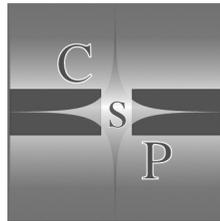


Metacognition and Theory of Mind

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By

Eleonora Papaleontiou-Louca



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**Dedicated to my husband Costas
and my three children
Despina, Kyriaki and Leontios,
for all their love and support.**

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ABSTRACT

Metacognition essentially means cognition about cognition. Flavell (1981) distinguishes between *metacognitive knowledge* and *metacognitive experience* and Ματσαγγούρας (1994) explains that metacognition refers to both people's *awareness* and *control*, not only of their cognitive processes, but of their emotions and motivations as well. A number of strategies are described, which teachers can use to facilitate children's metacognitive development and promote the monitoring and regulation of one's own cognitive enterprises. The educational implication of the application of metacognitive strategies such as self-awareness and self-monitoring is to **develop independent learners who can control their own learning and learn how to learn for life.**

Children's 'Theory of Mind' (ToM) is the "understanding children have of their own and others' minds and of the relation between the mind and the world. This understanding enables children to predict and explain actions by ascribing mental states, such as beliefs, desires and intentions to themselves and to other people" (Astington, 1991). The traditional Piagetian theory of egocentrism underestimates young children's understanding of mental phenomena. However, young children's elementary ability to refer to mental states and their distinction of mental from real entities, suggests that young children may have more conceptual understanding of mental phenomena than was previously recognized. This review attempts to facilitate our understanding of how young children think and how they behave on the basis of this thinking.

The **link** between '*Metacognition*' and '*Theory of Mind*' is that the former deals mainly with task-related mental processes, such as strategies improving cognitive performance, giving emphasis on knowledge about *one's own* mental states in elementary school children and young adolescents, while the latter refers to the basic knowledge about mental states such as desires, thoughts, beliefs, with emphasis in the understanding of mental states of *other people*, predominantly of preschoolers' (Flavell, 2000).

PREFACE

This is a very timely volume. Over the past two or three decades there has been a huge explosion of research concerned with young children's early understandings about their own and others' mental processing. However, as often happens in psychological research, this area has been dissected into a number of constituent parts and the research into each of these parts has then proceeded largely in isolation from the rest. So, in this area, the study of 'metacognition' and of 'theory of mind' have proceeded almost entirely separately, with their own literatures and separate teams of researchers, until very recently. Just in the last few years, a number of theorists have begun the important work of pulling these disparate fields together, and Eleonora Papaleontiou-Louca has made a very valuable contribution to this effort in the present book. As she very ably demonstrates, our perspectives on the early development of metacognitive and ToM processes and understandings in the young child, and of their general cognitive development, are enormously enhanced by combining the insights gained from these two complementary areas of research.

In addition, the book has a number of particular strengths, all of which make it a particular pleasure to be asked to write its preface. First, there is a strong emphasis through the book on the educational relevance of the research and theory reviewed and discussed. Much research, particularly in the metacognitive literature, has been located in the educational arena, and its importance is, of course, enormously enhanced by the evidence of the overwhelming significance of metacognitive abilities for educational outcomes. Papaleontiou-Louca has a strong background herself in education and this shines through the present volume, with a particularly exciting section concerned with teaching strategies to enhance children's metacognition. The fundamental significance of ToM for the development of children's social cognition is, of course, well established.

Second, the book is written very clearly within the socio-cultural tradition, starting with a reminder of the significance of Vygotsky's insights into the development of self-regulation, and continuing this theme through in the importance given within the book to the role of language in the emergence of both metacognitive and ToM processes. This is an important theoretical

issue, but also has clear messages for those involved in the education of young children. In a further separate literature, the role of dialogic teaching and ‘exploratory talk’ in classrooms in developing children’s abilities as learners is now well established, and is an important applied area which resonates so clearly with the approach to the more psychological literatures addressed here. Encouraging and supporting the teachers of our young children to engage in more ‘mental state’ and metacognitive talk, and to develop pedagogical approaches which also afford opportunities for the children to do likewise, is an important agenda item for education, from the early years through to university level study, in the 21st century.

Finally, in grappling with the theoretical and empirical links between metacognition and ToM, Papaleontiou-Louca re-engages with the underlying mental processes which make up the various elements of these general abilities. In particular, she reminds us of the various elements of the metacognitive system, including monitoring and control, or metacognitive experience, as well as metacognitive knowledge. As regards ToM, she reminds us that this is so much more than false belief, which has become a rather over-dominant marker in this literature. Sections dealing with children’s developing introspective abilities, their use of mental state language, their understanding of intentions and a range of other mental phenomena, all make a strong contribution to a much more rounded understanding of children’s developing understandings about their own and others’ mental worlds.

Binding this all together, and perhaps here we have the most important theoretical contribution of the book, is the pivotal notion of ‘meta-representation’. This seems to me to be a crucial and underpinning process in this whole area which links so powerfully with Nelson and Narens’ (1990) notion, in their model of metacognitive processing, of the ‘meta’ level of processing constructing a model of the ‘object’ level. When we are looking to select characteristics of the human brain which set it apart from those of other species, as is noted briefly in the book when reviewing work concerned with ToM in other primates, our ability for mental representation comes high on the list. Research related to metacognition and ToM combines very powerfully, it seems to me, to suggest that the ability to construct mental representations of our own mental processing is pre-eminently a unique human characteristic, and one that continues to evolve and increase in importance as the human species struggles to adapt to the demands of the vastly changed environment in which we must now

all live together. Being English, I would not wish to be too immodest or apocalyptic in my claims, but I do think that the present volume makes an important contribution to what is potentially an educationally very significant area for development, and certainly one which is of considerable current interest. I hope it is widely read.

David Whitebread
University of Cambridge, UK, March 08

Reference

Nelson, T.O & Narens, L. (1990). Metamemory: a theoretical framework and new findings. In G. Bower (ed.) *The psychology of learning and motivation: advances in research and theory, vol 26*. New York: Academic Press.

INTRODUCTION

The present work deals with two major issues of Developmental Psychology, namely ‘Metacognition’, and ‘Theory of Mind’ as well as the relation between the two.

‘Metacognition’ essentially means cognition about cognition; that is, it refers to second order cognitions: thoughts about thoughts, knowledge about knowledge or reflections about actions. Gradually, the definition of metacognition has been broadened and includes, not only “thoughts about thoughts” and cognitive states as it was before considered, but also affective states, motives, intentions and the ability to consciously and deliberately monitor and regulate one’s knowledge, processes, cognitive and affective states, motives and intentions.

During the last 40 years metacognition has become one of the major fields of cognitive developmental research. Research activity in metacognition began with John Flavell, who is considered to be the “father of the field” and thereafter a considerable amount of empirical and theoretical research dealing with metacognition can be registered.

‘Theory of Mind’ development, the second major issue of this work, is the area of cognitive development research that investigates the nature and development of our understanding of the mental world. Since its beginnings, about 25 years ago, this area has grown to be one of the largest and liveliest in developmental psychology.

The term ‘theory of mind’ was introduced by David Premack (Premack and Woodruff, 1978) to refer to our ability to explain, predict and interpret behavior in terms of mental states, such as *wanting*, *believing*, *thinking* and *predicting*. This ability, evident even in young children seems to have an adaptive for our species purpose, not only to develop some sensitivity for these properties, but also to facilitate human’s social behavior and social understanding on the basis of the interpretation and prediction of people’s mental states.

Traditionally, these two basic areas of Cognitive Developmental Psychology remained *relatively unrelated*, in spite of their common interest, that is, *the study of people’s inner states*. Consequently, they used different methods, they gave different emphasis on the content of their study and they worked

with different age populations.

However, which are the similarities, the differences and any possible convergences of these two areas? These issues, together with an in-depth analysis of the two basic notions of 'Metacognition' and 'Theory of Mind' is the aim of this booklet; the ultimate purpose of it, is not only to clarify the concepts and give an integrated review of the literature, but also to facilitate any research efforts by linking the two areas and making the study of both more coherent.

The author

CHAPTER ONE

METACOGNITION: A THEORETICAL FRAMEWORK¹

Psychology in general and developmental psychology in particular, are presently awash in a “meta” flood (metacognition, metamemory, metaperception, metalanguage, and so on). It seems that these constructs reflect a relatively new, stimulating and very attractive research perspective as suggested by a number of review articles (Brown, 1987; Cavanaugh & Perlmutter, 1982; Schneider, 1985; Wellman, 1983; Κουτσελίνη, 1995; Flavell 1999; Hacker & Bol, 2004).

During the last 40 years metacognition has become one of the major fields of cognitive developmental research. Research activity in metacognition began with John Flavell, who is considered to be the “father of the field” and thereafter a considerable amount of empirical and theoretical research dealing with metacognition can be registered.

Moreover, a number of strategies aiming to enhance children’s metacognitive abilities have been suggested, which teachers through all educational levels can apply in their instruction. Such strategies are set out in the relevant section dealing with the development of Metacognition in practice (see p.16) and contribute to both the promotion of critical thinking in education and staff development.

The concept of metacognition

Metacognition is a concept that has been used to refer to a variety of epistemological processes. “Metacognition” essentially means cognition

¹ Part of this Monograph, i.e. chapters 1, 3 & 4 are published in: Louca-Papaleontiou, E. (2003) "The Concept and Development of Metacognition" in *Teacher Development: an International Journal of Teachers' Professional Development*, 7.1., July-August 2003. We express our sincere thanks for the permission of reprinting it here.

about cognition; that is, it refers to second order cognitions: thoughts about thoughts, knowledge about knowledge or reflections about actions. So if cognition involves perceiving, understanding, remembering, and so forth, then metacognition involves thinking about one's own perceiving, understanding, remembering, etc. These various cognitions about cognitions can be labelled “metaperception”, “metacomprehension” and “metamemory” with “metacognition” remaining the superordinate term.

Flavell (1978) referred to it as “knowledge” that takes as its object or regulates any aspect of any cognitive endeavor”. Moore (1982) defines it as “an individual’s knowledge about various aspects of thinking” and it has also been described as “the abilities of individuals to adjust their cognitive activity in order to promote more effective comprehension” (Gavelek and Raphael, 1985 pp. 22-23).

In a more recent review Flavell (2000) divides metacognitive theory into two areas of study: knowledge and processes. Metacognitive knowledge includes understanding of how minds work in general and how your own mind works in particular. The processes of planning, monitoring, and regulating thoughts are generally known as *executive processes*, which involve the interaction of two levels: At one level is the creative, associative, wandering mind and above it is the executive, trying to keep it on task.

Gradually, the concept has been broadened to include anything psychological, rather than just anything cognitive. For instance, if one has knowledge or cognition about one's own emotions or motives concerning a cognitive enterprise (e.g. being aware of his anxiety while solving a problem in an exam paper), this can be considered metacognitive. In fact, the recent literature completes the term, by adding to its cognitive domain, the emotional one - referring to the emotions *that accompany the cognitive processes* and the person's ability to monitor them, as well as the domain of cognitive habits (Ματσαγγούρας, 1994). Similarly, Flavell (1979), when trying to define the concept of metacognition, refers to all those conscious *cognitive or affective experiences that accompany and pertain to an intellectual enterprise*.

Moreover, a definition of ‘metacognition’ according to Paris and Winograd (1990, p.17) “captures two essential features...:self-appraisal and self-management of cognition. Self-appraisals are people’s personal reflections about their own knowledge states and abilities, and their affective states concerning their knowledge, abilities, motivation, and

characteristics as learners. Such reflections answer questions about “what you know, how you think, and when and why to apply knowledge strategies”. Self-management refers to “metacognition in action”, that is, mental processes that help to “orchestrate aspects of problem solving” including “the plans that learners make before tackling a task”, “the adjustments they make as they work”, and “the revisions they make afterwards” (p.18). It is important to note, here, that “theoreticians seem unanimous – the most effective learners are self - regulating” (Butler & Winne, 1995, p.245). Key to effective self-regulation is accurate self-assessment of what is known or not known (Schoenfeld, 1987). Only when students know the state of their own knowledge can they effectively self-direct learning to the unknown.

Shortly, the definition of metacognition has been broadened and includes, not only “thoughts about thoughts” as it was before considered, but the following notions as well: knowledge of one’s knowledge, processes, and cognitive and affective states; and the ability to consciously and deliberately monitor and regulate one’s knowledge, processes, and cognitive and affective states.

Although metacognition may have sometimes indistinct boundaries, key distinctions can be made and a scheme offered that will be useful for organizing and assessing the experimental literature.

First, we can distinguish between knowledge and skills - between “knowing that” and “knowing how”, the old distinction between theory and practice, between competence and performance. One may “know that” s/he should distinguish relevant from irrelevant information in a problem, and another has the ability to do this in practice, perceiving what is relevant in a “noisy” environment. Similarly, one may know that different strategies can be applied in different problems, and another has the ability to select the suitable strategy, when needed, to resolve a problem.

Ann Brown (1987) distinguishes between knowledge about cognition, and regulation of cognition. *Knowledge* about cognition can be “stable, stable but fallible or late developing” (p.67) information that human thinkers have about their own cognitive processes, which usually remains relatively consistent within individuals. *Regulation*, on the other hand, can be “relatively unstable, rarely stable, and age independent”; ... (p.68). Regulation of cognition refers to the activities used to regulate and oversee learning. One may show self-regulatory behavior in one situation but not another, and a child may show self-regulatory behavior where an adult

does not. Regulation may be also affected by patterns of arousal (anxiety, fear, interest) and self-concept (self-esteem, self-efficacy).

These processes include planning activities (predicting outcomes, scheduling strategies and various forms of vicarious trial and error, etc.) prior to undertaking a problem; monitoring activities (monitoring, testing, revising, and re-scheduling one's strategies for learning) during learning; and checking outcomes (evaluating the outcome of any strategic actions against criteria of efficiency and effectiveness) at the end (Brown et al 1983).

Kluwe (1982) brought further definition to the concept of 'metacognition' describing activities referred to as 'metacognitive': (a) the thinking subject has some knowledge about his own thinking and that of other persons; (b) the thinking subject may monitor and regulate the course of his own thinking, i.e. may act as the causal agent of his own thinking" (p.202). Moreover, Kluwe uses the term 'executive processes' to denote both monitoring and regulating strategies. Executive *monitoring* processes involve one's decisions that help: (a) to identify the task on which one is currently working, (b) to check on current progress of that work, (c) to evaluate that progress, and (d) to predict what the outcome of that progress will be. Executive *regulation* processes are those that are "directed at the regulation of the course of one's own thinking" (p.212). They involve one's decisions that help (a) to allocate his or her resources to the current task, (b) to determine the order steps to be taken to complete the task, and (c) to set the intensity or (d) the speed at which one should work the task (Hacker, D.J., 1997).

Flavell (1981) makes a second important distinction between metacognitive experiences and metacognitive knowledge. "Metacognitive experiences" are conscious feelings during some cognitive activity that relate to the process - for example, during a communication task, feeling that you do or do not understand; or feeling hesitant about the choice you have made. "Metacognitive knowledge" on the other hand, is described by Flavell (1981, p.40) as "that part of your accumulated world knowledge that has to do with people as cognitive agents and their cognitive tasks, goals, actions and experiences". Some examples of this kind of metacognition are: when you are able to describe your understanding of what goes on, to explain and recognize feelings of uncertainty or confusion in some people, etc.

Briefly, *'metacognition'* refers to all processes about cognition, such as sensing something about one's own thinking, thinking about one's thinking and responding to one's own thinking by monitoring and regulating it.

As for whether the term 'metacognitive' should be used to describe thoughts that were once metacognitive but have since become non-conscious and automatic remains a datable issue. Nevertheless, many researchers adopt a convention that reserves the term 'metacognitive' for conscious and deliberate thoughts that have as their object other thoughts (e.g. Borkowski & Muthukrishna, 1992; Bracewell, 1983; Carr, Alexander, & Folds-Bennett, 1994; Davidson, Deuser & Sternberg, 1994; Paris & Winograd, 1990).

On the other hand, Koriat (2000) proposes that although metacognitive feelings appear to be an integral part of conscious, explicit cognition, they are actually two sided:

They serve to interface between implicit-unconscious-automatic processes on the one hand, and explicit-conscious-controlled processes on the other. Therefore, this double-sided nature of metacognition shades some light on the relationship between two layers of consciousness. (p.152)

Koriat (2000) therefore, distinguishes between two levels of experience, each with its own mode of operation: "The higher level involves an explicit mode of operation, characterized by relatively high degrees of consciousness and control, whereas the lower level involves an implicit mode of operation, characterized by relatively low degrees of consciousness and by automatic influences" (p.153). And as Koriat (2000) continues "it would seem natural to place metacognitive monitoring and control at the heart of the notion of consciousness" (p.151). Therefore, she sees "surprising that some leading experts arrived at the conclusion that metacognitive processes are, in fact, more properly seen as being part of unconscious and implicit functioning" (p.151). (see also Kelley & Jacoby, 1996b; Reder & Schunn, 1996).

It seems that in our cognitive system there are at least two hierarchical levels, with cognitions of the first level serving as the object of cognitions at the second level. However, the existence of a two-level does not necessarily imply conscious awareness (of the first level by the second level). Classical developmental theorists, such as Vygotsky (1934, 1962) and Piaget (1976, 1978) included conscious awareness as a defining attribute of metacognition. In contrast, in an information-processing theory

such as Sternberg (1984, 1985) ‘meta’ components played a major role in the absence of any attribution of conscious awareness (Kuhn, 1999).

Koriat and Levy-Sadot (1999) used the terms noetic judgments (or judgment of knowing) and noetic feelings (or feeling of knowing) to refer to the types of subjective feeling and showed how this distinction applies to the various forms of monitoring one’s own knowledge.

Nelson and Narens (1994) further subdivided the kinds of monitoring judgments we use to into three categories:

1. *Ease-of-learning (EOL) judgments* occur *in advance of acquisition*, are largely inferential, and pertain to items that have not yet been learned. These judgments are predictions about what will be easy/difficult to learn, either in terms of which items will be easiest (Underwood, 1966) or in terms of which strategies will make learning easiest (Seamon & Virostek, 1978).

2. *Judgments of learning (JOL)* occur *during or after acquisition* and are predictions about future test performance on *currently recallable* items. However, we now believe, in contrast to the above, that JOL should be defined as follows: Judgments of learning (JOL) occur *during or soon after acquisition* and are predictions about future test performance on recently studied items.

This newer formulation of JOL, although in some cases yielding overlap with the above formulation of FOK(see below), appears to be more useful (e.g., see Dunlosky & Nelson, 1992; Nelson & Dunlosky, 1991) than the earlier formulation.

3. *Feeling-of knowing (FOK) judgments* occur *during or after acquisition* (e.g., during a retention session) *and* are judgments about whether a given *currently nonmalleable* item is known and/or will be remembered on a subsequent retention test. [Empirical investigations of the accuracy of FOK judgments usually have the subsequent retention test be a recognition test (e.g., Hart, 1965), although several other kinds of retention tests have been used (for reviews, see Nelson, Gerler, & Narens, 1984; Nelson, 1988).]

Perhaps surprisingly, EOL, JOL, and FOK are not themselves highly correlated (Leonesio & Nelson, 1988). Therefore, these three kinds of judgments may be monitoring somewhat different aspects of memory, and whatever structure underlies these monitoring judgments is likely to be multidimensional (speculations about several possible dimensions occur in Krinsky & Nelson, 1985, and Nelson et al., 1984).

It seems that most of our behaviors represent a mixture of influences from both implicit, subconscious activations, and conscious considerations. This mixture is nicely demonstrated by slips of actions that ensue from automatic influences on deliberate behavior, resulting in actions that are not as intended (Reason, 1983).

Before ending this section, we can summarize the notion of 'metacognition' classifying it in the following basic components (Wikipedia, 2008 & Efklides 2002):

(1) *Metacognitive Knowledge* (also called metacognitive awareness) refers to what individuals know about themselves and others as cognitive processors.

(2) *Metacognitive regulation* is the regulation of cognition and learning experiences through a set of activities that help people control their learning.

(3) *Metacognitive skills* refer to conscious control processes such as planning, monitoring of the progress of processing, effort allocation, strategy use and regulation of cognition. (see p.15)

(4) *Metacognitive experiences* are those experiences that have something to do with the current, on-going cognitive endeavor.

CHAPTER TWO

VYGOTSKY AS PRECURSOR TO METACOGNITIVE THEORY

According to Brown (1987), Vygotsky's (1978) influence on metacognitive theory has primarily been effected through his discussion of transference from other-regulation to self-regulation. Basic to Vygotsky's approach is the assumption that social interaction plays a major role in the origin and development of higher mental (e.g., metacognitive) functions. These functions appear first on the interpsychological (i.e. social) plane and only later on the intrapsychological (i.e. individual) plane. Vygotsky (1978) states:

Every function in the child's cultural development appears twice: first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of ideas. All the higher functions originate as actual relationships between individuals (p.57).

This means, that a great deal of learning occurs in the presence of, and is fostered by, the activity of others. So many cognitive acts are initially experienced in social settings, but in time, the results of such experiences become internalised. Initially, supportive others, such as parents, teachers, peers, and so on, act as interrogators, leading the child to more powerful rules and generalisations and guiding the novice to mastery; and there seems to be a systematic regularity in how this guidance works. The interrogative, regulatory role, however, becomes internalised during the process of development and children become able to fulfil some of these functions for themselves through self-regulation and self-interrogation. To put it plainly, this process of internalisation goes like this:

... first the adult (parent, teacher, etc.) controls and guides the child's activity, but gradually the adult and the child come to share the problem-solving functions, with the child taking initiative and the adult correcting and guiding when s/he falters. Finally, the adult cedes control to the child

and functions primarily as a supportive and sympathetic audience (Brown and French 1979, cited in Brown et al 1983, p. 122).

An important concept in relation to this is the notion of scaffolding, defined by Bruner, which has come to be used for interactional support, often in the form of adult-child dialogue that is structured by the adult to maximize the growth of the child's intrapsychological functioning (Clay and Cazden, 1990). In other words, 'scaffolding' refers to the gradual withdrawal of adult control and support as a function of children's increasing mastery of a given task.

Another aspect of Vygotsky's theory is the idea that the potential for cognitive development is limited to a certain time span which he calls the **"zone of proximal development"**. ZPD refers to the gap between what a given child can achieve alone, their 'potential development as determined by independent problem solving', and what they can achieve 'through problem solving under adult guidance or in collaboration with more capable peers' (Wood, D. & Wood, H., 1966).

In time, children become mature thinkers who provide conflict trials for themselves, question their own basic assumptions, provide counterexamples to their own rules etc. In short, although a great deal of thinking and leading may remain a social activity, through the process of internalization children become capable of providing the supportive other role for themselves. In this way, progressively, children learn not only how to get a particular task done independently, but also how to set about learning new problems. In other words, **children learn how to learn**².

It is important however to note here, that **'metacognition' is not equated with 'learning' or 'development', but the conscious and deliberate regulation of that 'learning' and 'development'**.

Moreover, Vygotsky's theory of language plays an important role in thinking, mediating and directing the individual's cognitive endeavors. Together with this mediating role of language, Vygotsky's emphasis on social interactions stresses the sociocultural basis of self-regulation and leads to the fourth metacognitive issue discussed by Brown (1987); "the transference from other-regulation to self-regulation".

² 'Learning to learn', of course, is not content free, neither it refers to all learning, but it is specific to certain contents.

As to the question of how the individual eventually reaches reflective awareness (knowledge about cognition) and deliberate control of his own cognition (regulation of cognition), Vygotsky's theory (1986) focuses our attention on verbalized self-observation (introspection). This implies that the child perceives his/her own cognitive processes as meaningful. This view, of a close connection between knowledge about cognition and control of cognition is made clearer in his study "Mind in Society" (1978).

What is apparent, however, is that many topics discussed in contemporary metacognitive research are integral parts of Vygotsky's (1978, 1986) theory of cognitive development; undoubtedly he pioneered an approach to metacognition that cannot be easily disputed.

CHAPTER THREE

MODELS OF METACOGNITION

Flavell's Classical Model

According to Flavell (1979), the monitoring of a wide variety of cognitive enterprises occurs through the actions and interactions among four classes of phenomena (See Appendix Fig.1):

- a) metacognitive knowledge
- b) metacognitive experiences
- c) goals (or tasks) and
- d) actions (or strategies)

The first two have already been mentioned earlier, but will be analyzed in detail below. As for the last two, Flavell states that goals (or tasks) refer to the objectives of a cognitive enterprise, while actions (or strategies) refer to the cognitions or other behaviors employed to achieve them.

Let us now turn our attention to the analysis of metacognitive knowledge and metacognitive experience, as this had been proposed by their introducer, Flavell:

Metacognitive Knowledge

This refers to the segment of acquired world knowledge that has to do with cognitive matters. It is the knowledge or beliefs accumulated through experience and stored in long-term memory that concern the human mind and its doings. Some of this stored knowledge is declarative ('knowing that') and other procedural ('knowing how'). For example, your declarative knowledge is knowing how and when to supplement your poor memory by the use of shopping lists and other external memory aids (Chi, 1984). One's knowledge of any given metacognitive item, could, of course, be both declarative and procedural. For example, one might both know as a verbalizable fact that writing a shopping list is a good memory strategy and also 'know to' write them on appropriate occasions.

As already made clear, metacognitive knowledge consists primarily of knowledge or beliefs about what factors or variables act and interact to affect the course and outcome of cognitive enterprises. These factors or variables fall into three major categories: person, task and strategy.

The **person category** encompasses everything that you might believe about the nature of yourself and other people as cognitive processors. It can be further categorized into beliefs about intraindividual differences, interindividual differences, and universals of cognition. An example of the first subcategory would be one's belief that one person remembers more easily than another; of the second, a belief that one can learn most things better by listening than by reading; of the third subcategory the ascertainment that we usually forget many of the things we have learned as time passes.

The second category 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. 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.

Strategy variables are about what strategies are likely to be effective in achieving what goals in what sorts of cognitive undertakings. A child may come to believe, for example, that one good way to learn and retain information, is to pay particular attention to the main points and try to repeat them to him/herself in his/her own words.

Finally, most metacognitive knowledge actually concerns interactions or combinations among two or three of these three types of variables. To illustrate a combination involving all three, one might believe that a pupil (unlike his/her brother - person variable) should use strategy A (rather than strategy B, - strategy variable) in task X (as contrasted with task Y - task variable) (Flavell, 1979; 1987).

Metacognitive knowledge can have a number of concrete and important effects on the cognitive enterprises of children and adults. It can lead somebody to select, evaluate, revise and abandon cognitive tasks, goals, and strategies. Furthermore, it can lead to any of a wide variety of metacognitive experiences and help us interpret the meaning and behavioral implications of these metacognitive experiences.

Metacognitive Experiences

The other major conceptual entity in the taxonomy is metacognitive experiences. Metacognitive experiences can be fully or less fully conscious and verbalizable, brief or lengthy, simple or complex in context. What makes them metacognitive experiences rather than experiences of another kind is that they have to do with some cognitive (and often affective) endeavour or enterprise, most frequently a current, ongoing one. For example, if one suddenly has the anxious feeling that s/he does not understand something and wants and needs to understand it, that feeling would be a metacognitive experience.

One is having a metacognitive experience whenever s/he has the feeling that something is hard to perceive, comprehend, remember or solve; if there is a feeling that s/he is far from the cognitive goal. Metacognitive experiences are especially likely to occur in situations that stimulate a lot of careful, highly conscious thinking, and provide many opportunities for thoughts and feelings about your own thinking to arise. They may also occur at any time before, during or after a cognitive endeavor; may be more apt to occur when the cognitive situation is something between completely novel and completely familiar; and when attentional and mnemonic resources are not wholly preempted by more urgent subjective experiences, such as pain, anxiety, or depression. Thus, a metacognitive experience can be any kind of *affective or cognitive* conscious experience that is pertinent to conduct in an ongoing cognitive situation or enterprise. (Flavell, 1979, 1987).

Metacognitive experiences can have very important effects on cognitive goals or tasks, metacognitive knowledge and cognitive actions or strategies. First, they can lead somebody to establish new goals or revise old ones. Experiences of puzzlement or failure, for example, can have any of these effects.

Second, metacognitive experiences can affect one's metacognitive knowledge store by adding to it, deleting from it, or revising it, as in Piaget's model of assimilation and accommodation.

Finally, metacognitive experiences can activate strategies aimed at either cognitive or metacognitive goals. As an example of the former, one senses (metacognitive experience) that s/he does not yet know a certain chapter in a text well enough to pass tomorrow's exam, so s/he reads it through once more (the cognitive goal here, to improve his/her knowledge). As an

example of the latter, one wonders (metacognitive experience) whether s/he understands the chapter well enough to pass tomorrow's exam, so s/he tries to find out by asking oneself questions about it and noting how well s/he is able to answer them (the metacognitive goal, here, is to assess one's own knowledge).

Adding to the concept of 'metacognition', Efklides (2002) introduces another aspect of it, one that serves the control of cognition, namely, **metacognitive skills**. Since the components of metacognition serve the monitoring rather than the control of cognition (Brown, 1978), one could refer to this new aspect of metacognition, as one that serves the control of cognition. Metacognitive skills refer to conscious control processes such as planning, monitoring of the progress of processing, effort allocation, strategy use and regulation of cognition.

Before ending up with this model it must be noted that metacognitive knowledge, metacognitive experiences and metacognitive skills form partially overlapping sets. Some experiences have such knowledge as their content and some do not. Some knowledge may become conscious and comprise such experiences and some may never do so.

Moreover, metacognitive knowledge, metacognitive experience and metacognitive skills complement and enrich each other. For example, not only does some kind of metacognitive knowledge seem to be needed for one to interpret properly and act upon metacognitive experience, but conversely, metacognitive experience also contributes in adding information about persons, tasks, and strategies to one's developing store of metacognitive knowledge: The ideas and feelings one experiences while watching or playing, say, tennis, might contribute to the knowledge of tennis.

To put it simply, it seems likely that metacognitive knowledge, metacognitive experience and metacognitive skills, are constantly informing and eliciting one another during the course of a cognitive task.

An Alternative Model of Metacognition

Nelson and Narens' (1990) suggest an alternative model of Metacognition and the 'control' - 'monitoring' processes. In this model there are two critical features: The first is the splitting of cognitive processes into two or more specifically interrelated levels. This model (see Figure 2. in the Appendix) shows a simple metacognitive system containing two interrelated

levels that Nelson and Narens' (1990) call the "meta-level" and the "object-level." The second critical feature of a metacognitive system is also a kind of dominance relation, defined in terms of the direction of the flow of information. This flow - analogous to a telephone handset - gives rise to a distinction between what they call "control" (cf. Miller et al., 1960 in Nelson and Narens' 2000) versus "monitoring" (cf. Hart 1965 in Nelson and Narens' 2000).

This model is based on the idea that a meta-level contains a model of the object-level, these two abstract features, splitting into two interrelated levels (meta-level versus object-level) and two kinds of dominance relations (control versus monitoring), comprise the core of metacognition as use the term.