, but is rather a ubiquitous phenomenon observed across tasks and contexts. A unified understanding of insight can benefit research efforts across all domains.

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