

## Perception, attention and words: An interbehavioral account<sup>1</sup>

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### Abstract

Perception is still a controversial topic in psychology and in the history of science. Historically, it has been studied using non-existent entities that are responsible for the way organisms interact with the world perceived. A naturalistic approach developed by Kantor (1924, 1926, 1977; Kantor & Smith, 1975) is presented as an alternative of traditional explanations. The concepts of sensation, attention and perception are explained as fundamental parts of the total response system. Perceptual functions are described as historical and context dependent; they define how the organism will respond to a stimulus object. As any other function, perceptual functions can also be substitutable; this possibility is developed further while considering non-linguistic perceptual functions of words. It is concluded that perceptual reactions are fundamental for any further interaction of the organism with its environment; therefore it should not be left outside of the study of scientific psychology.

Key words: *perception, attention, function, substitution, words*

### Resumen

El fenómeno de la percepción ha sido un tema controversial en la historia de la ciencia y la psicología. Históricamente, se han utilizado entidades no-existentes para explicar la manera en que los organismos interactúan con el mundo que perciben. Kantor (1924, 1926, 1977; Kantor & Smith, 1975) propone una aproximación naturalista como alternativa a las posturas más tradicionales. En el presente documento, se definen los conceptos de sensación, atención y percepción como partes fundamentales del Sistema Total de Respuesta. Las funciones perceptuales son descritas en términos de sus características históricas y de su dependencia con el contexto; dichas funciones determinan la forma en que el organismo responde ante determinado estímulo objeto. Al igual que cualquier otra función, las funciones perceptuales son también sustituibles. Esta propuesta se discute en términos de las funciones perceptuales no-lingüísticas de las palabras. Se concluye que las reacciones perceptuales deben ser parte del estudio científico de la psicología ya que son fundamentales en cualquier interacción del organismo con su ambiente.

Palabras clave: *percepción, atención, función, sustitución, palabras.*

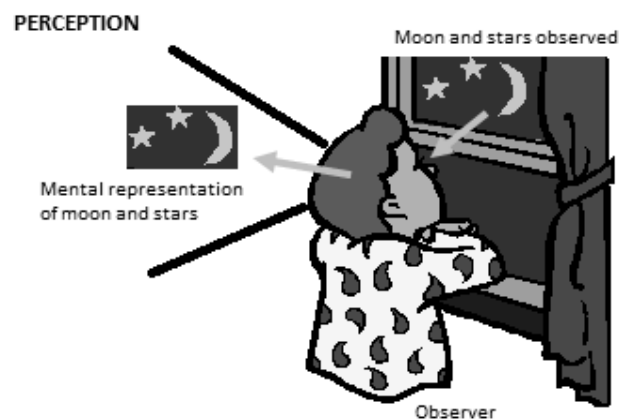
The topic of perception has been a controversial one in the history of science (Kantor, 1977; Kantor & Smith, 1975) given its subtlety and lack of objective research in which perception is not reduced to brain functions. Perception is a subtle phenomenon that has encouraged philosophers and psychologists to create different theories to explain it. In as much as the world itself cannot be taken in or possessed by a person, a popular view asserts that perceptions of the world are made through the creation of mental copies or representations (Skinner, 1976) as seen in Figure 1. According to this view, upon

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making sensory contact with aspects of the environment, copies of these aspects are made and stored inside the mind and it is by looking at these copies or percepts that organisms are said to perceive the natural world. Perception, as such, is held to occur inside the organism and to involve only indirect contact with the external world. Although the main tenets of this theory have, for the most part, been rejected (Palmer, 1999 p. 57 - 59), copy theory is still prevalent in current literature on perception (i.e. Stein, et al., 2011). Given this circumstance, a truly naturalistic theory of perception, which can relieve psychology of the need for hypothetical inner entities to explain perceptual behavior, is still warranted.



**Figure 1.** Traditional interpretation of perception

An alternative naturalistic account comes from Kantor's interbehavioral perspective. Kantor (1958) argues that a psychological event is comprised of five elements: history, media of contact, setting factors, stimulus function and response function. A psychological event is held to be the interaction of all of these elements. Sensation may be defined as the stimulation of an organism's sense organs in the form of different wavelengths of light or sound, for example. As such, sensation cannot be considered a psychological event since it is not comprised of all of the elements mentioned above. More specifically, sensation is not historical, which is a fundamental characteristic of all psychological interactions. It is rather an aspect of the organismic component of an organism-environment interaction. By contrast, perceptual activities are relations of responding on the parts of organisms with respect to stimulation on the parts of enviroing things and events (Kantor, 1926). This paper will elaborate upon Kantor's perspective on perception, substitution and will consider the implications of this perspective for perception of words.

### Stimulus, Stimulus Object and Stimulus Function

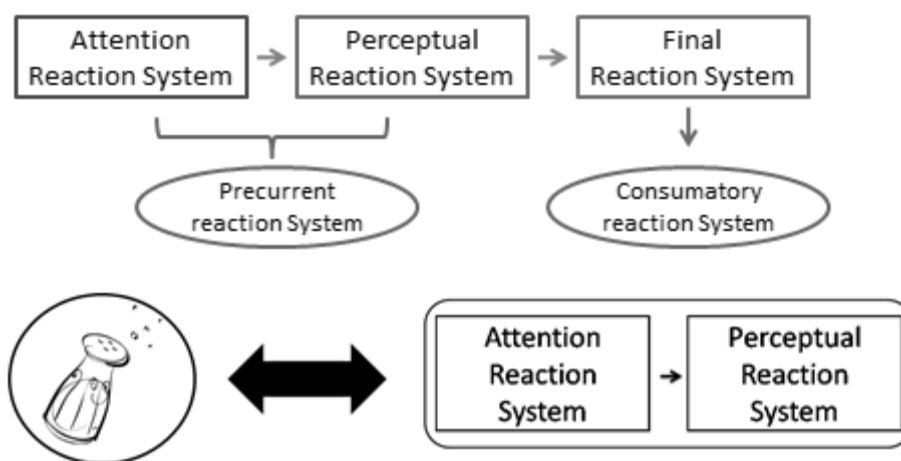
Perception is fundamental for all other psychological interactions since organisms are unable to behave unless they perceive the environment. It is thereby necessary to explore further the participation of the environment (i.e., what is perceived) in perceptual interactions. Kantor (1924) argues that it is not the stimulus object that participates in a perceptual event but rather the functions of this object which have developed throughout the organism's history. According to Kantor, there is reason to differentiate the environment prior any interaction with the organism, and the environment after interaction, in which case it is said the organism has some history with it.

In making this point, Kantor contends that an enviroing object with which an organism has no previous history is pre-psychological. This is to say, it is an element that might become a factor in a

psychological event but only after its functions are coordinated with responding (Kantor, 1958 p. 84). Once such a history has been established, an object becomes a stimulus object in Kantor’s frame of reference. A stimulus object is a source of stimulus functions – which may or may not be operating on a given occasion. A stimulus function refers to the action of a stimulus object in coordination and simultaneously with an action or function of a responding organism. A given stimulus object may have multiple stimulus functions. Likewise, different stimulus objects may have the same function. Stimulus functions may be seen by observing how an organism interacts with a stimulus object. For example, the stimulus object “chair” harbors “sitting”, “throwing” or “reaching” functions. In each of these cases, the organism must be oriented with respect to the stimulus object in question as well as make some kind of psychological contact with it. Kantor describes the former as attending, the latter as perceiving.

### The Total Response Pattern

In order to analyze how perception and attention are part of any psychological interaction, Kantor subdivides the organism’s complete response pattern into three reaction systems, as represented in Figure 2. There are two pre-current reaction systems which occur in sequence, these comprising the organism’s side of the interaction. The first of these is the *attention reaction system* which is defined as the process in which the objects and conditions in the person’s surroundings assume their particular stimulatory functions (Kantor, 1958 p. 216). In short, this reaction system organizes sensation, allowing the organism to interact with a particular stimulus object. Kantor (1924 p. 216) identifies two main functions of this system: inhibitory and integrative. An inhibitory function includes stopping previous reactions to other stimuli and the integrative function refers to the orientation response in which the organism enters in contact with the stimulus object that would be perceived. Through the attention reaction system, the organism is oriented to the stimulus object, the object’s function is actualized and the organism is thereby prepared to engage in another reaction. This actualization involves the synchronized movement of the body towards the stimulus object to be attended to and it depends on the organism’s history of attending with respect to such objects. The attending reaction is incomplete however in the sense that it is always accompanied by a perceiving action.



**Figure 2.** Total response pattern The upper figure shows an interaction in which perception is part of the overall response pattern while the bottom figure one shows one in which perception is the final reaction in the pattern. Adapted from “Principles of Psychology (V. I)” by J. R. Kantor, 1924 p. 255.

The second pre-current reaction system, comprising the organism’s side of the interaction, is the *perceptual reaction system*, in which the organism acts with respect to a stimulus function of the stimulus object as had developed historically. In other words the organism behaves in accord with its history with

this stimulus. Perceptual reactions are more than differential behavior since they depend on the functions of the stimulus object that are relevant to the situation. They cannot be considered S-R relations, because they are not cases in which a particular stimulus object elicits the same response from the organism independently of its context. Perceptual interactions implicate the operation of an object's stimulus functions. Further, the functions upon the perceptual system operates are not necessarily functions acquired by the particular stimulus object that is present. This would imply either that the organism has had to have previously interacted with every possible stimulus in the environment in order to perceive it or that perceptual reactions occur with respect to functions shared by the social community. Instead, Kantor (1926) argued that perceptual functions acquired by one object may substitute for those acquired by another when organisms have previously confronted these objects in spatial proximity. Perceptual substitution is fundamental to any perceptual interaction and it is of particular importance since it explains how a given organism's perception of the environment differs from that of another.

Finally, Kantor identifies the *final reaction* system, in which the organism behaves with respect to the perceived function of the stimulus object. For example, upon seeing a chair, a person may sit on it as a final reaction system. Nevertheless, while all interactions with the environment involve both the attention and perceptual reaction systems, in some cases the perceptual reaction system is the final reaction in the pattern. In the previous example the organism may perceive a chair but not sit on it. As mentioned above, while the interaction cannot end in the attention reaction system, Kantor considers it necessary to maintain the distinction between attention and perceptual reactions. While attention reactions determine whether the organism will perform a given reaction at all, the perceptual reaction consists of the identification and distinction of the stimulus function with which the response is coordinated. Since these two systems have different roles in the behavior segment they are best considered separately for analytical purposes (Kantor, 1958 p. 220).

Traditionally, naturalistic studies of perception have focused on the final reaction system, in which the interaction is less subtle, permitting easy measurement in the laboratory. The distinctions articulated by Kantor in this regard are particularly useful for purposes of research and conceptualization, as they allow for the study of each of these reaction systems separately as well as aspects of a sequential pattern of activity. In other words, this view demystifies perception and attention reactions, allowing them to be part of the subject matter of a scientific psychology.

### Linguistic and Non-Linguistic Perception

Perception is not limited to visual, auditory, olfactory or haptic stimuli, though. It is also possible to speak of linguistic perception (Kantor, 1926). As in any other interaction, interactions with verbal stimuli include the three systems of the total response pattern as described above. In the case of linguistic perception, however, the final reaction system consists of a referential action. For example, upon attending (hearing) to and perceiving (listening) the sound "pass the salt," the final reaction may be an action with respect to the stimulus object of the salt shaker. In other words, linguistic perception involves conventional referential functions such as prevails between the word "salt" and the stimulus object of the salt shaker. Linguistic perception is particularly pertinent for the analysis of verbal behavior and, more specifically, for the analysis of the listener's action in that a listener may engage in linguistic perception but it may not be followed by the act of passing the salt.

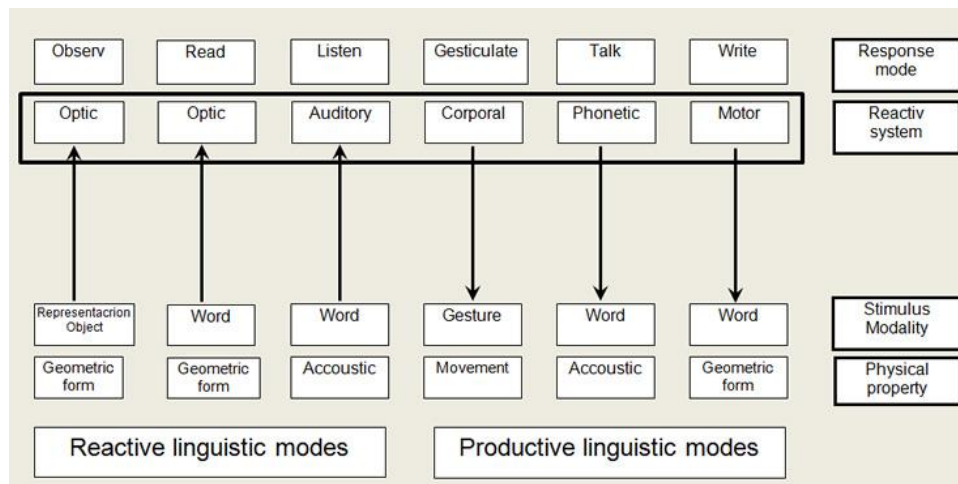
Linguistic perception is also interesting when we examine cases in which the final reaction corresponds to a conventional history with words regardless of language. An example of this is when, while visiting a different country, you encounter someone yelling at you. Under these conditions your linguistic perception of this yelling will correspond to your history with yelling in the past even though you are not familiar with the language. Therefore, you may perceive this event as aggressive and behave

defensively, for example, by apologizing. While linguistic perception includes much more than just language, the referential function of verbal stimuli is often the most salient feature. This example shows how perceptual interactions alter other types of behavior that we have previously considered.

In psychology and more specifically in behavior analysis, words have been used as stimuli to study a variety of human phenomena such as memory (e.g. Bourgeois, 1990), learning (e.g. Bentall, Fergus Lowe & Beasty, 1985), and decision making (e.g. Fantino, 1998), among others. In studies of perception, words are an interesting type of stimulus since they have multiple linguistic functions. Consider the word “apple”. Our history with this word permits us to react to it in a number of different ways. For example, “apple” might give rise to the response “pie” by virtue of they having been a proximal relation between these two objects in a person’s history. Likewise “apple” might give rise to the word “fruit” by way of a classificatory relation between them or, by virtue of a categorical relation of nouns, “apple” may give rise to “brick”. All such responses are actualized in a linguistic context, or what Varela et al. (2001) call a linguistic dimension, identified by conventional criteria. Further, there are some cases in which these substitutional linguistic functions are not part of the conventional criteria but are dependent on the person’s idiosyncratic history with the words. This possibility was explored in a study reported by Clayton and Hayes (2007) that showed how pre-experimental histories with stimuli can affect participants’ responses. In this study, equivalence relations were established among non-sense words (A), Chinese characters (B) and words such as “funeral” or “holiday” (C). Later, relations between Chinese ideograms and faces showing happiness and sadness (D) were trained. Participants matched the faces (D) with the non-sense words (A). This study demonstrates how substitutional linguistic relations can be established through the histories of individual participants, increasing the number of functions that a word may have.

Nonetheless, words do not have only linguistic perceptual functions. They also have non-linguistic perceptual functions corresponding to the words’ auditory and visual perceptual functions. For example, upon seeing the written word we may hear the spoken word. These perceptual reactions, while more subtle, are occurring concurrently with linguistic perceptual reactions. There are two types of interactions with verbal stimuli: reactive (as a listener) and productive (as a speaker), and in each case we may consider the characteristics of the verbal response as well as the characteristics of the stimulus. As shown in Figure 3, perceptual acts may be characterized by the type of reaction system involved (e.g., visual or auditory). Research that employs words as stimuli typically focuses on linguistic dimensions to establish the relations of interest, these being identified in accord with the particular experimenter’s history with the words used. However, little has been reported with respect to the nonlinguistic perceptual functions of words.

Just as substitution of linguistic functions of words was demonstrated in the study by Clayton and Hayes (2007), it is reasonable to suppose that substitution of non-linguistic perceptual functions occurs. Turkkan (1989) suggests that there are more functions shared by stimuli because of their histories of appearing together than have been investigated in the studies so far reported. Consider our interactions with an apple. We may have interacted not only with the stimulus object apple but as well with the written word apple and the spoken word apple. In other words, we may have heard the spoken word apple in the presence of an apple and seen the written word next to an apple or a picture of it. All of these stimuli have a history of appearing together in our histories of interaction with apples. Since auditory and visual word stimuli may substitute for one another due this history, it seems likely that nonlinguistic perceptual substitution would be present in words as well. In other words, we may “listen” to a written word and “see” a spoken word.



**Figure 3.** Illustration of the different reactions to verbal stimuli on reactive and productive linguistic modes according to stimulus properties and response modes. From J. Varela, M.A. Padilla, F. Cabrera, A. Mayoral, T. Fuentes & G. Linares, 2001 p. 367. Adapted and translated with permission

Nonlinguistic perceptual substitution has been investigated using homophones, which are words that have the same auditory perceptual functions as other words but different visual and linguistic functions. For example, the word “eight” and the word “ate” are homophones. Muñoz Blanco and Hayes (2010) trained relations between visually presented homophone words and letters of the alphabet (e.g. “ate” and “C”), and then tested for relations between those letters (e.g. “C”) and non-trained homophone words (e.g., “eight”) demonstrating nonlinguistic perceptual substitution. It was assumed that the non-linguistic functions of the word stimuli would be more subtle than their linguistic functions. Nonetheless, some evidence of substitution of the non-linguistic perceptual functions was found for some of the participants in this study. A subsequent study by Muñoz Blanco and Hayes (2012) used the same training but simplified and put a time limit to respond to the relations test. This study demonstrated substitution of non-linguistic perceptual functions with respect to the words homophone relations as well as other functions shared by numbers and letters that were not anticipated, such as their shapes. Future research in the area should look at other non-linguistic perceptual functions of words or other commonly used stimuli and their interaction with their linguistic functions. Also, it should be explored further substitution of non-linguistic perceptual functions to novel stimuli as well as the other non-conventional substitutional perceptual functions that are hindering the performance of an individual due to their particular history with the stimulus. Research in this area is currently scarce and more experimental data is needed to strengthen the argument with respect to the importance of non-linguistic perceptual functions.

All of an organism’s interactions with its environment involve perceptual actions. In many cases, these actions are consummated by other sorts of actions with respect to relevant stimulus objects. Thus, we not only see (perceptual reaction) a cup, but then also pick it up (final reaction). Our aim in this paper has been to suggest that the final reactions occurring in any given situation depend on the perceptual functions of stimuli actualized in that setting. The perceptual functions of stimulus objects may be original or substitutional in type. Further, in the case of words as stimulus objects, their perceptual functions may be linguistic or non-linguistic. Generally speaking, research has explored only the linguistic functions of word stimuli. A new line of research may be developed by examining substitution of the non-linguistic perceptual functions of these stimuli, the relevance of which to an understanding of verbal interactions remains to be seen.

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