a predication disputed by the modeling efforts of Cary and Reder. PRS also predicts that the most important variable in memory experiments is that the same processing is required at testing as at encoding. PRS predicts that the distinctiveness of various perceptual features will not have an effect on the degree to which perceptual match affects memory. Clearly, the findings of Reder, Donavos, and Erickson provide a strong challenge to this theory.

Later research (Diana and Reder, 2002; Diana, Peterson, and Reder, forthcoming) showed that not only does perceptual information influence participants to be more likely to recognize a word they have seen before; it also leads them to believe they have seen a stimulus that is novel. In other words, perceptual features of the verbal stimuli influence the likelihood that participants will spuriously recognize that stimulus. This result is especially interesting because it provides evidence that familiar perceptual features, as well as semantic features, can produce false memories. The Deese, Roediger, and McDermott paradigm (see Roediger and McDermott, 1995) shows that when words from a given semantic category are presented, participants are more likely to falsely believe that they have seen another word from that semantic category than one from a separate category, a result that supports the thesis that false memories can result from perceptual influences alone.

Our ongoing studies are investigating the degree to which the same effects can be found within the domain of face recognition memory as within that of perceptual and conceptual information memory. Our preliminary findings (Diana and Reder, 2002) suggest that irrelevant perceptual information also influences one's ability to recognize a face, that there is no need to propose a separate explanation for facial memory representations over verbal memory representations. Source of activation confusion models can make predictions about both visual/facial and verbal memory phenomena simply by assuming that the two types of information are governed by the same principles.

Metacognitive Processes Are Adaptive

Research on metacognition in laboratory tasks has led to the belief that our metacognitions are frequently inaccurate. While the evidence appears to support this belief, it is important to keep in mind that laboratory tasks may create artificial situations that subvert the adaptive character of metacognition. Human cognition is set up to deal with the real world and to conserve resources whenever possible. One major area of resource expenditure is careful and detailed attention to an entire scene, document, or conversation. Visual metacognition is important because it would be impossible to process all of the visual information in a complex scene. People require heuristics to figure out what aspects of a scene or display should receive attention. This is may help to explain change blindness—there are simply not enough resources to continually process all aspects of a scene.

What heuristics do we use to decide whether to direct attention to something? We learn the regularities in the display or scene and we focus our attention on those aspects we have not yet learned are best to ignore (i.e., because they are unchanging or irrelevant). That people learn to anticipate where to look and what to ignore has been demonstrated in low-level attentional tasks (e.g., Chun and Jiang, 1998; Reder, Weber, Shang, and Vanyukov, 2003) and higher-level tasks such as air traffic control or solving algebra equations (e.g., Lee and Anderson, 2001).

This is why change blindness strikes us as so bizarre. In real life, things such as the identity of our conversational partner do not change unexpectedly. When a person we do not know presents us with a task in an experiment, we do not bother to encode the facial features of that person because they are not relevant to the task at hand and because we certainly do not expect the identity of the person to change "before our eyes." Because of the specialization of our system, we are unlikely to miss a change when it is feasible and important, thus we are unlikely to realize that we have missed a change at some later point. We think that we see everything because we have grown to expect stability in certain areas and similar configurations within scenes of the same type. Based on our previous life's experience, we believe that our visual perception is accurate. Thus, when our metacognitions are accessed in answer to the question, "Would you be likely to detect a change in this scene?" we respond based on our experience.

Even if humans had the cognitive capacity to encode all the information in a visual scene, the overwhelming amount of information would take such great lengths of time to process that the human processor would freeze in confusion. The trade-off of occasional mistakes in unlikely situations is preferable to the overload of storing and attempting to use a huge amount of unnecessary information. Processes become routine over time, as the needless steps and processing are weeded out. The predictability of the world allows us to learn and to increase our efficiency, a principle that may be true of all metacognition, both visual and verbal, and one even more necessary in visual metacognition than in semantic metacognition. Visual input is much richer than semantic input and requires a much greater degree of filtering, although, of course, this assumption may also be an illusion. The voice of the speaker, the intonation, the problem of invariance in phonemes, or the font of the typeset are all extra information in semantic processing. We usually take these sources of information for granted and ignore them in our overall processing. Metacognition is the key to deciding where resources should be expended and what information is important.

Conclusions

Metacognition can be explained as part of an integrated cognitive system and does not need to be proposed as a separate one. The role of metacognition in general cognition is to provide a feedback loop by which strategy selection (e.g., memory search versus reasoning an answer; statistical learning) can be accomplished.