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Scale Errors: A New Dimension of Cognitive Development in Young Children

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Abstract:

The stories of 'Alice in Wonderland' and 'Gulliver's Travels' have always managed to intrigue adults and children alike. No wonder children are amazed to know the predicaments of Alice and Gulliver in different worlds where they are much larger or too small to live in. In the stories of Ramayana Hanuman changes size several times. From enlarging himself to the size of a mountain to that of a cat, his shape shifting character manages to fascinate one and all. In Development Psychology, a similar phenomenon called 'Scale errors' has been observed in children when they deal with sizes in real life. Researchers observed children's tendency to get into or onto objects which are too small for them to act upon in that manner (DeLoache, Uttal & Rosengren, 2004). It was found that children made efforts to sit in a miniature chair or to get into a small car. Hitherto researchers have observed children's pretend play with replicas or other objects. Discovery of scale errors provides a scope for a complete new enquiry about play behaviour of children which is clearly distinguishable from pretend play and provides us with new perspectives on children's thinking. This paper will explore the scope of scale errors as an important characteristic of children's cognitive development and its possibility as a cultural process of learning through action.

Keywords: Scale errors, cognitive development

1. Introduction

Since its first account in a scientific research paper in 2004, the concept of scale errors has been gaining importance as a phenomenon worthy of study (DeLoache et al., 2004). There have been various researches in this area, in laboratory settings, naturalistic observations, preschool settings as well as parent reports (DeLoache et al., 2004; DeLoache, Uttal & Ware, 2010; Rosengren, Carmichael, Schein, Anderson & Gutierrez, 2009). These researches have ascertained the existence of this phenomenon as well as the enormous potential it holds as a possible indicator of children's growing cognitive abilities, which are constantly striving to cope with the challenges of problem solving in a new world. We live in a world where objects have a major role in children's lives; however, the degree to which play objects are available for children to play with differs across communities. Children also play spontaneously with objects in the environment as well as with people. The availability of objects specifically designed for play corresponds to the affluence of a culture.

The paper seeks to study scale errors as a possible milestone in cognitive development where a child makes efforts not only to understand the symbolic aspect of replicas, but finds strength to integrate perception and action, struggling with outcomes of low inhibitory control and understanding the role and limitations of an object and her own body. Piaget (1993) had maintained that all development is composed of momentary conflicts and incompatibilities which must be overcome to reach a higher level of equilibrium. At the same time, it is imperative to understand that human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them (Vygotsky, 1993). Should we gauge scale errors as a possible landmark in the play behaviour of children where they realize the impracticality of performing a concrete action that can be substituted by the feasibility of a symbolic action? This question needs a justified analysis through existing body of research and there is a need to find some new questions.

2. Neuroscience and Scale Errors

Neuroscience has successfully emerged as an interdisciplinary science that also collaborates with allied fields like psychology and form disciplines like neuropsychology. According to the University of Rochester Medical Center, a neuropsychologist has the required expertise to understand how brain structures and systems relate to behaviour and thinking. It is an experimental field of psychology that aims to understand how behaviour and cognition are influenced by brain functioning. Goodale and Milner (1992) gave evidence that there are separate visual pathways for action and perception. The ventral 'perceptual' stream provides the rich and detailed representation of the visual world required for cognitive operations whereas the 'dorsal' action stream transforms incoming visual

information into the required coordinates for skilled motor behaviour. Prominent research on scale errors in children has claimed that the phenomenon involves dissociation of action and perception. Children face difficulty with inhibitory control and in integration of visual information for planning and controlling their actions (DeLoache et al., 2004). A scale error occurs when information about the identity of an object processed by the ventral system is not integrated with information about its size processed by the dorsal system (DeLoache et al., 2004 p. 1028). It was assumed that due to low inhibitory control children find it difficult to inhibit the pre potent response, so when they see a miniature replica chair the particular action of sitting on the chair is directed at the miniature chair too. In a way, it also includes being thoughtful regarding the concrete and symbolic nature of the chair- that is the difference between a bigger chair and its miniature replica which is too small to be used for sitting.

Casler, Eshleman, Greene and Terziyan (2011) investigated the phenomenon of scale errors with tools vis-à-vis their purpose guided reasoning. They argued that tools provide special insight into the origins and causes of children's scale errors and into the broader nature of children's purpose-based reasoning and problem solving. The teleo-functional reasoning bias of children is well documented in many studies. That is, it is believed that children think something exists for a purposeful reason (Casler & Kelemen, 2005, 2007). Is it possible that the likeness of a replica to its larger counterpart challenges child's ability to inhibit the desired actions appropriate for a bigger object not its miniature replica? Or does it have more to do with functions associated with that particular object? The study (Casler et al., 2011) validated the natural existence of scale errors without any prompts from the researcher unlike the former study (Ware, Uttal, Wetter & DeLoache, 2006) where children were prompted to interact with objects in a certain manner (e.g. "Can you help the baby go night-night?"). In addition to this, children's exploration with novel objects also yielded scale errors which further support the role of teleo-functional bias. This particular finding suggests and supports the exploration of scale errors in field observations in naturalistic circumstances without relying heavily on artificially controlled observations. That would really help us to enquire about the scope of scale errors as a cultural phenomenon.

3. Scale Errors in Context

Hitherto scale errors have been studied in laboratory settings, most of the work was concerned with how the child comes to deal with conflict of not being able to execute the desired action upon the objects. How can we begin to understand the cultural and social nature of scale error phenomenon is a noteworthy question? Scale errors need to be studied from the lens of everyday practices where the ecological setting and child's interactions will possibly determine the process of this occurrence. Perret-Clermont and her colleagues encapsulate the way in which this approach draws upon and yet goes beyond traditional Piagetian theory:

- "The child's activity is essential to his cognitive development; however, this activity is in constant interplay with the activity of others. The individual is, as it were, the "co-author" of the development of his intelligence. His partners are the persons, adults or children with whom he interacts" (Perret-Clermont, Brim, Saada & Schubauer-Leoni, 1984, p.64)

In a recent study, it was observed that children with younger siblings were less likely to make scale errors with the chair, dismissing it as too small, sometimes not even bothering to check (Chaudhary, 2013). How did they come to build this understanding? This question could only be answered by studying the role of social processes in a particular cultural context, and by studying the role of other children in the understanding of objects. Rogoff (1990) highlights the importance of learning through observation in societies where schooling has not been prevalent. Development can be viewed as an apprenticeship in which children engage in the use of intellectual tools in socially structured activities with parents, other adults, and children learn a great deal by observing and practicing (Rogoff, 1990). Weisner (1996) pointed out that development is multiply determined in a cultural context and it is important to recognize the role of cultural place in development. He describes the meaning of cultural place quite clearly: "By a cultural place I mean the cultural beliefs, practices, meanings and ecological setting characteristic of members of that community" (Weisner, 1996, p. 305). According to Cole (2000):

- "At the cultural-historical level of analysis we have reaffirmed the need to ground cultural differences in cognitive performance to activities within societies in order to capture the necessary degree of heterogeneity of cognitive processes within persons across activities" (p.176)

Cole (2000) strongly supports the study of ontogeny in its cultural historical context and an examination of the variety of ways in which culture plays a role in the process of ontogenetic development. According to him, "When we take ontogenetic development as our central concern, we arrive at a level of analysis that corresponds to our everyday experience" (Cole, 2000, p. 178). It is certainly important to recognize the systems with which the individual interacts. Urie Bronfenbrenner changed the way developmental psychologists looked at individual growth by highlighting the importance of environments as contexts of development. His theory guides us to study the interactions of an individual and of the dynamic systems, which include her immediate environment such as family and school, with the macro system that is culture (Bronfenbrenner, 1994).

Vygotsky has contributed immensely in highlighting the position of cultural historical context. He suggested that higher mental functions begin as an external activity which is gradually reconstructed and internalized. In his classic example of pointing, the caregiver is a mediator who develops the child's understanding to use pointing as a meaningful gesture to fulfill a desired goal. The child and culture are intricately interwoven through the process of social interaction (Vygotsky, 1978). His theory emphasizes the social context of cognitive development where children learn by support from others who have greater knowledge, both adults and children. In addition to this, Cole proposed prolepsis¹ to be a ubiquitous element of culturally mediated thought (Cole, 2000). According to him, parents presuppose the path of development for their children from their own past, specifically the cultural past. The present treatment of the baby and related future expectations are widely influenced by parents' cultural historical background. According to Cole:

“Two features of this system of transformations are essential to understanding the contribution of culture in constituting development. First, and most obviously, we see an example of prolepsis. The parents represent the future in the present. Second, if less obviously, the parents’ (purely idea) recall of their past and imagination of child’s future becomes a fundamental materialized constraint on the child’s life experiences in the present” (2000, p. 184).

This directs us to carefully examine children’s everyday experiences and their role in the developmental process.

4. Conclusion

The present paper clearly highlights the need to investigate and expand the literature on scale errors. This peculiar engagement of children with smaller replicas of objects stimulates the possibility of new findings on children’s play behaviour. The investigation should focus on describing the phenomenon in varied cultural settings. There is a definite paucity of literature on the processes involved in the phenomenon of scale errors. Is it a missing link in the process of symbolic development of children? This will be probably one of the most important question to address about young children’s thought in the near future. Many researchers have taken special note of distinguishing scale errors from pretense behaviour. Actions were coded as scale errors when children made serious effort to get into or onto the miniature replicas or tried to place dolls in miniature replicas as if placing them on their larger version. Any verbal behaviour with replicas was also put in the category of pretense (DeLoache et.al, 2004; Ware et al, 2006). So these studies hint at a clear difference between pretend play and scale errors. A scale error involves serious efforts to act upon objects, whereas pretend play involves non-literal actions. Vygotsky (1978) envisioned that pretend activities help children develop an understanding of referents and objects. Play takes a child to the upper end of his or her “zone of proximal development” (Vygotsky, 1978, p. 86). In play, children learn substitution and make progress to comprehend meaning out of concrete objects, leading to abstract thoughts (Vygotsky, 1967). In this way, for example, a banana could become a phone in a pretense situation and the child could act on it as if it were a phone, inhibiting how he or she would act on it if it were a banana. Additionally, children inhibit reality to go beyond direct perception. Research literature suggests that children also develop inhibitory control using pretense (Bodrova & Leong, 1996). There are studies that put forward the idea that scale errors can be related to low inhibitory control and purpose-based reasoning observed in children (DeLoache et.al, 2004, Casler et al., 2011). The teleofunctional reasoning and low inhibitory control in young children elicit actions desired for the given object. Thus the replica of a chair will prompt them to sit on it.

Further, there is a great need to observe whether or not adults in a particular culture will prefer to encourage scale error phenomenon in children. The experiences of children are shaped by their daily interaction with others in their ecological and cultural setting. The influence of a natural setting on scale errors is scarcely studied and the field of enquiry is really vast.

Thus, the study of a cultural account of cognitive processes involved in scale errors will be insightful and lead to a more comprehensive understanding of knowledge in practice.

5. Notes:

¹ Prolepsis means the anticipation of an explanation of a future act.

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