

How Language Promotes Human Cognition-A Study Based on the Work of Andy Clark on the Extended Mind

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ABSTRACT

This article focuses on the role of language in promoting human cognition. Drawing on the work of Andy Clark, this article deciphers how language promotes human cognition and provides arguments on language's function in cognitive development. Through the arguments expanded from Andy Clark's extended mind theory, this article contributes to the literature on language understood in terms of its role in developing human cognition. Moreover, the paper also critically reviews Andy Clark's extended mind concepts and finds some internally controversial arguments. By comparing Vygotsky's zone of proximal development with extended mind theory, this paper concentrates on the concept of learning capacity to explain cognitive development under the help of language. Based on the comparisons between Andy Clark's extended mind and Vygotsky's zone of proximal development, this article highlighted the following main results: 1) Language can promote cognitive development like mangroves. In other words, the special development of human cognition determines the language broad functions. 2) Then, the extended mind depicts language which prompts human to pursue many more profound understandings on the extended world as a necessary tool of extending human mind. After discussing Andy Clark's work, this article provides suggestions for how to develop language functions as a tool promoting cognitive development.

INTRODUCTION

Andy Clark has a key role in the fields of philosophy of mind and cognitive science ^[1]. After the concept of extended mind was put forward, numerous philosophers came to work in the field, such as Mark Rowlands, Michael Wheeler and etc. Based on what Andy Clark has achieved, it can be concluded that language indeed augments human computation. The idea that language does far more than serve as a vehicle for communication is widely accepted by numerous development lists, such as Vygotsky, Laura Berk and etc. Indeed, we are familiar with the function of language as a vehicle for communication, but this is accompanied by its function as something that transforms pattern-completing brain in order to tackle intractable classes of cognitive problems ^[2]. In addition to Vygotsky and Laura Berk, Peter Carruthers, Ray Jackendoff and Daniel Dennett also put forward their philosophical conjectures and arguments respectively, contributing to the literature on language understood in terms of its role in changing the computational space in which cognitive processes take place.

Based on the work of Andy Clark-Magic words: how language augments human computation, which mainly focuses on the extended mind, the paper aims at exploring how language promotes human cognition through understanding Andy Clark's extended mind and relevant scholars' theories referred to in Andy Clark's reading. The paper then provides arguments on language's function in cognitive development. According to the arguments based on the work of Andy Clark on the extended mind, conclusions are then made.

Arguments Based on Andy Clark's Work

This section first provides a brief overview of Andy Clark's views extracted from Andy Clark's Magic words: how language augments human computation and then based on that, this chapter depicts Andy Clark's opinions on how language augments human computation.

Clark developed the supra-communication views of language and analysed that public language, as a tool re-shaping the kinds of computational space, is a species of external artifact designed to complement the basic processing profile, instead of

recapitulating or transfiguring them ^[3]. What is most important, Clark thinks, it is to try to figure out what computational benefits attribute to biological pattern-completing brains regarding their capacity of manipulating and sometimes modeling external representations. In addition to Clark's views, many other scholars also put forward their own arguments which consist of the language's function augmenting human computation. Based on Andy Clark's views, the paper argues how language augments human computation as follows.

Paths of cognition development

In Clark's work, Clark compared the process of human cognition with the growth of mangroves whose growth rule is an exception to the general rule. Generally, trees are rooted in soil where fertilizer is fully provided. However, in the case of mangrove trees, seeds floating in the sea put down roots and catch floating plants and rubbish in the sea and thus build over time their own fertile soil, which was described in detail in Andy Clark's Mangroves and meta-cognition chapter. According to Andy Clark, some human thought processes may be compared to the same process. By taking poetry as an example, Andy Clark demonstrated that sometimes words determine thoughts, at least, the influences running in different direction compared with the situation where words root in human thoughts. Actually, in poetry, the changes of structure and cadence can determine thoughts, and words can at times determine thoughts, which is divergent from our common sense understanding cognitive processes. In the process, according to Andy Clark, we can derive more new possibilities by inspecting and re-inspecting the same ideas from different perspectives. The original thoughts are stable in poetry, but after being transformed by words, the space of possible thoughts is transformed. Such observations lead Andy Clark to the following conjectures. Firstly, public language is responsible for a complex of rather distinctive features of human thoughts, which is described as second-order dynamics. According to Andy Clark, the second-order dynamics involve self-evaluation, self-criticism and finely-honed remedial responses ^[4]. Based on second-order dynamics, Andy Clark argued that this 'thinking about thinking' is only a human capacity. Instead, animals do not share the capacity. Compared with animals living in non-linguistic environment, the distinctively human capacity transforms language to become a key factor of carrying out human 'thinking about thinking'. Above all, Andy Clark believed that language and the inner rehearsal of sentences act like mangrove's seeds, like fixed points attracting and positioning additional intellectual matters. In addition, in terms of the inner rehearsal of sentences, Jackendoff viewed the mental rehearsal of sentences as the primary means enabling human thoughts to become objects of further attention and implications ^[5]. What key point Jackendoff expected to claim was that linguistic formulations make complex thoughts available to the processes of mental attention, which in turn makes them open to a series of further mental operations. The key claim can make it possible that different elements of complex thoughts can be selected and then can be scrutinized one by one. In line with that, we can inspect and criticize our reasoning. Thus, it can also demonstrate that language can promote human cognitive development through the above-mentioned functions of language.

With respect to the special kind of mental object mentioned in Clark's work which is apt for scrutiny from various different cognitive perspectives, it is fixed in a high level. The special kind of mental object refers to human solid thoughts obtained through long-term cognitive activities in mind. More specifically, such the above mental object is suitable for careful and repeated checks highlighted by Jackendoff's linguistic attending to our thoughts. Thus, the coding system of language is apt for more private purposes of second-order cognitive dynamics mentioned above. In other words, language is key resources through which we describe our own thoughts in some special formats making them available for further operations. Based on above Andy Clark's arguments on the relationships between language and thoughts, it can be found that in the process of thoughts operated on and shaped by language, language plays invisible roles in representing human thoughts. During the process, human beings employ language to represent their own thoughts in some specific format, so representation of human thoughts depends on language. As a consequence, human thoughts cannot avoid being intervened and shaped by language. Because of the practical needs of further operations and manipulations, some tools are in great need of reopening the thoughts and after the thoughts are operated and manipulated, other formats need to be introduced to store and expedite the thoughts. Just like language learning of children, they need to first store language and when they need to use them, they would reopen them with their memory, after they make some progress in language learning, they will store with more advanced language through memory or language habit ^[6]. Human thoughts are operated in a similar way of children language learning. Thus, language becomes an irreplaceable role in the operations and manipulations of human thoughts. Moreover, in terms of second-order cognitive dynamics, Andy Clark argued that we can think about our thoughts that we can structure the world in our own designs structured and planned previously by language, which is similar to co-ordination and reduction of on-line deliberation belonging to one of six broad ways of language and computation ^[7]. In line with above argument, it can be concluded that language can actively structure the world under the help of language and moreover, in fact, it contributes to extend our cognitive development during the process of structuring the world. Language prompts human to obtain many more profound understandings on the extended world. Besides, in the extending process, language, as results of extended mind, effectively expedites the cognitive activities, especially in the computational process, because linguistic formulations can import novelties into human brain. Moreover, after the external world is created by human mind, the language re-shapes the internal brain. Because of the collective cognitions shaped by public language, language, as a tool of knowing new things, instructs human beings in both content and structure, which then promotes original mind to have more advance cognitive levels, for the processes are complement and influenced each other ^[8]. Therefore, in line with Andy Clark's extended mind, it can be found that language promotes human cognitive developments, especially in human computational developments. More importantly, the written texts and notation which are attaching to language can make it possible that human

starts to study more complex and extended thoughts and reason based on their previous cognitions. According to Andy Clark, if we want to accomplish it, we need to reflect the development of new kinds of thoughts and encoding in non-linguistic context. These above new kinds of thoughts and encoding aim at imagining and interacting with language in more powerful ways. In other words, language opens door for non-linguistic thoughts and in turn these thoughts interact with language, so the relationship, according to Andy Clark, is complementary rather than simply a process of replicating thoughts in words. Therefore, we can come to the conclusion that in terms of the complementary relationships between language and human thoughts, language, as a matter of fact, supports the development of human thoughts.

Confronting Clark's views on marginalization of thought, it really should be concentrated on, because Andy Clark's complementarity widens Churchland's ideas and adds more understandings to the marginalization of human thoughts. Without clear marginalization, all thoughts and cognition involving unconscious rehearsal are easily taken as mistakenly explained. As a result, encoding's prototype and pattern will be ignored. However, according to Churchland, the prototype and pattern are the foundation of biology and evolution. Based on Churchland's above ideas, we should insist existing fixed thoughts and then based on them to create new fixed thoughts under the help of language. Under this condition, therefore, in the pool of thoughts, we can then extend our cognition horizons under the help of language. Andy Clark's conciliatory attitudes are beneficial to balancing biologically basic pattern-recognition and cognitive fixatives, which is more comprehensive than Churchland's views.

With regard to the paths of cognitive development ways and directions, Andy Clark found that language can promote cognitive development, like mangrove's development ways. Through studying the paths of cognitive development, it is found that the language's operation, function, process and ways influence cognitive development in every aspect, including exploring new thoughts and so on.

Vygotsky's zone of proximal development

In order to answer the question of language's another function in augmenting human computation processes; we need to focus on Vygotsky's zone of proximal development helping us with appreciating that language augments cognition. Vygotsky's zone of proximal development provides us with learning capacity to explain cognitive development under the help of language.

In terms of learning capability, according to Lev Vygotsky, the real education is about learning the specialized knowledge and the skill under developing children's learning ability. The ability refers to their abilities to think clearly and creatively, to plan and execute plans, to express their understanding in different ways. He believed that these capabilities can be achieved by providing them with a set of cultural tools for thinking and creating. The key of human intelligence and the ability to make people different from other animals are their ability of using a variety of tools. Lev Vygotsky also stands for this. Just as humans use specific tools (such as knives and levers) to extend the capabilities of physics, these tools can be understood as symbolic systems for communicating and analyzing the reality, including: symbols, maps, plans, figures, music symbols, graphics, models, pictures as well as the most important one—language.

Regarding cultural tools, Lev Vygotsky indicated that these cultural tools are not inherited from the inheritance but are developed and preserved in the process of social and cultural activities. Lev Vygotsky holds that the purpose of education is to give children a detailed introduction to the cultural tools and to tell them that how to use those tools to analyze reality successfully. Only in this way can children understand the world. To develop new abilities for children by using cultural tools is called the ability of psychological quality. It is a necessary psychological habit for those who need to succeed in the special intelligence and creativity. The better their abilities to perceive cultural tools for children are, the greater their abilities are in all fields. Ability development results in a child's personal maturity. They begin to plan their own activities, to explain his point of view, to provide all kinds of non-standard solutions to deal with a variety of problems, to interact with others generously and the most important one is to begin to believe in themselves and their abilities.

The theme of Lev Vygotsky's most famous work is the relationship between thought and language. When children play games, they often talk out loud when they are before the age of 6 or 7 what is happening. For example, the train is running around the castle, the train crashes into the castle and the castle is falling and so on. Lev Vygotsky called it as external torrent or egocentric speech. As time goes by, the external torrent is internalized into thinking. Faced with a challenging situation, children and adults usually obtain help with thinking. As a result, the development of language plays a crucial role in the development of thought, which means the development of thinking is largely determined by the language ability of children. In addition, children's social and cultural experience to a certain extent, also determines the development of their thinking. As a consequence, a very important function of education is to promote the development of rich and effective oral language. A widely used way is the zone of proximal developed from Lev Vygotsky. Vygotsky and Veresov held the opinion that zone of proximal development is a place where children and adults meet^[9]. Vygotsky believed that the teacher's role is crucial. In terms of the development of children's intelligence, the teacher can guide them to complete the task which is just over the ability of children. Under this guidance, the children can complete the task beyond their own ability in a certain limit. Lev Vygotsky defined these limits as zone of proximal development, meaning the difference between the level of solving the problem with the guidance and help of adults and the level of children alone to solve the problem. The most effective education is to aim at the higher levels and the edge of challenge of the children's zone of proximal development. In the process, language plays vital role in structuring children's activities and then providing directions for their cognitive development.

The zone of proximal development details the higher psychological activities of the beginner in the process of being mature and the psychological activities of those who are still in the embryonic stage and will be mature on tomorrow. They are the "bud" or 'flower' of the development, not the 'fruit'. Lev Vygotsky thought that the traditional educational achievement test (such as test result) has the characteristics of intellectual development review, while the zone of proximal development has the characteristics of intelligence development expectation. What is more, Lev Vygotsky underlined the importance of games. He showed that games also create the zone of proximal development of children because in the process of the game, the child's behavior is usually more than his age, more than his daily behavior, beyond the limits of this time and place. The game is contained in a condensed form, as in the focus of the magnifying glass, and all of the intellectual development tends to be that, as if the child is always trying to exceed his usual level. In the course of the game, children focus on an imaginary situation with external purpose and intrinsic motivation. For example, when playing the "home" game, they pretend to understand the characters and determine their actions according to the characters. Therefore, they will speak the language in line with their role in the game. This will lead to self-adjustment in a large degree, and children need to determine their behavior and language according to the role of the game. In the course of the game, children focus on the process of task than the results.

The zone of proximal development, as a theory tool to explore psychological development of learners, can enable us to explore learner's cognitive development level, ascertain the language learning psychological state of development, and determine the level reached of the learners in the process of development and things being in the mature process in the social and cultural background. In other words, it can enable us to study the actual development level and the potential development level of language learners, clarify the knowledge construction of language learners. The process of language knowledge construction is not only the process of language acquisition, but also the process of the combination of external language and thinking. The ideal state of language learning should be based on the zone of proximal development and combined with the characteristics of the existing knowledge structure of language learners, take advantage of learning environment, such as situation, cooperation, communication and meaning construction, etc., motivate initiative, enthusiasm and creativity of language learners, and make the language learners realize the internalization and meaning construction of the learned knowledge so that their real ability can be effectively improved, and the potential gets corresponding development. As a result, the new zone of proximal development is created. As a consequence, the mechanism of language knowledge construction should include the creation of the zone of proximal development, the offer of Conceptual Framework, and the promotion of language knowledge "Internalization" and etc.

Symbol, as one of forms of language, has dual functions: it is not only a social communication unit, but also is gradually transformed into an inner unit of thought to instruct people's cognitive activities. That is to say, people's social communication and thinking through the language symbol has been unified. Therefore, the process of internalization of language knowledge into human cognition is the process of the combination of language and thinking and is the process of the individual through the constant repetition of external communication, so that the external speech through the egocentric language is transferred into the internal language development. In order to combine language with individual thinking, the correct way of thinking should be from the beginning of the speech training, to comply with the external speech-the order of the internal speech. Therefore, in the process of language knowledge teaching, teachers should rigorously study the actual development level and the level of potential development of learners, to create a 'zone of proximal development', to help language learners establish an orderly and organized cognitive structures.

The extended mind

The concept of the extended mind received a lot of disagreements. According to Andy Clark, mind is understood through cognitive processes, but some philosophers think of mind as naming more folk psychologically familiar states (beliefs etc.) and cognition as including non-conscious states. In terms of mind, holding beliefs is an evident characteristic. Although some mental states are determined by internal brain activities, regarding mental states, external environment does make outstanding contributions to mind. On the basis of that, mind is extended to the external world. Thus, from Andy Clark's view, mutual interactions between external environment and internal mind make some differences in the actual process. What play important roles in our cognitive activities is an external tool. Andy Clark valued the functions and importance of external tools, so language, without any doubt, becomes the most important tool in extending mind. More specifically, speech and text greatly extend human's problem-solving abilities. Naturally, that we transfer our thoughts into language, making our thoughts determinate and public objects, easily to be assessed rationally and scrutinized. Insofar, regarding Andy Clark's extended mind, language, as a practical tool, extends external world for the human beings. In addition to external tools, internal mind has same significant degree in terms of human's cognition development ^[10]. In other words; the extended mind is made up of brain's mind and external world. The complementary activities between internal mind and external world develop cognition. Based on above analysis, in viewing public language as a powerful transformer of individual computational and experiential space, Andy Clark mentioned the nature of the internal representations guiding human actions. A popular image which concerns Jerry Fodor's reflections on the need for a language of thought demonstrated the internal representations. Andy Clark deemed that Fodorian view is linked to views that language is regarded as communicative tool, which accrues to the Fodorian's view that linguistic formulations are seen as reasonably believable reflections on the content and structure forms of internal representations. In views of Andy Clark, linguistic formulations, seen as novel both in content and in structure, imported genuine novelties onto our cognitive horizons. According to Andy Clark, novelty of content consists in linguistic expression making new thoughts available. Structural novelty concerns their

amenability to various operations and transformations not coming to brain naturally in non-linguistic mode. Therefore, Andy Clark perceived that the image does not cover all predictions and concluded that linguistic formulations become key element in internal representations.

According to extended mind concept of Andy Clark, it can be concluded that language does contribute to human cognitive development. First, linguistic formulations can achieve content-novelty. Linguistic expression makes new thoughts available, for it freezes other thoughts. When new thoughts come into brains, linguistic formulations will make some differences in showing the meanings of new thoughts. In the process, language plays irreplaceable role in expressing new thoughts which need language as medium. In non-linguistic environment, new concepts or thoughts are hard to understand, because in existing cognition, there is no substantial subject to perceive new thoughts or concepts. New thoughts, belonging to extended mind, are expressed in external representations with language resulted from internal cognitive activities. Through learning new thoughts by language, human mind, actually, is extended by language, because novelties are effectively imported into mind. In terms of images mentioned by Andy Clark, they are hard to be traded in the public exchanges. Images are substantial objects, which are bound to be exchanged difficultly. Unlike images, language does not attach itself to substantial medium. Instead, language lives in human mind. Thus, language, expediting human computation in the process of learning new thoughts, competently accomplishes its job in content-novelty. Second, the structural novelty accrues to linguistic formulations' amenability to various series of operations and transformations that do not come into brains under non-linguistic context. In linguistic context, linguistic formulations are required to follow some specific operations and transformations which are closely related to human brain's computation. The operations and transformations themselves, belonging to internal computation, are destined to involving linguistic formulations and then can contribute to the structural novelty. The structures lie in the operations and transformations relying on language. Brain's operations and transformations, though language, play their roles in extending world. Certainly, these operations and transformations are related to human computations where the ways of structuring the world are provided and thus it can result in structural novelty, because linguistic formulations simultaneously adopt the brain's cognitive activities in terms of the process and plans co-ordination. Last but not least, regarding Andy Clark's concept of extended mind, the external world belongs to the extended results explored by human internal cognitive activities, so human cognitive on the usage and operations of external objects is the extended cognitive process. Besides, the mind and cognition has transcended the boundary of brain and they have developed into the fields of external environment and external tools. As a result of extended mind, cognition extends to the external world, instead of being constricted in internal brain. In the process of mind's extending, language, without any doubt, plays irreplaceable role in carrying out special computational tasks ^[14]. Language helps human beings expand and strengthen biological cognitive capacities, for language becomes a tool augmenting human computation capacities. Specifically, we tend to offload our cognitive tasks onto external environment, because our brain cannot support the oversized information ^[12,13]. In the external environment, much information can be stored, operated and re-presented, which can protect and strengthen our cognitive transformation. All the above processes are dependent on language. Without language, human beings cannot transform the cognitive achievements to other storage forms. Moreover, human beings cannot develop our computation and make cognitive progress without extended mind, because information cannot be fully stored and operated in human brain. Confronting the reality, language does matter in developing human cognition.

The extended mind, supported and constantly developed by Andy Clark, depicts language as a necessary tool of extending human mind. Clark believed that cognition is beyond individual mind and can be regarded as externalism. However, how can the mechanism work? The question motivated Clark to find a tool-language to be the point cut. The external mind needs a tool to work, and the tool is language. Language belongs to a stable resource in our mind. Once we recognize the important role of the environment in constraining the evolution and development of cognition, we can see that extended cognition is a cognitive process of nuclear, not additional. Language seems to be a means of extending the cognitive process to explore the core of the world, which can be demonstrated through a metaphor: a group of people around a table brainstorm, or a philosopher's way of thinking that he can develop his ideas well is writing. This may be the evolution of language, and to some extent, it enables our cognitive resources to expand in a positive panning system. Therefore, language as a force given by the external environment extends our cognitive process to the outside world. In this way, the body-brain-world promotes the progress of human cognition in such a vortex.

CONCLUSION

The paper concentrates on the three views generated from Andy Clark's work on extended mind, aiming at demonstrating that language functions as a tool of promoting cognitive development.

First, the paper explains Andy Clark's main views in the work-Magic words: how language augments human computation and then mainly expounds the three views employed in this paper to argue the preposition-language does far more than serve as a vehicle for communication. In terms of Andy Clark's main views, Andy Clark argued how language augments human computation. Andy Clark's cognition arguments about cognition are innovative and in addition, Andy Clark's extended mind belongs to the profound reflections on mind itself. Regarding language's function in augmenting human computation, Andy Clark provided adequate explanations on it. In line with Andy Clark's explanations, the paper argues the proposition from perspective of cognitive development paths, Vygotsky's zone of proximal development and Andy Clark's extended mind which are all extracted from

Andy Clark's work. After scrutinizing the three views in Andy Clark's work, the understandings are as follows. Like mangrove's development ways, language can also promote cognitive development like mangroves. It can be found that the language influences cognitive development in every aspect, including exploring new thoughts and so on. In other words, the special development of human cognition determines the language broad functions. Then, the extended mind depicts language which prompts human to pursue many more profound understandings on the extended world as a necessary tool of extending human mind. Because of the collective consciousness shaped by public language, language leads human beings in both content and structure. Therefore, in line with Andy Clark's extended mind, it can be found that language promotes human cognitive developments, especially in human computational developments. Based on the understandings of Andy Clark's work, the paper roots in them and provides detailed arguments on them. The paper finds that Andy Clark's extended mind can be strong evidence to support the proposition-language does far more than serve as a vehicle for communication.

In addition, the paper also finds part of Andy Clark's views is, to some extent, controversial. Although Andy Clark always denies that brain and body are the barriers to further cognition and mind, he also holds it in some degree, at least in the situations where cognitive activities take place in brain, which is regarded as Andy Clark's attempts to encompass the theory of organism-centered. Moreover, Andy Clark believed that the external environment and artificial tools are part of our mind, which lacked sufficient evidence. Instead, actually, there should be a boundary between human mind and external environment, or it is very hard to distinguish external world from internal world, which lays a vague basis to discuss the two objects. Although there are some controversial points in Andy Clark's views, he provided rather clear arguments for us to deem language as a tool of developing cognition. Therefore, based on extended mind work of Andy Clark, language plays irreplaceable roles in promoting cognition development.

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