Language Acquisition and Cognition

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ABSTRACT
Cognitive revolution paved the way for new ways of thinking about human psychology and the mind. The relationship between language and cognition and the effect each has on the development of the other one has been one of the most controversial issues in the field of linguistics and psychology. Different theoretical perspectives like Artificial Intelligence, Connectionism, Modularity and Cognitive Neuroscience Movement have given us different views in this regard. This paper presents an overview of this relationship and different approaches to understanding it. It discusses the views of Piaget and Vygotsky and also reviews some theoretical perspectives on language-cognition relationship.

Keywords: Cognitive Development, Connectionism, Cognitive linguistics, Cognitive neuropsychology.

INTRODUCTION
Language acquisition does not occur in vacuum. A child acquires a sign system closely related to cognitive factors and social aspects in the process of language acquisition (Hickmann, 1986). However, As Campbell (1986) points out, exploring the relationship between language acquisition and cognitive development is to enter a very dark forest and the best advice that one can offer to a person who wants to do research about this is ‘Danger, keep off.’ It may result from its incoherent theoretical framework and failure to allocate a distinct role to consciousness.

Developing a powerful theory of cognition to comprise all human mental abilities including language abilities is the goal of modern cognitive science. Harris (2002) considers two ways of conceptualizing human cognition developed out of different philosophical traditions. The first way referred to as 'general-purposed' cognition proposes that general processes can explain all varieties of human intelligence. The tradition of artificial intelligence emphasized general-purpose problem solving abilities. According to the second approach, referred to as the 'modularity of cognition' or 'mental modules' approach, many different domains of cognition exist and must be learned separately through different mental mechanisms. The tradition of linguistics and philosophy led to an emphasis on distinct mental modules.

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COGNITIVE DEVELOPMENT

Three aspects of development are language, thought and social interaction. How they will be defined, analyzed or related internally depends on what developmental approach is taken social or cognitive. Here two developmental theories, Piaget's and Vygotsky's, are considered in order to scrutinize language acquisition either as intrinsically tied to its social-interactive context of use or as relatively autonomous from it.

For both Piaget and Vygotsky, a gradually complex organization of means and ends in sensorimotor activity characterizes child early development; however, Vygotskian research does not provide very rich details about the sensorimotor period as Piagetian research does.

The internalization of the means-ends organization of Sensorimotor activity achieved in early development results in cognitive development. Cognitive development is in principle both autonomous from language development (i.e. autonomy) and causally prior to it (causal priority). In Piagetian paradigm language development is peripheral and the principles of cognitive development are autonomous and use of language by child is one among many behaviors and uses of linguistic signs are ones among many sign uses; therefore, it does not play a central role for cognitive development. So language may be necessary at higher stage (formal operation) but neither necessary nor sufficient at the earlier stages (pre-operational, concrete operational). In fact language plays a secondary role in cognitive development. What develops cognition is the processes of adaptation, i.e. accommodation and assimilation, which are independent from language. The child adjusts reality to his cognitive organization and vice versa in order to interact with his surrounding environment. Consequently, he gradually decenters his cognitive structures and makes abstract reasoning. With the development of this decentering capacity, linguistic behaviors change. That is, child's language development is explained as one of the many symptoms of cognitive structure.

In Vygotskian paradigm, language development is the principal motor of development since it connects the intellectual and social life. Thus the principles of cognitive development are not independent from the linguistic signs which the child confronts in his interaction with the world. The uses of language are necessary for cognitive development. For Vygotsky language development is at the heart of the social line of development which interacts with the natural line of development. According to this view, the uses of sign systems, particularly language, result in new forms of development, i.e. semiotic principle. Thought is mediated by inner speech. Fundamental to understanding Vygotsky's theories and/or constructs is the understanding that Vygotsky viewed language as the force that drives cognitive development because language mediates the child's participation in his intellectual and social environment.

For Piaget role of social interaction is secondary while within Vygotskian paradigm cognitive development cannot be understood independently from social-interactive processes. Vygotsky claims that all higher mental interactions appear twice in ontogenetic development: they first appear as social or inter-psychological functions, and only later do they become individual or intra-psychological functions, through the internalization of social-interactive processes.

Within the Piagetian paradigm, the child interacts with social and inanimate object in various situations. Verbal and non-verbal responses are elicited. Then based on evaluation of child's reasoning and its consistencies and inconsistencies, inferences about cognitive structures are made. In this process social interaction can be a tool without any significant effect on the nature of inferences.

In contrast, Vygotsky proposed two types of problem-solving behaviors: inter-psychological (the behaviors when they solve a problem in social interactions) and intra-psychological (the behaviors when they solve a problem on their own). The relation between these two types of behavior is 'zone of proximal development'. Vygotsky often
wrote of “compensatory strategies” whereby the objective of intervention was enhancing the “mightiness of the mind”. These strategies include: abstract reasoning, logical memory, problem solving and goal directed behaviours.

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Campbell (1986) considers two clear positions in order to answer the question he poses: What is cognitive development and how should it be studied? In mainstream American psychology, cognitive structures and processes are identified with information structures and processes, which mediate the connection of output from sensory mechanisms with inputs to motor mechanisms. In the genetic epistemology of Jean Piaget, cognitive structures and processes are identified with representations tied in an intimate way to explicit knowledge and awareness, i.e. only certain functions in certain organisms involve cognitive process.

Is our knowledge about the rules of language explicit? To answer this question we can consider several possibilities:

1) The rules of language are presented in the mind of the speaker directly ,but they are inaccessible to consciousness. That is what Chomsky means by tacit knowledge, i.e. the rules are not known but just observed.
2) It is not necessary to know anything about the rules, tacit or not. They have to be there.
3) We know something about the rules of language and exercise this knowledge on some occasions.

According to Campbell, language user exploits two kinds of knowledge, explicit and tacit. Campbell describes two modes in which they function. Where action is governed by explicit knowledge, the organism functions in a phenic (evident) mode, i.e. action is regulated by structures and processes accessible to consciousness. Where action is governed by tacit knowledge, the organism functions in a cryptic (hidden) mode, i.e. action is regulated by structures and processes inaccessible to consciousness.

Some scholars such as Dennett or Brentano have described the intentional system as well. Intentional acts are mental acts that involve computations in a representational system. But many of our cryptic acts are intentional because they involve computations in a tacit system of representations. According to Chomsky, such acts involve cognizing.

But what criteria determine the attribution of explicit knowledge? How can we know that we are dealing with a phenic process or structure? In the information-processing paradigm, explicit knowledge is regarded as epiphenomenal (by-product) so this question is not fundamental while for Piagetians a way should be found to decide when to attribute explicit knowledge and what knowledge to attribute. However there is a general theory to determine criteria for explicitness. Due to this fact, no formal distinction can be made between cryptic and phenic routines and normally functions carried out by phenic processes are observed as cryptic routines. This confusion has had some destructive consequences:

1) Cognitive psychology is almost exclusively concerned with cryptic processes.
2) Our understanding of the (phenic) functions of cryptic processes is illusory.
3) Massive data in this regard is called valid work of older traditions in question.

Rational processes at the heart of communication are at least potentially phenic, while the grammatical processes at the heart of language are normally cryptic- grammar is an underground process.(Seuen, 1987)
THE ROLE OF LANGUAGE IN COGNITIVE DEVELOPMENT

Language seems to be related to the development of autobiographical memory. The development of language is obviously dependent on long-term memory, because it requires the storage and retrieval of information about word meanings (as well as knowledge of grammatical structure, linguistic conventions, etc). The development of language in turn enables us to share our experiences with other people (Nelson, 1996). Given that we appear to be social beings innately preprogrammed to form attachments with others, communicate, and learn from and about others through interaction, the development of language gives memory more purpose. We can trade memories with others and use the trading of experiences to form relationships. The formation of relationships can then contribute to our cognitive development as other people can tell us things that add to our knowledge base. Language development helps memory development because it increases the motivation to form memories and be able to recall them.

Does language itself play a role in cognitive development? Clark (2004) answers this question considering three possibilities:

a) Words may be regarded as invitations to form categories. They direct young children’s attention. It then can influence how children organize and consolidate what they know about particular kinds and relations.

b) Language can influence cognitive development through its availability as a representational resource. Having a word for a relation, action or object can draw attention to similarities between cognitive categories across domain. That is, language might enable analogies that allow for greater complexity of thought.

c) Language offers children a way to make explicit different perspectives on the same event. Very young children recognize and make use of alternate perspectives on object and on events. They may identify the same referent in a variety of ways depending on their perspective.

According to Piaget, children partake in egocentric speech, utterances neither directed to others nor expressed in ways that the listeners might understand. Egocentric speech played a little role in cognitive development. Speech tended to become more social as the child matures—less egocentric. According to Vygotsky, thought and language eventually emerge. A child’s nonsocial utterances, which he termed private speech, illustrate the transition from paralinguistic to verbal reasoning. Private speech plays a major role in cognitive development by serving as a cognitive self-guidance system, allowing children to become more organized and good problem solvers. As individuals develop, private speech becomes inner speech.

It seems that recent studies support Piagetian paradigm more. Regarding contemporary research, children rely heavily on private speech when facing difficult problems; there is a correlation between “self-talk” and competence, and private speech does eventually become inner speech and facilitates cognitive development.

THE ROLE OF COGNITION IN LANGUAGE DEVELOPMENT

The importance of cognitive prerequisite for language development has been approved by some researchers. Carroll (2008) considers two types of cognitive processes that may assist or guide language development. Slobin’s operating principles (Slobin, 1973,1985) as preferred ways of taking in (operating on) linguistic information have proven useful in explaining certain patterns in early child grammar. For instance, children in all languages use fixed orders to create meanings; this early tendency is related to
Principle C according to which children pay attention to the order of words and morphemes. Several of the principles are also useful in understanding children's acquisition of complex sentences. For example, children simply place the negative or question marker at the front of a simple declarative sentence when they try to form negatives or questions to avoid breaking up linguistic units (Principle D: Avoid interruption or rearrangement of linguistic units). These operating principles are first approximations to the kind of cognitive prerequisite a child must have to benefit from linguistic experience. The general prediction that the cognitive position makes is that children with a given cognitive prerequisite should acquire corresponding aspects of language more rapidly than those without the prerequisite.

Another type of cognitive processes that can assist language development is Piaget’s sensorimotor schemata as ways of organizing the world that emerge in the first two years of life and include banging, sucking, and throwing. Studies of Sensorimotor schemata suggest that cognitive processes do not emerge prior to language but rather simultaneously with language. According to piaget the first 2 years is the sensorimotor period of development because the schemata the child uses to organize experience are directly related to taking in sensory information and acting on it. The end of the Sensorimotor period is the time of the acquisition of object permanence, i.e. object continue to exist even when they cannot be perceived. Developments of this magnitude are related to child's language acquisition. In fact, we can make 2 predictions about child language. First, the very young infant who has not yet acquired object permanence should use words that refer to concrete object in the immediate environment. Second, infants who have mastered object permanence should begin to use words that refer to objects or events that are not immediately present (more in more milk). The idea behind this prediction is to use the metaphor of a waiting room (Johnston & Slobin, 1979), a room with 2 doors. Entry door is considered as achievement of the cognitive prerequisite. Exit door is the same as non-cognitive factors such as the amount of exposure to the linguistic item. The length of time child stays in this waiting room (the time between the cognitive achievement and the corresponding linguistic achievement) depends on some factors. However, Gopnik (2001) believes that it is simultaneous; words are acquired with a very short cognitive-linguistic lag or none at all depending how salient they are for the child.

To sum up, there are specific relations between cognition and language. But the notion that cognition predates language by a significant period of time is not well supported. Rather, most studies suggest that in several areas specific language and cognitive achievements occur with very short time lag or nearly simultaneously. In fact, children do not stay in the waiting room for so long. According to Gopnik (2001), “these children choose the concepts that are at the frontiers of their cognitive developments.”

Cognitive Constraints play a role in children’s vocabulary acquisition as well. Children are constrained to consider only some of the possible meaning of a given word or at least to give priority to them over others (Markman, 1989). There are several possible cognitive constraints. One is Whole object bias: when children encounter a new label, they prefer to attach the label to the entire object rather than to part of the object. The other one is taxonomic bias: children assume that the object label is a taxonomic category rather than a name for an individual dog. A third constraint is called mutual exclusivity bias: Children who know the name of an object will generally reject applying a 2nd name for that object. Children have some clear biases or preferences in learning new words. So they use these constraints to guide their lexical acquisitions, as if the biases are working assumptions. That is, they continue to use the biases until there is evidence to the contrary.
THEORETICAL PERSPECTIVES ON THE LANGUAGE-COGNITION RELATIONSHIP

In the 1970s and 1980s, most of linguists have emphasized the specialness of language and cognition while psycholinguists tried to demonstrate commonalities between language and cognition. In this section some theoretical perspectives including connectionism, cognitive linguistics and cognitive neuroscience movement will be presented.

Piaget emphasized the commonalities between language and cognition, and proposed language emerge out of the same broad cognitive changes that transform the sensorimotor processing of infants into the formal and logical mind of adults. His work inspired psychologists drawn to the information processing movement and the artificial intelligence models of language which emphasized general-purpose learning and was opposed to the innateness theory of Chomsky; due to the poverty of the stimulus, Chomsky believed that children could not learn by using general-purpose problem solving. A rich set of language-specific abilities did not share commonalities with other aspects of cognition.

In the mid 1980s the connectionist theories propose that language is something that is learned as a result of interaction with the social environment. Proponents of this approach claim that no innate knowledge is necessary for language acquisition, and that no domain-specific learning processes are required.

Rumelhart and other cognitive scientists declared that mental functioning involves computation, but asked what type of computation would be carried out by an organic structure like the brain, composed of massive numbers of simple processing units, linked together in a complex network. According to the connectionist approach to modeling cognitive development, intelligent behavior was posited to emerge from large number of neuron-like processing units, connected together into networks in ways that fostered parallel processing. This model supports a common computational architecture underlying both language and cognition.

In the late 1980s the field of cognitive linguistics helped initiate a flood of work connecting language and cognition. Cognitive linguists proposed that aspects of general cognition – such as how we construct the meaning of a grammatical construction- are important for describing linguistic structures. Cognitive linguistics has as its central concern the representation of conceptual structure in language. This field can initially be characterized through a contrast of its conceptual approach with two other familiar approaches: the formal and the psychological. The formal approach focuses on the overt structural patterns exhibited by linguistic forms, largely abstracted away from any associated meaning. The psychological approach regards language from the perspective of general cognitive systems such as perception, memory, attention, and reasoning. The aim of cognitive linguistics is to ascertain the global integrated system of conceptual structuring in language. Further, cognitive linguistics addresses the formal properties of language, accounting for grammatical structure in terms of its representation of conceptual structure. And, distinguishing it from earlier semantics, cognitive linguistics relates its findings to the cognitive structures of the psychological approach. Its long-range trajectory is to integrate the linguistic and the psychological perspectives on cognitive organization in a unified understanding of human conceptual structure.

The confluence of the nineteenth-century mode of neurology and the flow-chart formalism of modern cognitive psychology led to the development of cognitive neuropsychology. The goal of cognitive neuropsychology is to explain complex cognitive abilities, but rejects the tradition of artificial intelligence that one can understand cognition abstractly, without reference to its neural underpinnings. Cognitive neuroscientists attempted to evaluate basic aspects of the language-cognition relationship, such as the autonomy of syntax hypothesis and the innateness and modularity of language
from the neuroscientific point of view. Regarding the plasticity of neural tissue, neurologists argue that the regions of the brain that mediate language use appear to be flexible. Like other aspects of cognition, language acquisition is heavily dependent on experience. From the view of neuropsychology modularity of cognitive functions, including language is highly debatable. Cognitive scientists believe that language has an 'epigenetic' not a 'genetic' origin. Epigenetic development dating back to psychologist Piaget is the proposal that behavior results from a complex dynamic evolution of genes and environmental forces during prenatal and postnatal development. Like other brain regions, the language areas in the adult brain are the end product of complex chains of interactions with internal and external environments. Cognitive neuroscientists emphasize the joint development of language and perceptuomotor processes; they consider language acquisition to be semantically driven and embodied.

**IMPAIREMENTS OF LANGUAGE AND COGNITION**

Studies about children with cognitive or linguistic impairments have also advanced our knowledge of the relationship between language and cognition, specially studies of individuals with Down Syndrome, i.e. having language delays that are proportionate to the severity of their cognitive disability/ significant differences between the level of cognitive functioning and the level of linguistic functioning. Besides, children like Genie express grammatically rudimentary but semantically and conceptually more advanced sentences. The language development in mentally retarded children also provides us with useful insights about the relation between language and cognition. These children produce sentences with complex syntax with relatively rudimentary meaning. For instance, hose children with William syndrome acquire good syntactic skills and linguistic comprehension despite their cognitive impairments. Children with chatterbox Syndrome demonstrate unexpected language abilities and can talk continuously but their low intelligence quotient is considerably problematic for them.

This provides evidence against the thesis that cognition is sufficient for language. That is cognitive development, although it is generally associated with language development may be neither necessary nor sufficient for it. We must look beyond cognitive factors in our efforts to explain the course of language development.

**REFERENCES**


