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# Speculations About the Nature and Development of Metacognition

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Metacognition is usually defined as knowledge and cognition about cognitive objects, that is, about anything cognitive. However, the concept could reasonably be broadened to include anything psychological, rather than just anything cognitive. For instance, if one has knowledge or cognition about one's own or someone else's emotions or motives, it could be considered metacognitive. Any kind of monitoring might also be considered a form of metacognition; for example, attempts to monitor one's own motor activity in a motor skill situation. It is very difficult to rule out the conscious monitoring of motor acts as being something entirely different from what is ordinarily understood to be metacognition. Because some metacognitive knowledge and cognitive self-regulatory activity is not very accessible to consciousness, researchers may eventually feel compelled to include processes that are not conscious and perhaps not even accessible to consciousness as forms of metacognition or metacognitive-like phenomena.

This researcher (Flavell, 1979, 1981) tried to classify part of the domain of metacognition. The taxonomy created is not very satisfactory, but at least it helps in thinking about the domain. The key concepts in the taxonomy are *metacognitive knowledge* and *metacognitive experience*. Metacognitive knowledge refers to the part of one's acquired world knowledge that has to do with cognitive (or perhaps better, psychological) matters. As people grow up, an important part of what they learn or come to believe concerns the mind and other things psychological.

### METACOGNITIVE KNOWLEDGE

Metacognitive knowledge is conceived as simply that portion of the total knowledge base that pertains to this content area. Metacognitive knowledge can be subdivided into three categories: knowledge of *person variables*, *task variables*, and *strategy variables*.

#### Person Variables

Knowledge of person variables refers to the kind of acquired knowledge and beliefs that concern what human beings are like as cognitive (affective, motivational, perceptual, etc.) organisms. There are three subcategories of person variables: *intraindividual*, *interindividual*, and *universal*. An example of an intraindividual variable is a person's belief that he or she is fairly good at dealing with verbal kinds of material, but poor at spatial tasks; therefore, it is knowledge or belief about intraindividual variation in one's own or someone else's interests, propensities, aptitudes, and the like. In the case of interindividual variables, the comparison is between, rather than within, persons. Examples might be the judgment that one is brighter than one's parents, but that the parents are more reflective and thoughtful than certain of their friends. The most interesting variables are acquired ideas about universal aspects of human cognition or psychology. It is hard to imagine a culture in which people grow up without acquiring any naive psychology; in particular, without developing any intuitions about the way the human mind works. For example, one cannot imagine anyone growing to maturity without having some kind of intuition that short term memory is fallible and of limited capacity. That is something adults know, but did not always know, about themselves; it must have been acquired in the course of childhood development. Similarly, can one imagine a culture in which a person has not acquired the concept of a mistake or error? Something is believed to be true and it turns out not to be true. You think you understand something and it turns out that you have misunderstood it or failed to understand it. Surely, adults the world over have acquired knowledge of such universal mental phenomena and make use of that knowledge in managing their lives.

#### Task Variables

The second subcategory is knowledge of task variables. The individual learns something about how the nature of the information encountered affects and constrains how one should deal with it. For instance, experience has taught that very difficult, very densely packed, and very low redundancy information is troublesome to process. To comprehend and to deal effectively with such information, it is necessary to proceed slowly and carefully and to process deeply and self-critically (i.e., with high comprehension monitoring activity). Other inputs

are loosely packed and contain mostly familiar information. People know if they can comprehend these inputs without paying really close attention, and they are likely to process them accordingly. Thus, much is learned about the different kinds of information that are encountered and about the kind of processing that each kind of information requires or does not require. In addition, given the information, it is learned that different kinds of tasks place different kinds of information-processing demands on individuals. An example would be the knowledge that it is easier to learn the essence or gist of something, such as a story, than it is to learn it verbatim. All adults recognize that it is easier to recall the main events of a story than to recite the story word for word. Thus, one learns about the implications of various task demands for self-processing. One learns that in some cases the task demands are much more rigorous and difficult than they are in other cases, and that one must take these demands into account and act accordingly if the task goal is to be achieved.

#### Strategy Variables

Much is also learned about cognitive strategies or procedures for getting from here to there in order to achieve various goals (strategy variables). It has been suggested (Flavell, 1981) that one can distinguish cognitive strategies from metacognitive strategies. A cognitive strategy is one designed simply to get the individual to some cognitive goal or subgoal. For instance, a cognitive strategy for getting the sum of a list of numbers would obviously be to add them up. The goal is to find the sum, and in order to do so the numbers are added. In the same situation, a metacognitive strategy might be to add the numbers a second time to be sure the answer is right. If it is an income tax return or something equally important, one might even double check by adding them up a third time. The purpose of the second and third addition is somewhat different from that of the first. The purpose is no longer to reach the goal (cognitive strategy), but rather to feel absolutely confident that it has been reached (metacognitive strategy). Similarly, sometimes one reads things slowly simply to learn the content (cognitive strategy); other times one reads through things quickly to get an idea of how difficult or easy it is going to be to learn the content (metacognitive strategy). That is, one skims or scans a text in order to get some idea of how much work lies ahead. In the course of development one learns about cognitive strategies for making cognitive progress and about metacognitive strategies for monitoring the cognitive progress.

Finally, it should be emphasized that person, task, and strategy variables always interact, and that intuitions about their interaction are also acquired. For instance, I may sense that I but not my brother would do better to use strategy A rather than strategy B, because the task is of this type rather than that. Given one's particular cognitive make-up and the particular task, one develops intuitions about which strategies are better.

## METACOGNITIVE EXPERIENCES

The other major conceptual entity in the taxonomy is metacognitive experiences. Metacognitive experiences are conscious experiences that are cognitive and affective. What makes them metacognitive experiences rather than experiences of another kind is that they have to do with some cognitive endeavor or enterprise, most frequently a current, ongoing one. For example, if one suddenly has the anxious feeling that one is not understanding something and wants and needs to understand it, that feeling would be a metacognitive experience. One is having a metacognitive experience whenever one has the feeling that something is hard to perceive, comprehend, remember, or solve; if there is the feeling that one is far from the cognitive goal; if the feeling exists that one is, in fact, just about to reach the cognitive goal; or if one has the sense that the material is getting easier or more difficult than it was a moment ago. Thus, a metacognitive experience can be any kind of effective or cognitive conscious experience that is pertinent to the conduct of intellectual life; often, it is pertinent to conduct in an ongoing cognitive situation or enterprise. Metacognitive experiences play a very important role in everyday cognitive lives. As one grows older one learns how to interpret and respond appropriately to these experiences. The converse implication is that young children may have such conscious experiences, but may not know how to interpret them very well; children simply may not know what these experiences mean and imply. Recent research supports this implication (Beal & Flavell, 1982; Flavell, Speer, Green & August, 1981; Singer & Flavell, 1981; see also various chapters in Dickson, 1981).

In one series of studies (Flavell et al., 1981), the young child subject hears a brief tape-recorded instruction to build a simple block structure; for example, "Take the red block and put it on top of the blue block." His task is to make a structure identical to that of the child speaker, based on her instructions. Some of the instructions are wholly unambiguous and the child can follow them without any difficulty. Other instructions are ambiguous, impossible to execute, or otherwise inadequate. For example: "Put the big block on the tray. Put the little block on top of it so you cannot see the big block." Or: "Put the red block on the tray," when there are two different red blocks to choose between. It has been found that when kindergarten children (5 or 6 years of age) hear these inadequate instructions and try to carry them out they often act puzzled or uncertain and may even say something like "Huh?" or "Which red block?" However, when they are asked if they think that their building looks exactly like that of the speaker's they are very likely to say that it does; and when they are next asked if the speaker did a good job or a bad job of telling them how to make their building exactly like hers, they are even more likely to say that she did a good job. The evidence suggests that these curious responses are not artefacts of the method of questioning used; rather, it seems that young children often do not fully understand the meaning and implications of metacognitive experiences of puzzlement

and uncertainty. They may feel puzzled, but they do not know what the implication of that feeling is for the existing situation. These children cannot be sure their building matches the speaker's because the speaker did not describe it adequately enough. In conclusion, the evidence from these studies and those of other investigators suggests that young children have more trouble than older children in properly comprehending their own feelings of incomprehension, and in properly appreciating the meaning, significance, and implications of such metacognitive experiences.

## QUESTIONS, PROBLEMS, AND ISSUES

The following are some of the questions, problems, and issues concerning metacognition that should be addressed. First, where does metacognition fit in psychological space? That is, what other psychological concepts does it relate to, and how does it relate to these concepts? The concepts that might be related to metacognition include: executive processes; formal operations; consciousness; social cognition; self-efficacy, self-regulation; reflective self-awareness; and the concept of psychological self or psychological subject. Also related are developing conceptions of, and about thinking, learning, and other cognitive processes—the child's emerging "theory of mind."

Another group of questions concerns the types of metacognitive acquisitions that develop and the earlier foundations or prerequisites from which they develop (the taxonomy given will probably not prove to be the best one). Similarly: What aspects of metacognition are inherent or very early acquired, and what aspects must be acquired in the course of childhood, adolescence, or even during the adult years? Some aspects of metacognition, just like some aspects of general cognition, are probably present almost from the beginning. Also, is the acquisition, use, and usefulness of some types of metacognition impeded by information-processing limitations or biases, by lack of relevant experiences in most environments, or by other factors? For example, perhaps some types of metacognition are unlikely to occur in a given cognitive domain until some amount of expertise or knowledge in that domain is acquired.

How might various types of metacognition develop? What might account for possible individual or cultural differences in what does develop? A rough distinction can be made between cognitive-developmental changes in the child that allow for metacognitive acquisitions and experiences the child might have that could assist or facilitate metacognitive development. In the case of the former, there might be three closely related but conceptually distinguishable types of changes. First, there might be cognitive-developmental changes that could lead directly to metacognitive acquisitions. For example: An increase in the capacity to plan ahead could lead, more or less directly, to a greater tendency to think about cognitive means and cognitive goals. Second, there could be changes

which increase the child's cognitive readiness to profit from experiences that promote metacognitive development. Third, and closely related to the second, one can imagine cognitive-developmental changes in the child that might increase the child's opportunity to have experiences that could lead to metacognitive acquisitions. For example: Once one has developed sufficiently to start reading, one can start having the formative experiences that reading brings. These include the metacognitive experiences of conscious comprehension difficulties, misreadings, and sudden insights; thus, any experiences that can promote metacognitive growth.

Two changes in the development of the child might possibly contribute to the acquisition of metacognition. One is the developing sense of the self as an active cognitive agent and as the causal center of one's own cognitive activity. The development of such an internal locus of cognitive control could promote the monitoring and regulation of one's own cognitive enterprises. A second kind of change that should facilitate metacognitive development, an increase in planfulness, has already been mentioned. More generally, an individual that represents and interrelates past, present, and future actions and events should be in a good position to acquire metacognitive knowledge. That is, such an individual could notice and store covariations in person, task, and strategy factors. The person who can look ahead is also in a position to scan upcoming information or impending problems, and can plan in advance how processing resources should be allocated. Thus, an individual who can create conscious and explicit representations of the past, present, and the future should be in a better position to make metacognitive progress than one who does not.

There may also be a number of experiences that might assist metacognitive development; some of them may consist of direct practice in metacognitive activity. Metacognition, like everything else, undoubtedly improves with practice. Other kinds of experiences, although not themselves metacognitive activities, may simply be heuristic or propaedeutic to metacognitive development. Therefore, one way to become better at metacognition is to practice it; another way may be to practice other things which are not metacognitive themselves but which indirectly promote metacognitive activity.

One class of these experiences may be supplied by parents (Wertsch, 1978). Parents may unintentionally model metacognitive activity for their young children. They may also deliberately demonstrate and teach it, helping the child to regulate and monitor his or her actions. Similarly, teachers in schools may sometimes model, as well as teach and encourage, metacognitive activity. Schallert and Kleinman (1979) describe some of the things they have observed teachers doing to help the child regulate and monitor own cognition. They indicate how teachers provide the kind of assistance, not provided in textbooks, to help the child wend his or her way through a cognitive endeavor.

There are a variety of other school experiences that may assist the growth of metacognitive skills, including reading, which was mentioned earlier. A piece of

text is very different from an oral communicative interchange between people; the text has little communicative context (Donaldson, 1978; Olson, 1972). The child has to treat a written passage as a cognitive object and attempt to figure out what can be concluded or inferred from it alone, without the additional expressive and situational clues to meaning normally present in an oral communication situation. In the course of learning to read, the child gets practice in scrutinizing messages in isolation from context, and thus in evaluating the possible intended meanings and implications (a form of metacognition). Writing also affords practice and experience in metacognition. It allows one to critically inspect one's own thoughts. It also encourages the individual to imagine the thoughts of others. For example, to think about whether they will understand or believe what one is trying to convey in one's writing. Of course, learning to be a skillful speaker and critical listener also involves considerable practice and skill in cognitive monitoring. Similarly, learning mathematics provides opportunities for monitoring all sorts of activities. This was shown earlier, in the example of checking one's addition by adding the column a second time.

Good schools should be hotbeds of metacognitive development, for the banal-sounding reason that so much self-conscious learning goes on in them. In school, children have repeated opportunities to monitor and regulate their cognition, as they gradually pass from novice status to semi-expert status in microdomain after microdomain. They have innumerable metacognitive experiences and innumerable opportunities to acquire person, task, and strategy metacognitive knowledge.

There are still other interesting questions involving metacognition. What is the particular usefulness and adaptiveness of metacognition? How and why has metacognition evolved? Metacognition is especially useful for a particular kind of organism, one that has the following properties. First, the organism should obviously tend to think a lot; by definition, an abundance of metacognition presupposes an abundance of cognition. Second, the organism's thinking should be fallible and error-prone, and thus in need of careful monitoring and regulation. Third, the organism should want to communicate, explain, and justify its thinking to other organisms as well as to itself; these activities clearly require metacognition. Fourth, in order to survive and prosper, the organism should need to plan ahead and critically evaluate alternative plans. Fifth, if it has to make weighty, carefully considered decisions, the organism will require metacognitive skills. Finally, it should have a need or proclivity for inferring and explaining psychological events in itself and others, a penchant for engaging in those metacognitive acts termed social cognition. Needless to say, human beings are organisms with just these properties.

An important future endeavor is to try to create detailed process models for various aspects of metacognition. Process models will have to address questions such as: How is the information about cognitive processes that is needed to monitor and regulate these processes obtained? What cues are observed? One cue that might be used is the speed of processing, especially the processing of sudden

changes in speed. When you are reading along and suddenly find yourself reading more slowly, the slowdown in processing may function as a cue that the material is getting difficult, or that something is puzzling, etc. Similarly, individuals may become aware that they have just read a sentence for the second time, and that awareness may serve as a metacognitive signal that the material is difficult, or that attention has wandered, etc. There is also the question of how monitoring information gets translated into self-regulatory metacognition.

The final question is: When are we most likely to have metacognitive experiences? First, they are obviously apt to occur whenever the situation explicitly demands or elicits them. For example, someone is asked to justify a conclusion, or defend a claim. Second, metacognitive experiences may be more apt to occur when the cognitive situation is something between completely novel and completely familiar. In this broad range, one knows enough to be puzzled and to formulate questions, but not enough that the processing is wholly automatic and effortlessly accurate. Third, metacognitive experiences are likely to occur in situations where it is important to make correct inferences, judgments, and decisions. If it really matters whether or not one's judgments and decisions are correct, one is apt to monitor them very carefully. Fourth metacognitive antennae are likely to go up whenever one's cognitive enterprise seems to be in any sort of trouble. There is nothing like the sudden awareness of self-contradiction or some other mental cul-de-sac to cause critical analysis of one's own thinking. And finally, one is more likely to have metacognitive experiences (useful ones, at least) when attentional and mnemonic resources are not wholly preempted by more urgent subjective experiences, such as pain, anxiety, or depression.

What will the future bring to the area of metacognition? During the next few years more careful and critical examinations of metacognition and related concepts will probably occur. Undoubtedly, the concept itself will be further refined, clarified, and differentiated. Some methodological advances, better ways to measure and assess metacognitive experiences and knowledge than is presently available, should also develop. Finally, deeper insights into the entire concept are needed. A number of psychologists have the abiding intuition that metacognition is an extremely important topic, eminently worthy of further theoretical and experimental investigation. However, none of us has yet come up with deeply insightful, detailed proposals about what metacognition is, how it operates, and how it develops. Perhaps the future will bring such proposals.

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