CHAPTER

24

Insight

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Abstract

In the century since the Gestalt psychologists introduced insight as a component process of perception and problem solving, researchers have studied the phenomenological, behavioral, and neural components of insight. Whether and how insight is different from other types of problem solving, such as analysis, has been a topic of considerable interest and some contention. In this chapter we develop a working definition of insight and detail the history of insight research by focusing on questions about the influence of the problem solver's prior knowledge, the origins and significance of representational change, and the roles of impasse and incubation. We also review more recent investigations of the neurological correlates of insight, discuss neurobehavioral states that facilitate or inhibit insightful problem solving, and highlight new methods and techniques that are proving useful in extending our knowledge of insight.

Key Words: knowledge, fixation, impasse, restructuring, Gestalt, special process, hemispheric differences, anterior cingulate cortex, superior temporal gyrus

Insight Defined

Insight occurs when a new interpretation of a situation or the solution to a problem suddenly springs into conscious awareness, seems obviously correct, and is accompanied by a surprising and emotional experience known as the "*Aha*" phenomenon (Kaplan & Simon, 1990). Although the necessity of some of these components of insight has been disputed, most researchers and lay people agree that these are at least typical characteristics of insight. To this basic definition theorists often add the requirement that the problem solver has to restructure or change his or her thinking about some aspect of the problem or the solution in order to achieve insight. Insight is usually contrasted with "analytic" solving in which the solver consciously and deliberately manipulates problem elements to discover the solution. Before discussing the mechanisms of insight, it is important to consider whether it is a unique process or simply a peculiar manifestation of typical problem-solving mechanisms.

Is Insight Different?

When a chapter on insight appears within a volume that includes a separate chapter on problem solving (see Bassok & Novick, Chapter 21), it is implicitly assumed that insight problem solving is fundamentally different from other types of problem solving. However, the possibility that insightful problem-solving processes share the same mechanisms as analytic processes must be considered. Theorists belonging to the "business-as-usual" camp have argued that the processes by which problems are solved via insight are the same as those used in search solutions and that it is only the affective experience that is different (Atchley, Keeney, & Burgess, 1999; Perkins, 1981; Weisberg 1986, 2006; Weisberg & Alba, 1981). In research examining verbal protocols, Perkins reported that participants experienced insight characteristics, such as the affectively loaded *Aha* reaction, in conjunction with analytic-type search-based solutions. More recently, researchers have noted that the heuristics traditionally applied during the solution of such search problems (e.g., hill climbing and means-ends analysis, which select moves that appear to make progress toward the solution) can be used to explain the processing displayed by participants when solving with insight (Chronicle, MacGregor, & Ormerod, 2004; MacGregor, Ormerod, & Chronicle, 2001). Furthermore, research exploring the analogical transfer of information during the solution of insight problems has revealed that transfer in insight is met with the same successes and failures as transfer in other problem-solving situations (e.g., Chen & Daehler, 2000; Ormerod, Chronicle, & MacGregor, 2006). Considering the aforementioned overlap, it makes sense that an affective experience similar to that occurring with an *Aha*, and perhaps other cognitive processes typically associated with insight, could operate when achieving solutions with analysis.

Historically, researchers have identified the distinctive emotional qualities of the insight experience and the mystique or inexplicability of the process as evidence that the cognitive mechanisms involved in achieving insight solutions must be distinct from ordinary noninsight solving. Theorists adhering to this view are in the "special-process" camp, and evidence to support their perspective has steadily accumulated (Anderson et al., 2009; Aziz-Zadeh, Kaplan, & Iacoboni, 2009; Bowden & Jung-Beeman, 2003; Jung-Beeman et al., 2004; Knoblich, Ohlsson, Haider, & Rhenius, 1999; Kounios et al., 2006, 2008; Luo, Niki, & Phillips, 2004a; Mai, Luo, Wu, & Luo, 2004; Schooler & Melcher, 1995; Smith & Kounios, 1996).

Accumulating evidence demonstrating that the right cerebral hemisphere makes a unique contribution to insight not evident in analytic processing has led many researchers to accept that insight is a special process. For example, several studies investigated the time course of hemispheric differences in solution activation for compound remote associate (CRA) problems (Beeman & Bowden, 2000; Bowden & Beeman, 1998). CRAs, adapted from Mednick's (1962) remote associates task, are brief problems in which participants are presented with three words (e.g., CRAB, PINE, SAUCE) and must generate a solution word (e.g., APPLE) that can be combined with the problem words to yield a compound word or familiar phrase (e.g., CRABAPPLE, PINEAPPLE, and APPLE SAUCE). Like many problems solved with insight, CRA solutions rely on unusual or remote associations, which are likely to capitalize on semantic processing in the right hemisphere. This hypothesized asymmetry stems from the left hemisphere's tendency to mediate fine semantic coding in which a small number of close associates are activated, whereas the right hemisphere mediates coarse semantic coding involving the weak, diffuse, activation of a larger number of distant associates, often required to solve such problems.

In several studies, participants worked on CRAs for various time limits; if they failed to solve a problem before the time limit, they were presented with a target word to name (read aloud). Target words were either solution words or unrelated (solutions to other problems), and they were presented to either the left visual field (right hemisphere) or the right visual field (left hemisphere). Participants named solution words faster than unrelated words, that is, demonstrated solution-related priming for problems they had failed to solve. Participants showed more solution-related priming when naming targets presented to the left visual field (right hemisphere) than targets presented to the right visual field (left hemisphere) for both solved and unsolved problems, and this asymmetry increased with longer solving times (Beeman & Bowden, 2000; Bowden & Beeman, 1998). The right hemisphere advantage in priming was so strong that, when participants were asked to decide whether the words presented were solutions to unsolved problems (yes or no), their responses (button press) were significantly faster for words that were presented to the left visual field (right hemisphere), without sacrificing accuracy for speed. Thus, the typical left hemisphere advantage for responding to words was reversed. Beeman and Bowden's results were in accord with the findings of previous research (Fiore & Schooler, 1998) showing that hints to insight problems are more effective when presented to the left visual field (right hemisphere) than when presented to the right visual field (left hemisphere).

Functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have also shown lateralized differences between insight and analytic solutions of CRAs. Participants solved problems while brain activity was monitored, and they reported after each solution whether they used insight or analysis to solve the problem. Participants were told to classify solutions that arrived suddenly, seemed obviously correct, and were achieved without clear intermediate steps as insight solutions, and those that were achieved more methodically through conscious analysis as noninsight solutions. fMRI showed that insight solutions were associated with distinct lateralized activity in the right anterior superior temporal gyrus (STG), activity not evident in noninsight solutions (Jung-Beeman et al., 2004). A follow-up study (Subramaniam, Kounios, Parrish, & Jung-Beeman, 2009) confirmed this right temporal activity, as well as activity in anterior cingulate cortex and parahippocampal areas, which were just below threshold in the original study. In a separate experiment of the original study (Jung-Beeman et al., 2004), high-density EEG revealed a sudden burst of high-frequency gamma-band activity over the right anterior temporal region about 0.3 seconds prior to the button press indicating solution (thus, approximately coinciding with awareness of the solution), which was localized to a region close to that identified in the fMRI experiment. Because the STG is thought to be involved in semantic integration (e.g., St. George, Kutas, Martinez, & Sereno, 1999), and because the right hemisphere has been found to play a significant role in processing distant semantic associations and figurative language (Jung-Beeman, 2005), this activation is thought to be linked to the sudden integration of semantic information resulting in the solution.

In addition, about 1.5 seconds before participants solved problems with insight, a burst of low-alpha EEG activity occurred over the right parietal-occipital cortex (see Fig. 24.1), subsiding just as the right temporal EEG gamma burst began (Jung-Beeman et al., 2004). Low alpha activity over visual cortex is understood to reflect visual sensory gating (cf. Ray & Cole, 1985). The researchers argued that this burst of alpha-band activity signifies a brief deactivation of visual cortex, reflecting a reduction of distracting sensory inputs. Similar posterior alpha activity was measured over this region in an EEG study that explored the restructuring component of insight (Wu, Knoblich, Wei, & Luo, 2009). Wu et al. used a Chinese-character task that required chunk decomposition, a form of restructuring, to break down complex Chinese characters to form new target characters. Their results support the idea that the attenuation of visual inputs facilitates representational change.

Recently, Aziz-Zadeh and colleagues (2009) used fMRI to examine activity associated with the solution of anagrams by insight, and they found relatively greater right prefrontal cortex (PFC) activity associated with insight versus analytic solutions. Such results build on other recent findings demonstrating right-PFC activity associated with creativity and the production of novel ideas in normal adults (e.g., Howard-Jones, Blakemore, Samuel, Summers, & Claxton, 2005). Moreover, individuals high in schizotypy, who tend to use loose associations processed in the right hemisphere (see Mohr, Graves, Gianotti, Pizzagalli, & Brugger, 2001) solve classic insight problems at a higher rate compared to healthy, nonschizotypal adults (Karimi, Windmann, Güntürkün, & Abraham, 2007), further supporting the critical role of the right hemisphere in insight.

Although there seems to be substantial and increasing evidence that insight processes rely more on the right hemisphere than analytic processes do, such findings should not be interpreted to suggest either that the right hemisphere is exclusively used in insight and not analysis, or that left-hemisphere processing is not needed for insight. Rather, the fMRI and EEG literature indicates that, though the two strategies share many processes, additional activity in right temporal cortex and other areas

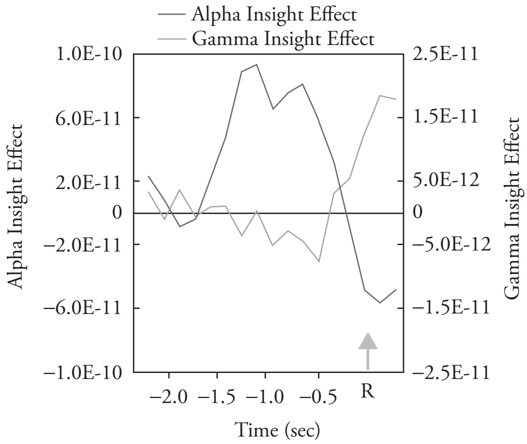

Fig. 24.1 The time course of the insight effect. Electroencephalogram (EEG) alpha power (9.8 Hz at right parietal-occipital electrode) and gamma power (39 Hz at right temporal electrode) for the insight effect (i.e., correct insight solutions minus correct noninsight solutions, in μv^2). The left *y*-axis shows the magnitude of the alpha insight effect (purple line); the right *y*-axis applies to the gamma insight effect (green line). The *x*-axis represents time (in seconds). The yellow arrow and *R* (at 0.0 s) signify the time of the button-press response indicating that a solution was achieved. Note the transient enhancement of alpha on insight trials (relative to noninsight trials) prior to the gamma burst signifying insight. (Reproduced from open source article by Jung-Beeman et al., 2004.). See color figure.

(Subramaniam et al., 2009) is present when solvers produce insight solutions. Regardless of the outcome of the debate on the hemispheres in insight, the literature supports the idea that the solution of verbal problems through insight is associated with a unique and sudden integration of weakly and distantly related problem components, and that briefly blocking sensory input facilitates the retrieval into conscious awareness of solution-related ideas initially represented at an unconscious level.

It is possible that other mechanisms, such as the application of unconstrained hypothesis generation, could explain the hemispheric asymmetry associated with insight (e.g., Vartanian & Goel, 2005). In fMRI research with anagrams, Vartanian and Goel observed significant activation in the right ventral lateral prefrontal cortex when participants solved semantically constrained (i.e., anagram letters to be rearranged to generate a word in a specific category) versus unconstrained problems (anagram letters to be rearranged to generate a word with no category specification), which they suggest indicates the role of this region in hypothesis generation in unconstrained situations. Insight problems have been labeled as unconstrained in prior research (e.g., Isen, Daubman, & Nowicki, 1987). Specifically, insight problems often either mislead people trying to solve them, because they imply one solving strategy (or one interpretation or association of problem concepts) or simply lack constraints suggesting the correct approach.

Another distinctive feature of insight is the relative inaccessibility of insight mechanisms to conscious analysis. Research on metacognition and insight has revealed that participants appear to lack conscious awareness of solution-related ideas during intermediate stages in the solving process (Metcalfe & Wiebe, 1987) and are limited in their ability to explain these thoughts aloud (Schooler, Ohlsson, & Brooks, 1993; to be discussed later). The limited accessibility of insight-related processing to conscious awareness may also be linked to the unique contributions of right-hemisphere processing to insight. Research with split-brain patients has demonstrated that conscious experience in these patients with divided hemispheres is more strongly tied to left-hemisphere processing (e.g., Gazzaniga, 1998), whereas right-hemisphere processing tends to influence their behavior without awareness.

Based on the accumulated evidence, especially the brain imaging data, a strong version of the "business-as-usual" view of insight no longer seems tenable. Insight appears to involve "special" processes.

Insight and Conscious Awareness

When Gestalt psychologists first began to discuss insight about a century ago, they distinguished between insight and analysis based mostly on the different affective experience that accompanies insight but also because insight sometimes comes incidentally when one is not directly focusing on the problem. The Gestalt psychologists' view was supported not only by shared experience but also by famous anecdotes of scientific insights that led to creative solutions to vexing problems. Some of the most famous of such insights were Archimedes' eureka moment in the bathtub, Newton's falling apple, and Poincaré's bus ride. One thing that these discoveries have in common is that, at least according to the stories, these great thinkers were not consciously considering the problem at the time they experienced insight (see Simonton, Chapter 25). In contrast, since analytic thought is by definition deliberate, solution by incidental analysis is an oxymoron.

Insight problem solving is also different from analytic problem solving in that insight seems to involve processing that renders it inaccessible to metacognition (see McGillivray et al., Chapter 33). Metcalfe and Wiebe (1987) asked participants to periodically judge during the course of problem solving how close they were to achieving a solution. They found that prior to analytic solutions, subjects reported gradually increasing closeness to solution. In contrast, prior to insight solutions, subjects reported little or no progress toward solution right up until the point in time at which solution was imminent (cf., Smith & Kounios, 1996). Metcalfe and Wiebe, therefore, concluded that insight was fundamentally a different process, one that involves critical mechanisms that go on outside awareness.

Using a somewhat different paradigm in which participants were interrupted during solution and asked to give a verbal description of their solution efforts, Schooler and Melcher (1995) found a difference in conscious access to solution information between insight and analytic problem solving. Schooler and colleagues (1993) found that verbalization during solving interfered with the solution of insight problems but not analytic problems. Based on these findings, Schooler proposed a verbal overshadowing effect on insight due to the inaccessibility of critical insight processes to verbal description. A recent investigation by Gilhooly, Fioratou, and Henretty (2010) suggests that verbal overshadowing might be specific to visual problems, regardless of insight or analytic solution strategy. Nevertheless, much of the research on metacognition and verbal overshadowing of insight suggests that steps in the insight process are beyond conscious analysis. Furthermore, it is possible that the inaccessibility of insight processes to linguistic analysis may be due to the involvement of the less-verbal right hemisphere.

The unconscious processing of insight antecedents may be a critical factor in the eventual *Aha!* reaction that accompanies insight solutions. The sudden conscious awareness of the solution can be particularly surprising given a comparison to analytic processes that may even be "reasoned out" either vocally or subvocally as the solver advances toward completion (Newell & Simon, 1972; Smith & Kounios, 1996; Thorndike, 1898).

Knowledge Selection and Fixation

In the first half of the 20th century, the Gestalt psychologists proposed that insight involves the application of a special type of knowledge that is different from that used in trial-and-error problem-solving strategies (e.g., Duncker, 1945; Koffka, 1935; Köhler, 1925; Wertheimer, 1945/1959). They argued that it was the incorrect application of prior knowledge that prevented the achievement of insight and that insight is facilitated only when problem solvers go beyond trial-and-error processing to acquire extraordinary knowledge structures (e.g., Duncker, Köhler). Ordinary thought is *reproductive*, involving the reuse or adaptation of older ideas or approaches, whereas insight requires *productive thought* (Wertheimer, 1945/1959; see also Mandler & Mandler, 1964) in which a deeper conceptual understanding allows problem solvers to select relevant knowledge components and combine them in novel ways, or to guide problem solvers to attend to the environmental stimuli that are most relevant. Wertheimer suggested that insight was not the result of the problem solver blindly recombining problem elements in search of a solution; rather, he argued that it requires that the problem solver gain the necessary structure on which to build a solution. Thus, a lack of success in problem solving could stem either from the retrieval of irrelevant information from long-term memory or the retrieval of relevant components that are applied or linked within an inappropriate structure.

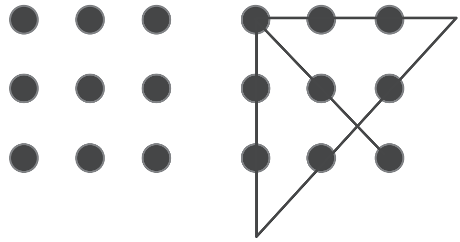

Fig. 24.2 The nine-dot problem. *(Left)* Subjects' task is to draw four straight lines that go through all nine dots without backtracking or lifting the pencil from the paper. *(Right)* One solution to the problem.

Problem solvers often do poorly in solving classic insight problems, such as the nine-dot problem (Maier, 1930; see Fig. 24.2). Researchers have suggested that participants fail to solve this problem (solution rates are consistently less than 10% without hints) because either they do not possess solution-relevant knowledge about extending lines "outside the box," or because they lack the visuospatial capacities to mentally construct the solution configuration (e.g., Chronicle, Ormerod, & MacGregor, 2001; Kershaw & Ohlsson, 2004). However, when experimenters provide participants with training problems and strategies and give hints about the solution (e.g., Lung & Dominowski, 1985; Weisberg & Alba, 1981) or provide perceptual hints about the overall solution configuration (Chronicle et al. 2001; MacGregor et al., 2001), problem solvers achieve only modest gains in solution rates. Kershaw and Ohlsson had to provide extensive knowledge about pivoting solution lines on non–dot points and to train participants to think outside the constraints of the problem presentation space in order to substantially facilitate solution rates.

The limited transfer of problem-related information during the solution of the nine-dot problem mirrors results observed in prior research on analogical transfer using Duncker's (1945) radiation problem (see Holyoak, 2005, for a review). In the radiation problem, another classic insight problem, participants are asked to generate a solution that will enable an inoperable stomach tumor to be eradicated by allowing enough radiation to reach the tumor without destroying the surrounding healthy tissue. The problem can be solved by employing the convergence principle: Multiple rays of weaker intensity can be applied from various positions converging with sufficient strength at the tumor. In preliminary research on transfer, participants were provided with one or more source problems that also relied on the convergence principle for solution (Gick & Holyoak, 1980, 1983). When a relevant source problem was provided prior to the radiation problem, few participants transferred the convergence principle solution unless they were explicitly told that the source information might be helpful in generating the solution. The application of the solution principle was more likely if multiple source problems with convergence solutions were presented for comparison instead of one (Gick & Holyoak, 1983; Kurtz & Loewenstein, 2007), when the source problem appeared similar in character and theme (e.g., a patient with a brain tumor) to the target problem than if the source problem was from an unrelated domain (Keane, 1987), or when abstract statements explicating the solution principle were provided (Chen & Daehler, 2000). These findings suggest that gaining problem-relevant knowledge may do little to facilitate solution success in insight unless that knowledge results in the acquisition of a deep conceptual understanding of the problem's components.

The Gestalt psychologists felt that repeated application of incorrectly selected knowledge from long-term memory (i.e., fixation) could prevent the deep conceptual understanding necessary to achieve insight (Duncker, 1945; Luchins, 1942; Maier, 1930; Scheerer, 1963). Duncker conducted much of the pioneering work on fixation, most notably with the candle problem. In the candle problem, researchers present participants with a candle, a book of matches, and a box of tacks, and ask them to devise a way to attach the candle to a door so it can burn properly. The insightful solution to this problem is to empty the tack box and use it as a ledge to support the candle. However, when problem solvers first approach the problem and see the box filled with tacks, they become functionally fixated on the standard function of the box as a container, which limits their ability to consider the tack box as having other functions that may potentially facilitate the solution to the problem. Perseveration on an object's dominant function may be so persistent that the solver reaches an impasse and becomes increasingly fixated on a solution idea, repeatedly attempting the same approach (Smith, 1995).

Modern theorists have suggested that when a problem solver's initial problem space contains irrelevant or incorrectly constructed prior knowledge, the problem solver will reach an impasse that prevents further constructive work on the problem (Knoblich et al., 1999; Ohlsson, 1992). Knoblich and colleagues proposed that during impasse, a problem solver's prior knowledge leads him or her to incorrectly apply constraints to the problem-solving situation that limit the possibilities for solution. In their research on matchstick arithmetic problems (see Fig. 24.3), participants' prior knowledge of algebra (which is relevant in most equation solving but is irrelevant in matchstick arithmetic) blocked their consideration of relevant ideas during problem solving. For example, participants may have assumed that what happens on one side of the equation must happen on the other side, or that the operands could be subdivided to correct the equation, whereas the operators could not. Continued progress was only possible when these mental constraints were relaxed and additional ideas were considered for solution.

In imaging research exploring comprehension in insight, Lang and colleagues (2006) recorded event-related brain potentials (ERPs) in participants who gained an insightful understanding of the underlying structure in the number reduction task (NRT) and compared them to ERPs of those who did not achieve such an understanding. In the NRT, participants apply rules to sequentially presented numbers to produce a new string of numbers, the last of which is most important. For all trials, the pattern of cues was *ABCCB*, such that the last answer is the same as the second answer. Participants who came to explicitly understand that they could skip to the end of the sequence based on this pattern were viewed as achieving insight. Lang and colleagues reported that those who eventually achieved insight had greater slow-positive-waveform (SPW) amplitude across the length of each trial over parietal electrode sites and a relatively enhanced P3a

Problem: IV = III + III

Solution: VI = III + III

Problem: III = III +III

Solution: III = III = III

Fig. 24.3 Sample matchstick arithmetic problems (after Knoblich et al., 1999, p. 1536). The goal is to move a single stick in such a way that the initial false statement is transformed into a true arithmetic statement.

component over frontal-central sites, both observed from the outset of the task, compared to those who failed to achieve insight. Researchers had previously tied such effects to increased working-memory involvement (Vos et al., 2001) and the perceived novelty or distinctiveness of the stimuli (P3a; Gaeta et al., 2003). Considered together, these results suggest that thought processes applied in earlier trials determined whether participants would absorb the correct knowledge to achieve a deep conceptual understanding of the task.

Restructuring

Insightful problem solving seems to depend to a significant extent on the problem solver making one or a combination of three basic mistakes: the solver misrepresents the problem elements in such a way as to preclude solution; the solver focuses on information retrieved from memory that is not pertinent to obtaining the solution and may in fact lead him or her away from the solution (Knoblich et al., 1999; Ohlsson, 1992; Seifert, Meyer, Davidson, Patalano, & Yaniv, 1995); or the solver works with insufficient information to achieve success (Kaplan & Simon, 1990). Because they have made one of these critical errors preventing them from reaching solution, the solvers' focus on the unproductive line of reasoning must be broken via interruption or restructuring of thought allowing a shift in solution strategy (Ohlsson, 1992; Weisberg, 1995) and new paths to solution.

There are several theories as to how we change representations or restructure a problem. Gestalt psychologists stressed the importance of restructuring in insight processing and described it as an automatic process that occurs as you attempt (and fail) to solve the problem—you simply "see it in a new light" (Duncker, 1945; Koffka, 1935; Köhler, 1925). According to the cognitive view (Ohlsson, 1992), problem solvers develop a representation of the problem and apply heuristics to transform the problem space so that it looks like the solution space. Eventually, when progress stops, they apply the "restructure when stuck" heuristic (Kaplan & Simon, 1990).

As described previously, people experiencing insight are usually unable to report the processes by which they are able to restructure a problem or even that they did restructure a problem. Therefore, to explain the insight experience, restructuring theories must make room for unconscious reorganization of unsuccessful knowledge structures in favor of continued progress, though not necessarily in a series of increments, as is common in analysis. Knoblich and colleagues (1999; see also Ohlsson, 1992) have suggested just such a process in their *representational change theory*. First, the problem solver pursues and rejects nearly all the possibilities within the presently available problem space. Once at impasse, the problem solver can reject assumptions about the problem that were made based on incorrectly selected prior knowledge, thereby clearing the path for exploring a problem space based on different assumptions. Finally, reorganization and restructuring are spontaneous and out of conscious control. For example, after reaching impasse when attempting to solve a matchstick arithmetic problem (Fig. 24.3), the participant may refocus on a non-numeric aspect of the problem that is also depicted by the matchsticks, such as the addition sign, as an element of the problem space that may be altered.

When Chronicle, Ormerod, and MacGregor proposed their *progress monitoring theory* (2001; MacGregor et al., 2001; Ormerod, MacGregor, & Chronicle, 2002), they suggested that fixation and impasse may occur prior to insight but that they are not necessary to the process. According to their theory, the problem solver actively monitors progress toward solution and is continually applying problem-solving heuristics that enable him or her to change strategy based on a lack of progress toward solution. Fleck and Weisberg (2004) generated support for the progress-monitoring theory in research using the verbal protocols of solvers attempting Duncker's candle problem. They found that participants often restructured their assumptions about the problem after they rejected solution ideas as implausible without actually having to implement them.

Other researchers have been skeptical that restructuring has to be sudden or that it even has to occur outside of awareness. In an early study on failure and insight, Weisberg and Suls (1973) proposed that failed solutions during the solving process allow participants to acquire additional knowledge regarding problem components that alters future solution attempts. For example, in the candle problem, participants may have discovered that the tacks were too short to go directly through the candle. They may then have wondered what the tacks could penetrate and subsequently made the leap to tacking through the relatively thin box. A solution that could seem like a release from functional fixedness with regard to the nature of the box may have actually been a logical extension of knowledge gained based on previous failures.

Durso and colleagues (1994) reported that participants gradually accumulated solution-related knowledge when they solved anagrams, rather than experiencing sudden, all-or-none solutions. Durso and colleagues asked participants to rate the similarity of word pairs to infer the location of words within the semantic network and to demonstrate the change in network structure that accompanies restructuring. Beginning before problem presentation, continuing during the solving process, and even after solution, participants gradually rated words that were critically involved in the restructuring process as being more similar, showing that, at some level, they may have been steadily accumulating the necessary solution-related information needed to take the critical step of restructuring.

In a series of experiments using fMRI, Luo et al. (2004a) explored the neural correlates of restructuring. It is important to note that in their experiments participants did not solve problems, but rather recognized solutions (or cues), so the cognitive and neural processes necessarily would be expected to differ from those involved in pure solving. Indeed, the patterns of brain activity observed (Luo et al. 2004a, b; Mai et al. 2004) overlap with, but differ from, those observed when people solve problems (Jung-Beeman et al., 2004; Kounios et al., 2006; Subramaniam et al., 2009). Luo et al (2004a) had 13 subjects read incomprehensible sentences followed by solution cues that would eventually trigger an alternative interpretation of a concept that was critical to understanding the sentence, e.g., "You could not tell who it was, because a professional took the photo of that old man (x-rays)." Or "His position went up because his partner's position went down (see-saw)." Participants were presented with a sentence for 7 seconds and asked whether they understood it. Then they were shown the response cue and asked if they understood it in the new context. Participants were assumed to have achieved insight if they initially failed to understand the sentence but understood it after the cue. They found a correlation of insight with activity in anterior cingulate cortex, an area known to monitor cognitive conflict (Carter et al., 2000), and left lateral prefrontal cortex, an area thought to select semantic representations from among competing alternatives (Thompson-Schill, D'Esposito, Aguirre, & Farah, 1997). In addition, the level of ACC activation present in insight trials decreased across blocks, suggesting that the ACC is more involved when the task is novel, before participants develop strategies that facilitate comprehension of sentences of this type.

In similar research, Mai, Luo, and colleagues (2004) presented participants with answers to riddles that they could not solve and examined their neural activity with fMRI. They proposed that when participants switched from their initial, prepotent response to a representation that coincides with the riddle's solution (a process possibly similar to restructuring), this should initiate cognitive conflict reflected by increased activation in the anterior cingulate cortex (ACC). Using ERPs time-locked to the solution word's presentation, Mai and colleagues reported greater negativity for insight trials than noninsight trials 250–500 ms post solution, localized via dipole modeling to the ACC.

In addition, Luo and colleagues (Luo, Niki, & Phillips, 2004b, as cited in Luo & Knoblich, 2007) observed greater ACC activation when participants attempted to solve riddles with heterogeneous solution types than when participants were presented with riddles of a single solution type. Therefore, the role of the ACC in this paradigm may be to facilitate abandonment of incorrect problem representations. However, as the novelty of the problem-solving environment decreases, there may be less experience of cognitive conflict, so the ACC may not need to mediate conflict as actively. It should be emphasized again, though, that these researchers were likely studying a representational change phenomenon that differs from insight as classically conceived—more of a recognition or understanding moment than a generative insight—although the two processes may involve some similar mechanisms.

To what degree is restructuring determined by more fundamental cognitive abilities? While working memory, vocabulary size, and visuospatial ability may help some solvers with aspects of more complex problems, there is little evidence at the moment that they correlate with the ability to restructure a problem, which is the basis of insight. Ash and Wiley (2006) examined the relationship between working-memory capacity and the size of the initial search space of a problem. Working memory is essential for maintaining the elements of a problem during solving, especially for problems with large search spaces (i.e., problems that require the exhaustion of several approaches prior to restructuring). The researchers compared problems with search spaces of different sizes so they could isolate the restructuring component of insight from other processing that may be necessary as the initial problem space becomes more complex. Ash and Wiley found a relationship between working-memory capacity and the tendency to restructure, but only for problems with large search spaces. For problems with small search spaces, which do not involve much systematic search, working-memory capacity did not predict restructuring (see also Fleck, 2008; Gilhooly & Murphy, 2005). Thus, when restructuring is isolated from other components of problem solving, individual differences in controlled search and the conscious application of strategies are apparently unrelated to success at solving.

Impasse and Incubation

There is some controversy (Dominowski & Dallob, 1995; Smith, 1995; Weisberg, 2006) about what drives restructuring of the problem space and to what degree impasse is necessary for restructuring. Taking a break from the problem after impasse, a period known as incubation, can promote the solution of insight problems (Christensen & Schunn, 2005; Segal, 2004). Because restructuring is so critical if solvers are to overcome an initial misleading solution idea in favor of novel solution ideas (e.g., Martindale, 1995; Metcalfe & Wiebe, 1987; Ohlsson, 1992), it is vital to understand what scenarios promote restructuring. There is a significant literature on the importance of incubation in this regard.

Various theories have been proposed regarding the nature of incubation and the mechanisms of its effect (see Sio & Ormerod, 2008, for a review). First, researchers have posited that incubation may lead to insight because time away from the problem results in the deactivation of incorrect knowledge representations in the brain (i.e., selective forgetting; Smith & Blankenship, 1991). It has also been proposed that incubation may result in success because the unconscious remains at work (perhaps as spreading-of-activation) while the conscious mind is engaged on another task (e.g., Wallas, 1926; Yaniv & Meyer, 1987). In research testing these theories, Segal (2004) reported that solution rates for insight problems improved when participants took a break after impasse, regardless of the duration. Moreover, this break was more successful when the break interval was filled with a cognitively demanding task. In incubation research conducted by Kohn and Smith (2009), an incubation effect was observed when the to-be-solved problems were completely removed from sight during the incubation period, and not when they remained partially in view, implicating the value of distraction/attention switches in incubation, rather than merely selective forgetting. However, Kohn and Smith (see also Vul & Pashler, 2007) only revealed an incubation effect when participants were exposed to misleading information at a problem's outset, lending support to the selective forgetting hypothesis.

Some researchers (Fleck & Weisberg, 2004; MacGregor et al., 2001) have speculated that restructuring may occur as the result of an internal or external search for new information following impasse or failure. Spontaneous restructuring stemming from exposure to relevant external hints has also received empirical support from research demonstrating that exposure to problem-relevant information during incubation periods can facilitate the insight experience (Maier, 1930; Seifert et al., 1995).

Despite the prominent place of incubation as a means of overcoming fixation in many insight theories, research on fixation and impasse has been sparse in part because it is difficult to operationally define fixation: How long must it last? What is considered "limited" progress? Must there be repeated failure with the same incorrect solution? and so on. Although problems that typically produce insight solutions are often created by inserting misleading components designed to generate fixation on irrelevant aspects (Weisberg, 1995), it can be difficult to tell if solvers have actually been misled. Researchers have had some success verifying and evaluating fixation and impasse by collecting verbal protocols (Fleck & Weisberg, 2004; Kaplan & Simon, 1990) and using eye tracking (Grant & Spivey, 2003; Jones, 2003; Knoblich, Ohlsson, & Raney, 2001; Thomas & Lleras, 2009a). Fleck and Weisberg (2004) examined verbal protocols for the presence of impasse characteristics and were able to demonstrate that impasse-like characteristics were present in the thought processes of approximately 45% of participants attempting to solve Duncker's (1945) candle problem. Statements that led Fleck and Weisberg to classify a participant as being at impasse mostly reflected confusion about specific problem components or an inability to generate additional ideas. However, verbal-protocol analysis is not beyond criticism, because it is based on the assumption that what participants actually verbalize accurately reflects their cognitive processes and that they choose to verbalize all the mechanisms to which they can consciously attend.

The use of eye-tracking technology to measure gaze fixation has shown promise as a method for measuring what may be fixation during problem solving (e.g., Grant & Spivey, 2003; Jones, 2003).

Knoblich and colleagues (2001) operationally defined increased gaze-fixation duration to be indicative of impasse during problem solving, and they speculated that increased gaze fixation on specific problem elements could be reflective of fixation on incorrect problem components. Mean gaze-fixation duration increased across the solving period as participants attempted to solve matchstick arithmetic problems (see Fig. 24.3), indicating that solvers began to reach impasse as time spent working on the problem progressed. Furthermore, solvers fixed their gaze on irrelevant elements of the problem during the initial solving period and fixation on relevant items increased with time. Using a somewhat different approach, Jones (2003) operationally defined the point that impasse occurred in the solving process as the instant gaze fixation was at least two standard deviations above mean gaze fixation for the participant. Jones found that all solvers experienced impasse before they reached solution and speculated that impasse preceded a representational change that led to solution. Thus, eye-movement and verbal-protocol research suggests that fixation and impasse play important roles in the insight process and may be fundamental in establishing the necessary environment for representational change.

Insight: Finding the Proper State of Mind

In addition to incubation, there are other processes that facilitate insight. One of these is positive mood. Researchers have often noted a link between positive affect and creativity (e.g., Amabile, Barsade, Mueller, & Staw, 2005), and several studies have directly examined the role of affect in insight (e.g., Isen et al., 1987; Subramaniam et al., 2009). Isen and colleagues were among the first researchers to demonstrate the relationship between insight and positive affect when they observed that participants' solution rates for Duncker's (1945) candle problem increased when brief comedic films were used to induce positive affect. More recently, Subramaniam and colleagues asked participants to indicate their solution strategy (either insight or analytic) on a trial-by-trial basis for solved CRAs during fMRI scanning and to complete self-report measures of affect and anxiety. When participants were high in positive affect and low in anxiety, they solved more problems overall, especially more problems by insight.

Positive affect may promote insight and creativity because it allows people to broaden attention, both perceptually and conceptually, and consider ideas for solution that would typically fall outside the scope of their awareness (Rowe, Hirsch, & Anderson, 2007). In research exploring the link between cognitive processes and mood, Rowe et al. observed changes in selective attention and semantic access with positive mood. A positive mood state was associated with significantly weaker selective attention (i.e., a broader scope of attention or a leakier filter) on a flanker task, as well as increased semantic access to remote associations in Mednick's (1962) RAT, than were negative or neutral moods. Mood-based performance on tasks of attention and semantic access was highly correlated (r = .49), a result not observed for task performance during neutral or negative moods. Rowe et al. interpreted these findings as further support for a common origin (i.e., an affective influence) for the two processes.

In similar research, researchers who compared attentional resources in creative versus less creative individuals found support for a relationship between attention and creativity. As measured by scores on Mednick's (1962) RAT, those high in creativity tended to use hints they had been instructed to disregard (Ansburg & Hill, 2003). A functional-neuroanatomical explanation for such a relationship may be seen in neuroimaging results reported by Subramaniam and colleagues (2009) in which greater positive mood assessed at the start of the experiment session was associated with an increase in insight solutions, as well as brain-related activation in the ACC, both before and during problem solving. Specifically, level of positive affect modulated dorsal ACC activation (the more positive participants were, the higher ACC activation was) during the preparatory interval prior to all problems that were eventually solved. Across all participants, this preparatory activation was stronger for problems that were subsequently solved with insight than for problems subsequently solved by analysis (see also Kounios et al., 2006). These findings led the researchers to suggest that a positive mood may create a brain state helpful for achieving insight, perhaps by modulating the cognitive control system to better detect (or switch to) weak brain activity associated with more distant associations.

The efficacy of brief training intervals in enhancing insight problem solving (e.g., Ansburg & Dominowski, 2000; Cunningham & MacGregor, 2008; Dow & Mayer, 2004; Lung & Dominowski, 1985; Maier, 1933; Schwert, 2007) has also been tested. Training typically involved advice on avoiding common obstacles to achieving insight: initial ideas during problem solving are often misleading;

problem solving may be difficult because you are applying unnecessary constraints to the problem (see Ansburg & Dominowski, 2000; Cunningham & MacGregor, 2008). After learning the heuristics, participants usually worked on example problems that demonstrated the solution and its associated logic. Results of such training regimes have so far been generally limited to domain-specific or even problem-specific training effects, similar to those present with training to solve other types of problems (Ansburg & Dominowski, 2000; Dow & Mayer, 2004; Gick & Holyoak, 1980). Furthermore, training was most beneficial in enhancing solving ability for traditional insight problems, such as riddles and puzzles, and less influential when the insight problems involved real-life contextual information (Cunningham & MacGregor, 2008).

Investigators have also enhanced insight rates by altering the solving process through provision of implicit hints (e.g., Grant & Spivey, 2003; Sio & Ormerod, 2009; Thomas & Lleras, 2007). Furthermore, Christensen and Schunn (2005) observed an increase in insightful problem solving when external hints related to the solutions were incidentally provided during incubation periods that occurred at regular intervals throughout the problem-solving task.

Hints diverting attention from one problem component to another can facilitate the occurrence of insight (e.g., Grant & Spivey, 2003; Kaplan & Simon, 1990; Thomas & Lleras, 2009a). Grant and Spivey were able to enhance solution rates for Duncker's (1945) radiation problem, described earlier, by presenting the problem with the outside surface of the body flashing, drawing attention to a component that could trigger insight. Thomas and Lleras (2007) also directed participants' attention to the problem's solution by having participants track a series of letters and digits that appeared on the computer screen in a sequence such that the eye-movement pattern mirrored the layout of the problem's solution (i.e., across the surface of the skin and moving in toward the tumor). Similar effects occurred when participants directed their attention to letter and number locations resembling the solution pattern without physically moving their eyes to track the stimuli (Thomas & Lleras, 2009a). Furthermore, having participants engage in physical movements that coincided with the solution to Maier's (1931) two-string problem (i.e., swinging their arms back and forth in a pendulum-like motion) facilitated problem solving (Thomas & Lleras, 2009b). This research collectively supports the benefit of shifting attention from misleading to relevant problem components in facilitating insight.

In addition to facilitatory effects from external hints, the likelihood of experiencing insight has been associated with specific preparatory brain states. For example, Kounios et al. (2006) discovered that neural activity immediately prior to the presentation of a problem predicts whether solutions will arise with insight or analytically. They asked participants to solve a series of CRA problems using the insight judgment procedure. Of interest was the time window preceding the presentation of a CRA problem. EEG and fMRI measures of neural activity during this preparatory time window predicted whether the subsequently displayed problem would be solved with insight or analytically. The analysis of low-alpha EEG activity (8–10 Hz) revealed greater preparatory activity for trials subsequently solved with insight measured over midfrontal, bilateral temporal, and bilateral somatosensory regions. In contrast, the interval preceding trials solved analytically was associated with greater activity over posterior brain regions. A parallel experiment with fMRI generally replicated the results of the EEG experiment and further clarified the neural components underlying the strategy differences, identifying increased signal strength for insight trials in the ACC, posterior cingulate cortex, and bilateral middle and superior temporal gyri. These results suggest that a form of preparation before problem presentation helps determine whether a subject will tackle the subsequent problem with an insight or analytic strategy. Preparation for insight apparently involves inward focus of attention and priming of brain regions supporting semantic processing. In contrast, preparation for analysis involves outward focus of attention on the screen on which the expected problem will appear.

A more recent study by the same researchers revealed that even resting-state brain activity, that is, brain activity when an individual is not engaged in task-directed cognition, predicts that individual's likelihood of later solving problems insightfully or analytically. Kounios and colleagues (2008) grouped participants into high-insight and high-analytic groups based on the proportions of anagrams they solved with insight. High-insight subjects showed greater right-hemisphere EEG activity and more diffuse activity of visual cortex suggestive of broader attention in accord with previous research highlighting an association among insight, right-hemisphere activity, and broad attention (Fiore & Schooler, 1998; Jung-Beeman, 2005; Martindale, 1995). These results demonstrate that the tendency to solve problems with one or the other strategy is a function of states and processes that begin well before the presentation of a problem. Indeed, these states may be relatively stable and constitute a dispositional cognitive style. Such studies of insight-related preparatory and resting-state activity imply that getting the problem solver into the appropriate brain state may be one of the most effective means to enhance insight.

Conclusions: Current Perspectives in Insight

In the current chapter we reviewed the themes and advances in insight research over the last century. Regarding the debate between "business-as-usual" and "special-process" views of insight, research revealing right-hemisphere contributions to insight not present in analysis, as well as the contribution of unconscious processing in insight, has strengthened the perspective that insight is fundamentally different from analysis. Insight researchers have expanded our understanding of the components of insight to include the occurrence of impasse/fixation and the eventual restructuring of thought. Much of the research surrounding these components has focused on mechanisms that facilitate restructuring, and therefore, insight, including the benefits of incubation, external hints, and preparatory mind states. Next we review three of the most significant developments in insight research since the resurgence of research in this area.

Three recent developments in insight research have substantially changed how we study insight and what we know about its cognitive, neural, and affective underpinnings. First, methodological developments in the construction of problem stimuli have circumvented criticisms of the traditional approach of studying insight based on classic insight problems. These methodological developments have laid the groundwork for the second development, namely, the application of neuroimaging techniques to study aspects of insight that could not easily be studied using traditional methods (see Morrison & Knowlton, Chapter 6). Third, there is a new emphasis on examining factors that enhance insight. These three points are briefly discussed next.

Although much was learned in the decades spent studying the solution of more complex "classic" insight problems such as the candle, nine-dot, and two-string problems, more recent innovations in stimulus construction and methodology have begun to transform the study of insight. The traditional approach of comparing performance on such insight problems with performance on analytic problems has two basic flaws. First, while *processing* can be insightful or analytic, *problems* are neither. Generally, classic insight problems are often solved with a flash of insight. But there is nothing about such problems that *requires* that they be solved with insight. Undoubtedly, subjects sometimes solve them analytically. So the assumption that so-called insight problems are always solved insightfully is problematic. Second, the analytic and classic insight problems used in past studies are complex. Evidence that different types of processes are used to solve them is ambiguous because these two classes of problems differ from each other in many ways—working memory load, modality specificity, and so on—and not just in terms of the insight/analytic distinction.

One approach to overcoming this problem is the development of larger sets of smaller, relatively homogeneous, problems amenable to standardization and norming. An important example of this approach is the development and application of CRA problems (described earlier). These problems can be solved within a few seconds, allowing researchers to acquire more data per subject within a session, which is a prerequisite for neuroimaging studies (see Jung-Beeman et al., 2004, for more on the advantages of such stimuli). Though it is possible that aspects of the insight process are lost when simpler stimuli are utilized, distinctions between the insight processes involved in the solution of classic insight problems and such modern stimuli, should they exist, will be revealed as research in the field progresses.

A related development, based on the notion that a defining feature of insight is the sudden awareness of the solution, is the systematic use of subjects' judgments about their own solving strategies. As described earlier, the studies of Beeman, Bowden, Kounios, and others require subjects to report, for each solution, whether it was the product of insight or analysis, a distinction with which virtually all subjects indicate that they are familiar. In this way, insightful and analytic processing can be directly compared while controlling for ancillary differences between the stimuli that result in these two types of processes by using many examples of a single type of problem (e.g., CRAs and anagrams).

These methodological developments have fueled an ongoing series of neuroimaging studies of insight focusing on aspects of problem solving that are, at best, difficult to study using traditional behavioral techniques. As noted earlier, researchers using fMRI and EEG have corroborated the unique role of right-hemisphere processing in insight (Aziz-Zadeh et al., 2009; Jung-Beeman et al., 2004), observed initially in behavioral research. Furthermore, this research has clarified the role of sensory gating and semantic integration in the solution of verbal problems with insight (see Jung-Beeman et al., 2004). Researchers have also linked activity in the ACC, a region associated with conflict monitoring, to the restructuring component of insight (Luo et al., 2004a; Mai et al., 2004); this activation may signify processing involved in the abandonment of incorrect problem representations in favor of continued progress. Finally, neuroimaging has contributed to our understanding of the resting (Kounios et al., 2008) and preparatory (Kounios et al., 2006) brain states associated with the subsequent occurrence of insight.

Because insight can be instrumental to real-world innovation, researchers have also been expanding their efforts to isolate components of insight and factors that influence or facilitate these components. Studies have shown that some components of insight processing rely on the same core abilities as analytic processing, such as working memory, fluid intelligence, general problem-solving ability, and vocabulary (Ash & Wiley, 2006; Davidson, 1995; Fleck, 2008; Gilhooly & Murphy, 2005; Schooler & Melcher, 1995; Sternberg & Davidson, 1982), so methods that improve more fundamental problem-solving abilities (see Koedinger & Roll, Chapter 40) would naturally be expected to improve insight as well. Researchers have also begun to explore correlates of insight that could be exploited in the future as mechanisms for enhancing insight. For example, one correlate that investigators have identified is divergent thinking (Ansburg, 2000; Davidson, 1995; DeYoung, Flanders, & Peterson, 2008). Divergent thinking is the ability to rapidly generate multiple solutions for a single problem, such as listing as many uses as possible for a brick. Divergent thinking has been explored extensively in creativity research (Guilford, 1950) and efforts have been made to enhance it (Clapham, 2001; Runco & Okuda, 1991).

The aforementioned developments in problem stimuli and neuroimaging methods, as well as additional knowledge regarding insight components and factors relevant in facilitating insight, have set the stage for further advances in insight research. We conclude with a discussion of some of the questions and concerns to be considered by researchers in this advancing field.

Future Directions

The evolution of theories and methodologies in the study of insight has fashioned an ideal climate to enable researchers to continue the exploration of fruitful veins of research, as well as consider topics that have received little attention to date. Neuroimaging offers continued promise in isolating and identifying components of insight, such as restructuring and impasse. We believe that employing a broad range of advances in neuroscientific techniques and theories constitutes an important approach to further elucidating mechanisms of insight and adjudicating among contrasting theories. However, to reach their full potential, neuroscientific approaches must be fully integrated, both in terms of methodology and theory, with behavioral techniques and cognitive theory. For example, metacognitive research supports the notion of sudden conscious awareness of an insight near the point of solution (Metcalfe & Wiebe, 1987; Smith & Kounios, 1996), whereas other behavioral research indicates the accumulation of partial information prior to solution (Durso et al., 1994). If both veins of research are valid and the possibly gradual reorganization of thought occurs outside of awareness and enters consciousness in a sudden leap, then we should be able to determine the point at which enough solution-relevant information has been acquired or activated on the unconscious level to enter into conscious awareness. This should be possible by integrating existing behavioral methods with neuroimaging techniques, thus permitting researchers to correlate the conscious experiences of the individual with associated neural activity.

Though neuroimaging studies have begun to isolate insight-related brain regions thought to reflect relevant information-processing components, equally important is the identification of component sequencing and mutual influence exemplified, for example, by how aspects of impasse may affect restructuring (Fleck & Weisberg, 2004). If insight is best conceptualized in terms of constraint satisfaction implemented by parallel processing, then the use of neuroimaging techniques should be expanded beyond identifying critical brain regions to explore how these regions work together to yield insights (e.g., Payne & Kounios, 2009).

While we learn more about insight itself, we must continue to explore how insight is related to other forms of creativity and innovation (see Smith & Ward, Chapter 23). Although hypothesized connections among insight and other forms of creativity are helping to stimulate interest in insight, research examining the hypothesized overlap between insight and other types of creative cognition is lacking. Such research will contribute toward delineating the field of creativity research, which suffers from vague and outmoded definitions.

Clarifying the relationships among insight and other forms of creativity is particularly important for the development of techniques to enhance insight (e.g., Cunningham & MacGregor, 2008). Research in the field of creativity enhancement has achieved recent successes, which may very well be generalizable to insight. For example, Markman, Lindberg, Kray, and Galinsky (2007) have evaluated the use of *counterfactual mindsets* as a means of enhancing either creative or analytic thought. In their research, priming people with additive counterfactuals (achieved through statements modifying reality by adding elements to a situation) induced a mindset that enhanced creativity, whereas priming with subtractive counterfactuals (achieved through statements modifying reality by removing elements from a situation) enhanced analytic thought. In a similar manner, Friedman and Förster (2005) have successfully enhanced either creative or analytic problem-solving success by inducing approach or avoidance motivational states. If the relationship between insight and other forms of creativity can be clarified, then these and other creativity-enhancement factors and techniques can be examined for their potential efficacy in facilitating insight.

Interest in facilitating insight, combined with recent advances in delineating the cognitive components and functional neuroanatomy of insight, has raised the possibility of using brain-stimulation techniques such as transcranial direct current stimulation or transcranial alternating current stimulation to enhance insight during problem solving (van Steenburgh, 2011). This approach will undoubtedly contribute to our understanding of the neural basis of insight, though whether brain stimulation ever becomes a practical technique for enhancing insight is currently unknown.

Recent advances in insight research have fostered additional questions for future research to answer. For example, to what degree are the existing research findings generalizable? By defining insight in terms of the subjective sudden awareness of a solution or interpretation, are we lumping together phenomena that should really be considered separate? Is recognition that a presented solution is correct ("*Uh-duh*;" Luo et al., 2004a; Mai et al., 2004; Qiu et al., 2008) the same as generating an insight solution oneself ("*Aha*;" Jung-Beeman et al., 2004; Knoblich et al., 1999)? To what degree can we make conclusions about perceptual insight based on findings using primarily verbal stimuli (Gilhooly et al., 2010)? When an individual solves a CRA problem, an anagram, or, for that matter, a classic insight problem, is this similar to what happens when a person makes a scientific breakthrough (see Dunbar & Klahr, Chapter 35) or comes to a new realization about a real-world situation? With new methodological tools and theoretical perspectives, researchers must take advantage of the current momentum in insight research to broaden their efforts in ways that address such concerns and bridge the gap between the laboratory and life.

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