The cognitive mechanism between observation and theory: A representation-based approach

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Abstract

The thesis of relation between observation and theory is one of the basic important issues in philosophy of science and scientific epistemology. However, the mechanistic processes of theory-ladenness of observation have rarely been discussed. Current research in cognitive science on thought processes provides powerful analytical tools and empirical support for this problem. In the light of the perception-based knowledge representation of Barsolou, this paper attempts to give a representation-based explanation for theory-laden mechanism in virtue of constraints on production and explanation of representation. If representational mechanism in observation is not an absolutely subjective but a constraint construction, it will give the reliability of observation a rational support.

Keywords

Observation, theory, expression, perception, cognition

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Introduction

Since Hansen's proposed that "observation is theory-ladenness", it has been recognized that there is a theoretical element involved in observation, even in the process of scientific activity. However, because of the limitations of the study of the thinking process, the question of how the inner mechanism of theory penetration is achieved has not been well explained. At the same time, the question of whether the observation of theory penetration remains reliable has been questioned.

The research of cognitive science in artificial intelligence, neuroscience, and psychology has changed the cognitive process from a completely black-box operation to a gray-box operation, and the thinking process is considered a natural process that can be studied using empirical means, which has brought about a change in the approach of epistemological research. The study of cognitive science put the study of the thinking process, the process of scientific discovery, in an important position, and it pointed out that a reinterpretation of certain philosophical arguments could be made through the clarification of process mechanisms. According to cognitive psychology, the cognitive process is not only a process of discovery, of learning, of reasoning, but also a process of expression. If cognitive processes are expressive processes, this provides a possible entry point for a process study of the inner mechanisms of observation and theory in terms of expression

Hansen's analysis of "seeing" suggests that observation is a process that involves both seeing and inference. Tharp also argues that observation essentially involves seeing and inferring. Psychology suggests that the theoretical penetration of observation presupposes a continuity between perception and cognition. Fodor's analysis of perception also states that because of the inadequate determination of perception by sensory material, a commitment to observation as inferential is required. The study of the observation process according to cognitive psychology suggests that it is a process that encompasses the perception of an object and the associated reasoning and cognition. If the process of reasoning is understood as a process of transforming information, then knowledge representation provides an actionable/computational basis for information processing and transformation. It thus appears that the cognitive processes involved in observation are primarily embodied in the processes of generation and comprehension of expressions. Certainly, the cognitive Psychologists believe that broader cognitive processes such as expression, memory, and attention all constitute cognition, and we do not believe that the process of observation involves only expression, but it is an important and fundamental process and one that is well supported and illustrated empirically in current research in cognitive psychology.

The perceptual schematic character of expression is supported by Barsolou through experiments in cognitive psychology, where he asserts that perceptual expression is a schematic symbol, and that the symbol system is capable of serving as a conceptual system with the important property of being the basis of knowledge expression. Although this is only one school of thought among many theories of expression, the theory proposes a different form of knowledge expression and demonstrates clear explanatory and expressive power on the issue of conceptual structural expression, incommensurability.

Through the analysis of Barsolou's theory of perception-based expression, we find that, on the one hand, this mechanism of expression shared by perception and cognition provides a possible account of the mechanism inherent in the penetration of the theory into observation; on the other hand, the generation and understanding of expression involved in the process of observation is not a purely subjective construct, but it needs to satisfy the relevant institutional constraints. Because perceptual symbolic expression is based on a sensory-motor system, the analogy between perceptual symbols and perceptual states provides a constraint on the nature of knowledge expression; on the other hand, the conceptual system constructed on top of perceptual symbols needs to satisfy the constraint of making a successful simulation of the perceptual object, i. e., the simulation system, the perceptual object, and the simulation all three On the other hand, a conceptual system constructed on top of a perceptual symbol needs to satisfy the constraint of successful simulation of the perceptual object, i.e., the simulation system, the perceptual object, and the simulation match before the understanding is considered successful and capable of expressing "truth". Thus, it seems that theories of the representation of knowledge both promise that we can make sense of the world, but also place constraints on the process of making sense of it, which, in a sense, supports the reliability of observation.

Barsolou argues that a theory of representation of concepts/knowledge can be obtained on top of perceptual symbol systems, which avoids the difficulties of syntactic representation of formal features and does not require the direct use of neural mechanism language to account for cognition. He argues that the schematic representation of perceptual states can be extracted and stored in long-term memory as symbols involved in expression and computation. This perceptual symbolism is organized through frames to form a simulation system (equivalent to a conceptual system) that can generate infinite simulations (equivalent to conceptual understanding) for perceptual objects. In Barsolou's view, this simulation system can also be applied to the simulation of sensory experience, proprioception, and introspective states. Once established, the simulation system can take on the functions of a conceptual system - expressing types, supporting classification, and performing category reasoning. Clearly, Barsolou wishes to give this theory of expression the universality of a conceptual system and to replace the existing theory of expression.

Currently, non-modal (amodal) forms are considered to constitute the main mechanism of expression of knowledge, concepts. The expression system mostly employs formalistic expressions, e. g., is represented through a wide range of expression structures such as feature lists, frames, diagrams, semantic networks, and generative systems. They are considered to constitute symbolic systems in a fully functional sense, e. g., with combined syntactic and semantic features that can support high-level cognitive functions (memory, knowledge, language, thought, etc).

Barsolou argues that the cognitive expressions of non-modal systems are opposed to the modal nature of perceptual symbols. The former is considered non-perceptual, i. e., the expression obtained is unrelated to the perceptual state, while the latter is perceptual, i. e., the perceptual symbolic structure is relatable or analogous to the perceptual state. Barsolou advocates that cognitive and perceptual states share the same system of expression.[1] Non-modal systems, on the other hand, argue that there is no correlation between expression and perceptual states, that they operate in separate systems in terms of expression form, and that there is no systematic similarity or analogy between cognitive expression and perceptual objects. Barsolou argues that if the two systems, cognitive expression and perceptual objects, use different mechanisms of expression and operate according to different principles, then such symbols are arbitrary of the two systems. Because there are no similarities between non-modal symbols and perceptual states, just as there are arbitrary relations between words and objects, the connections between symbols and perceptual states are also arbitrary, and accordingly, the connections between sentence expressions and conceptual system to the external world is also arbitrary.

Barsolou argues against constructing the expression of knowledge in isolation from the perceptual processes of the cognitive subject. He notes that although non-modal systems are widely used as basic forms of mental expression, there is little direct empirical evidence to support the existence of non-modal symbols. On the one hand, research (Seifert, 1997) suggests that conceptual symbols have a perceptual character, and on the other hand, there are studies (Burgess & Lund, 1997) that imply that non-modal vectors from linguistic contexts can serve as the basis for semantic processing. Glenberg (1998) provides strong evidence that sensory -motor simulations are critical for semantic processing. Furthermore, neuroscientific studies have shown that categorical knowledge is based on sensory-motor areas, and that specific impairments in this area will result in the failure of conceptual processing that uses this area for object categorical recognition to function properly. From this, Barsolou infers that categorical knowledge is modal. Barsolou further notes that because non-modal symbols are uncorrelated with perceptual states, then the correspondence process of how to switch from perceptual states to non-modal symbols is difficult to justify for non-modal systems. Although non-modal theories emphasize the understanding of symbols, they are not able to provide a persuasive explanation of explanatory symbols that have a referential function. Clearly, the explanatory gap in this key process gives reason to doubt the need for the existence of non-modal symbols.

Barsolou argues that one of the plausible solutions to the above problem is the introduction of perceptual expressions. He tries to show that perceptual symbolic expressions are capable not only of providing a plausible explanation of the correspondence between perceptual states and symbols, but also of performing various functions of non-modal symbol systems, such as expressing type-disjunction relations, providing category reasoning, performing symbolic combinations, and expressing propositions and abstract concepts. If a perceptual symbol system is not only a system of records of the physical world, but is also capable of providing explanations of the recorded objects or events and of establishing various inference relations between types and disjuncts, then functionally the perceptual symbol system is capable of functioning as a conceptual system.

According to our analysis, Barsolou's perceptual symbols are considered to have the following core properties.

1. Perceptual symbols are the neural unconscious expressions of the sensory-motor system

2. The representation of perceptual symbols is iconographic, constitutive and inadequate.

3. Perceptual symbols are multimodal (multimodal).

4. Perceptual symbols have an integrative function; the frames they construct can be combined into a simulation system and can make sense of the object.

According to Barsolou, perceptual symbols derive from neural activation of the brain's sensorymotor system. If unconscious neural encoding/recording constitutes the core content of expression, then this presupposes that the brain is able to employ neuronal constructions to make expressions about perceived objects, events and their properties.

The diagrammatic nature of perceptual symbolic expressions is mainly reflected in the fact that, on the one hand, they are partial and do not give expression to the overall perceptual experience; on the other hand, their storage is also partial and not holistic. For example, in a set of perceptual objects, selective attention extracts their spatial shape and filters out information about colour, texture, location, etc. The schematic nature of perceptual symbols dictates that they are insufficiently determined in their representation and that their neuronal encoding has a qualitative character. It is usually the referent of the perceptual symbol that is referred to by (designation) to determine what it expresses, e.g., whether it expresses a particular individual or a particular class. The adequacy of the same perceptual symbol to express a variety of referent objects often depends on the association between causal, situational factors and their referent objects in different contexts. An ordinary illustration of a skyscraper can symbolize either the Empire State Building, a skyscraper in a general sense, or a garment made in New York. In addition, higher neurons in the perceptual system are able to make qualitative encodings of information, i.e., they consider only specific spaces, frequencies, and do not make specific quantitative prescriptions.

Barsolou argues that perceptual symbols are not only applicable to all aspects of perceptual experience (e.g., the five senses of seeing, hearing, touching, and smelling), but can also operate at the level of proprioception and introspection. For example, one can acquire perceptual symbols about a conversation and store them. The perceptual symbols of different perceptual experiences are accordingly stored in specific modal areas of the brain.

Frames are integrated systems of perceptual symbols with corresponding attributes and values[2], whose attributes express the spatial relations of the object, they establish the overall shape of the object by depicting its unspecialized sub-regions, and whose values are the perceptual symbols that give content to the sub-regions in the later specialization process. The process of frame construction requires the satisfaction of certain structural and constraining relations, such as specific spatial, spatio-temporal, and causal relations, as well as configurational relations between attributes and fetches, or even purpose-based requirement constraints. Frames are able to organize themselves in the process of simulation of perceptual symbols and construct infinite simulations of particular categories; in other words, the structural expression of frames, on the one hand, is able to integrate into a system of simulations (equivalent to a conceptual system) and, on the other hand, is able to provide understanding of perceptual objects, and it is obvious that it has an important role in the expression of perceptual symbols.

The process of frame construction often begins with the extraction of information about the object, where the activated perceptual symbols extract the overall contours and partial composition of the object and integrate it into an object-centered referential frame. When subregions of important constituent parts are attended to, the perceptual composition about the spatial description is stored and connected to its associated content information (fetches). The spatial representation of the frame establishes the entire frame structure, while its content information fleshes out the entire structure.

Barsolou notes that the framework of a given category can be constructed accordingly to a simulation in which, first, the overall spatial representation is activated, followed by the activation of a series of collections of subregions, each of which establishes the strongest connections according to its content prescriptions. And in a simulation, the information processing is not limited to the extraction of frame information, but also includes the process of transformation, reconstruction, addition and subtraction of the extracted information.

Frames not only generate simulations but also provide possible structural support for the role of contextual concepts in the conceptual understanding process. On the one hand, frameworks need to be constructed on the basis of certain background knowledge; on the other hand, understanding based on frameworks needs to depend on the meaning of background knowledge. In frame construction, the core concepts cannot be specified independently of the background concepts, e.g., payment is determined relative to purchase. When the contextual concept changes, the understanding provided by the framework also changes, e.g., when the contextual concept changes from "person" to "tree", the conceptual understanding of "foot" also changes. The understanding of the concept of "foot" changes when the contextual concept changes from "person" to "tree". Because frames have attributes and values, and the same attribute can have different values, and thus different levels of structure are derived, frames provide possible structures for the process of constructing conceptual knowledge. For example, the event frame of "buy" provides the necessary background knowledge for understanding "pay", and the object frame of "person" provides the necessary background knowledge for understanding "foot". provides the necessary background knowledge for the understanding of "feet". Frames likewise provide naturalistic accounts of context-dependent meanings, e.g., the conceptual understanding of "foot" in which "person" is used as a contextual analogue is different from that of "horse" or "tree". "tree" as a background is obviously very different. When different perceptual symbols are extracted for different framing contexts, then the simulation of the perceptual object also changes.

The frames thus combine with the simulations they construct into a system of simulators. In this way, a simulator system also contains: the basic frame - the integration of perceptual symbols in a category instance - and the infinite simulations it constructs. It can be said that the simulation system resulting from the integration of perceptual symbols is the most important component of the perceptual symbol system. Barsolou argues that a simulation system is capable of anticipation, imagination and inference. If the information extracted from an object or event is integrated into an organized simulation system, then it is able to make a coherent simulation of the perceived individual based on the available information. For example, if a car is viewed from different directions, information about the car can be extracted and stored, and then integrated into a spatial organization system about the car. Then, when the car in physical state is not present, one can anticipate the organization of different parts of the car based on the information available. A similar simulation process can be performed for event sequences.

In Barsolou's view, a simulation system is functionally equivalent to a conceptual system in that the simulations it generates are relative to conceptualization, or possessing a way of interpreting or understanding concepts. A given simulation system expressing a particular class of objects or events is capable of generating an infinite number of simulations of a particular class, each of which provides a different way of understanding. For example, Simulation systems for "chairs" are able to simulate different chairs in different contexts, each providing a different understanding of the concept of "chair" in the category class. Barsolou argues that, given sufficient constraints, different subjects can have similar simulation systems and can simulate the same class of objects similarly. Even though people may understand concepts in different ways, as long as the simulations of the same objects all come from the same simulation system, then they can be seen as giving a specific realistic account of the same concept.

Barsolou argues that by considering concepts as simulation systems we can obtain a dynamic way of understanding concepts: if the simulation system of a category is able to provide a satisfactory simulation of the perceived object, then the object belongs to that category. If the simulation system is not able to provide a satisfactory simulation, the object is not a member of this category. [3] In addition, classification based on perceptual symbols has another important property: the knowledge that determines the classification has approximately the same expression as the way in which the perceived object is classified. For example, the perceptual analogue used to classify a chair is roughly analogous to the actual perception of a chair. The categorization of objects provides the possibility for related category reasoning. Once an object has been categorized, the knowledge associated with the category provides relevant foresight into the structure, historical development, and behaviour of the object. Clearly, this not only facilitates the identification of category members in subsequent contexts, but also provides relevant category reasoning through simulation. The large amount of information about categories contained in the simulation system can help us to model perceptual information beyond the categorized objects. In other words, the simulation system not only provides anticipation of the unperceived states, structures, and behaviours of the domain members, but also provides the corresponding domain inference for the absent domain members.

Thus, we can see that the simulation system and the generative nature of its simulations provide possible ways of constructing knowledge beyond the realm of experience. On the one hand, knowledge is essentially perceptual, and the constitutive expression of perceptual states about objects or events provides the corresponding expressive mechanisms and constraints for cognitive expression; on the other hand, neural expressions from the sensory-motor system - perceptual symbols - can be integrated into organized simulation systems whose basic framework expressions and the constructed infinite simulations provide plausible cognitive explanations for humans to construct knowledge beyond the realm of experience.

By extracting perceptions into diagrammatic compositions and integrating them into frames, the development of simulation systems is able to give expression to the types of objects and events in experience. In this way, Barsolou argues that perceptual symbol systems do not merely record the overall expression of perceptual experience, but are also capable of constructing knowledge about categories. Barsolou argues that for a perceptual symbol system to be functionally a conceptual system, it must demonstrate that it can embody the generative nature of a conceptual system and express propositions and abstract concepts. Clearly, if perceptual symbol systems can achieve the basic properties of non-modal systems, then they can support the assertion that knowledge is essentially perceptual and provide a rational account of the expression of knowledge based on intrinsic psychological mechanisms.

Barsolou argues that the complex simulations obtained through the integration of simulation systems by means of combination and recursion reflect the generative nature of conceptual systems; the matching of simulation systems with perceived individuals as a way to obtain expressive relations from types to diffeomorphs can be seen as propositional expressions; and abstract concepts are expressed over complex simulations between physical and introspective events.

Generativity is the ability to construct infinitely complex expressions from a finite number of symbols through combinatorial and recursive mechanisms, and Barsolou believes that perceptual graphical expressions of cognition have the same generative capacity. Figure 1 shows us the generative function of the perceptual symbol system. The pictures shown in Figure 1(A) are not

pictures of perceptual expressions or consciousness; they represent only the neuronal configurations activated by physical information. Each drawing is simply a metaphorical representation of the simulated system. Figure 1(B) expresses the analog system for spatial location. When the balloon appears above the cloud, attention is selected to focus only on spatial location and ignore specific objects, and the thick line indicates where attention is located.

The pictorial nature of perceptual symbols offers the possibility of generativity. During the formation of a perceptual symbol, a lot of information is removed and only the pictorial representation is extracted, while the generative process fills in some of the information that is filtered out. For example, the perceptual symbol for "balloon" expresses only the shape and filters out the colour, texture and other elements, but this information can be added back in. Then the balloon simulation can include a green balloon, a smooth yellow balloon, etc. The generation process can not only fill the illustrated area, but also replace, transform or even change the existing structure. The complementary nature of the diagrammatic features and content provisions of the perceptual symbol system allows the system to perform its relevant functions as a conceptual system.

In non-modal theory, theories of knowledge are able to make descriptions and understandings of situations through propositional expressions. A given situation can be constructed in an infinite number of ways and propositions. A proposition is not only able to express the truth value of an utterance, but also enables an understanding of various contexts through the communication of substance. Barsolou believes that perceptual symbol systems are also capable of mapping expressions from types to disjuncts. He points out that the mapping from type to diffeomorphism is constituted when the simulation system successfully establishes a connection with the perceived individual through simulation. This mapping intrinsically constitutes a propositional expression so that the perceptual symbol system can make simple propositional expressions. A simulation system expresses a true proposition when it can successfully connect with the perceived individual through the simulation, and a false proposition when it cannot successfully connect. When the simulation explicitly states that the absent individual is analogous to the absence in the perceived situation, it constitutes a negative proposition. Different understandings of the same situation can be achieved through different simulations. Obviously, all aspects of the scene can be chosen to make connections to the relevant simulation system, so that an infinite number of understandings of the scene are possible. Likewise, various hierarchical relationships between simulations and simulation systems clearly allow for hierarchically structured expressions of complex propositions.

Barsolou argues that perceptual symbol systems are also capable of directly expressing some abstract concepts. It is often assumed that abstract concepts are expressed by means of metaphors. But Barsolou argues that it is the direct expression that constitutes the basic understanding of a given conceptual domain, and that the expression made by metaphor is clearly indirect and inadequate. For example, understanding anger as like a liquid bursting out of a container can hardly constitute an adequate conceptual expression. Direct expressions of abstract categories, on the other hand, require the establishment of correspondence between them and concrete objects. Barsolou argues that the following three mechanisms are central to the expression of abstract concepts.

1. The ability of abstract concepts to be framed in the context of the sequence of events being modelled.

2. Selecting attention to the core elements of abstract concepts that can be highlighted in the context of events.

3. The perceptual symbols of the introspective state are crucial for the expression of abstract concepts.

According to the above mechanism requirements, in the expression of abstract concepts, the sequence of events that are relevant is first delineated, and the corresponding sequence of events is expressed by delineating the frame, while making a distinction between the physical and introspective states in the prescribed sequence, and identifying the core factors in the simulation, so that the perceptual symbols are also able to express some of the abstract concepts, e.g., "true" to be expressed. Obviously, the success of this expression implies that other abstract concepts can also be expressed in this way. It can be inferred that abstract concepts are also perceptual, and that they can be expressed on the basis of extended simulations of internal and external events in time.

Clearly, the perceptual symbol system is not merely a recording system, or a storage and processing of the overall picture. Functionally, it is equivalent to a conceptual system. Once established, the system is capable of making representations of types and can perform related category reasoning. They can be combined to construct simulations of experienced or never-experienced objects, and thereby gain an understanding of the world. The matching of correspondence from types to diffeomorphs intrinsically constructs propositional expressions, and the success of the correspondence with the otherwise corresponding assertion of "true" and "false". Barsolou argues that a perceptually based system of knowledge representation can perform the important functions required by modern cognitive science for a theory of knowledge. If perceptual expression can serve as the basic mechanism of cognitive expression, then a theory of the expression of knowledge can be obtained on the basis of the analysis of mental mechanisms. If this theory can provide a reasonable explanation and account of human cognitive expression and its processes, then the analysis of psychological mechanisms should not be excluded from understanding the theory, but should be an important part of our understanding of it.

In cognitive psychology research, the debate on the question of whether perception and cognition are continuous is often considered to be able to be significant for the determination of the observation-theory relationship. This paper argues that an analysis of the perception-cognition relationship based on expression over expression can provide a plausible explanation for this issue.

According to the expression theory of perceptual symbols, Barsolou argues that cognition is essentially perceptual and that there is no strict dichotomy between cognition and perception. The reason he gives is that cognition and perception share the same neural expression system and perform related symbolic operations through the same expression mechanisms. In this way, perception is no longer a cognitive inaccessible module system; the upward information of perception activates cognition and participates in the information processing of perception, and the dichotomy between perception and cognition can only be an artificial division without adequate basis. Obviously, if it can be shown that the same mechanisms of expression are capable of serving not only as the basis for the expression of perception but also of cognition, then it is difficult to make a strict dichotomy between perception and cognition in terms of expression. Of particular importance is the fact that if the expressive system constructed by perceptual symbols is able to give expression not only to the object of perception but also to the expressive function of the conceptual system, then, in a certain sense, the continuity between perception and cognition is also affirmed. The corresponding analog system can be obtained by activating the perceptual symbols in the framework and providing the corresponding understanding of the perceptual object. It thus appears that if the cognitive process is an expressive process, and this expressive mechanism has a conceptual function, then in terms of the information process, it also means that information from the higher processing system is involved in the perceptual processing from the top down, which provides a fine expression-based account of the downward process into the perceptual processing. By extension, it can also be argued that the process of expression-based mechanisms for theoretical penetration of observation is provided.

Strong empirical evidence showed that perception is the Muller-Leyell illusion when it is not accessed by cognition. In that illusion, two straight lines of the same length are made to appear different because the arrow at the end is facing a different direction. Even knowing that the straight lines have the same length does not change one's visual reflection. In this visual case, it is clear that background beliefs are not capable of influencing people's visual experience, and Barsolou argues that this does not mean that cognition is inaccessible to perception. It is simply that in the illusion, the upward information from the external stimulus conflicts with the downward information that the perceiver has, and the upward information temporarily gains dominance, so that the impression of the visual illusion is maintained despite the fact that people know that the line segments are the same length. Studies of discourse recognition have similarly shown that when upward and downward information conflict, the upward information gains dominance. Although downward processes are able to enter the discourse process, when there is a situation where upward and downward information contradict each other, the downward information is replaced by the upward information. For example, in an utterance such as "The cowboy climbed", one would presume, based on semantic and syntactic knowledge, that the utterance is "The cowboy climbed into the saddle", but when the sentence ends with "bathtub ", i.e., "The cowboy climbed into the bathtub", then the information about the "bathtub" gains dominance and activates the relevant processing.

It thus appears that although the sensory-motor system is cognitively accessible, the downward process is not always activated and involved in the information processing of that process. Apparently, in the case of conflicting information, upward information usually prevails, and when no upward information process is present (e.g., imagination), downward information enters perceptual processing, and in the case of mutual coordination between the two, downward processes can enter perceptual processing and complement upward processes in an imperceptible way, i.e., cooperate with each other to accomplish task processing. This explanation is reasonable in light of studies of the neural mechanisms of the brain. The upward information that gets activated, gains a higher weight value, and when in conflict with the downward information, the initially set experience weight will largely tend to activate the upward information, then it can gain dominance and inhibit the activation of the downward information by virtue of its higher activation and larger weight value. Of course, in many cases, it also depends on the role of causal and contextual factors.

Barsolou has provided a detailed analysis of the mechanisms by which upward and downward processes interact. It is clear that upward and downward processes are capable of acting independently in different processes. The mechanism of expression of sensory-motor areas is able not only to express the perceived objects but also to provide them with relevant conceptual understanding in their absence. In this way. In perception, they are able to express physical objects; in imagination, they express objects that are not present; in conceptual understanding, they likewise provide expression for objects that are not present. Barsolou argues that in each of these three processes, upward and downward processes act independently, as in imagination and conceptual understanding, only downward processes occur, and they activate sensory -motor expressions, whereas purely perceptual processes need only bottom-up processes to be able to activate the corresponding expressions.

At the same time, Barsolou notes that the four cognitive processes of implicit memory, filling-in, anticipation, and comprehension also employ sensory-motor expression mechanisms, but they demonstrate a subtle and complementary combination of upward and downward processes, which exemplifies the continuity between cognition and perception. In implicit memory, perceptual memory enhances the perceptual speed of familiar examples. For example, the memory acquired by seeing a particular chair will contribute to the subsequent perceptual response to that particular chair. Numerous studies have shown that this memory has strong perceptual characteristics. Moreover, the imagination of a particular object also contributes to the perception of that object, which implies that they share the same basis of expression. Crucially, implicit memory, located in the sensory-motor areas of the brain, is able to reduce brain perceptual activity for a familiar object accordingly. In this way, the expressions that constitute implicit memory apparently have the same representational system as the object perceptual processing. In the filling process, perceptual memory fills in the gaps of upwardly directed information. As in the phonemic recovery experiments accompanied by noise interference, knowledge about words can generate conscious auditory experience to aid recognition. barsolou notes that the process employs more low-level feature-awareness mechanisms, which means that they share the same representational system as sensory-motor. The perceptual anticipation process allows the cognitive system to use past experience to provide a simulation of the object's future behavior. Moreover, people's beliefs about perceptual objects can influence their understanding of what is happening. Thus, it appears that upward and downward processes together construct meaningful perceptions.

This paper argues that if perception and cognition share the same neural expression system, then they are expressively continuous. According to Fodor's modular view, modules may have their own expressions and computations and have a clear demarcation line with cognition, so clearly perception is not continuous with cognition. Both Fodor and Barsolou provide different empirical evidence to support and explain this. There is no conclusive empirical evidence to support either side of the debate on whether cognition and perception have different mechanisms of expression. However, it is argued that Barsolou's explanation of the mechanism of the relationship between upward and downward information is reasonable and can be reconciled with the neural mechanism explanation. However, obtaining a rational understanding of the world is not a purely empirical or rational process, and the complementarity and interaction of upward and downward processes provide the possibility for rational understanding.

By examining Barsolou's theory of perception-based knowledge representation, this paper argues that it is possible to draw on this theoretical analytical tool of cognitive science from which the binding mechanisms of cognition acting on perception can be revealed. In the above analysis in general, we get the following important implication.

1. the generation of expression is constrained by constraints derived from perceptual processes.

2. theories of expression about knowledge promise that we can make sense of the world, and this understanding is constrained accordingly.

People are able to generate internal frameworks of expression based on the structure and properties of the inputs and outputs about the external world. Artificial Intelligence Research in this area provides us with a mechanistic analysis of external modelling. For example, a model network, called NETtalk, is able to convert English letters in written form into English pronunciations. In this experiment, it was not necessary to provide the network with English pronunciation rules in advance, but only to provide the network with a certain set of letters and phonemes for language training, after which the network was able to pronounce not only the letters correctly, but also letters beyond the training set. It can be inferred from this that the network makes an intrinsic representation of the structure of the information input and its features, and forms a certain structure of expression.

Barsolou's perceptual symbols provide a more intuitive understanding of the acquisition of expression. The sensory-motor system is the basis for the occurrence of perceptual states, and unconscious neural expressions based on the sensory-motor system form the basis for the expression of perceptual symbols. People acquire various perceptual experiences through contact with the world and thus generate representations of the world. Not only do perceptual symbols reflect the neuronal patterns activated during perception, but the structure of their modal expressions is similar to that of perceptual states; in other words, there is a correlation between perceptual states and expression generation. These extracted perceptual states are used as symbols toperform the corresponding cognitive functions and constitute the graphical representation of the perceived object. Obviously, the input of perceptual information forms the basis of expression generation, and its form and structure have certain constraints on knowledge expression. Thus, the paper argues that the form and structure of perceptual information constrain our representation of the world. Of course, this does not mean that all expressions of the world are necessarily based on perceptual expressions, but that the latter have a binding effect on the former in terms of form and structure.

Intellectual expression, on the one hand, allows us to make sense of the perceived world and, on the other hand, constrains this process of understanding so that they are not entirely arbitrary and subjective.

In Barsolou's perceptually based knowledge representation, the constitutive character of the graphical representation of perceptual symbols makes it not only unnecessary for perceptual symbols to make a representation of a particular object, but this representation is insufficiently determined, which opens up the possibility of infinite simulations of concepts by frameworks and simulation systems. Perceptual symbols stored in memory can be integrated into frames with a structural hierarchy. The properties and fetches of the frames connect the representation of spatial relations with the representation of subregional content and allow the construction of simulations about perceptual objects. The simulation system constituted by frames and simulations is functionally equivalent to a conceptual system, so that the simulation system is able not only to make representations of types, but also to reason about categories accordingly. The perception of an individual will activate the best-fit simulation system and allow the establishment of a mapping from types to diffeomorphs. The multiple correspondences between types and disjuncts provide us with knowledge about categorization and categorization methods. Because the simulation system is able to make schematic simulations for the perceived individual and to supplement them with relevant category inferences, a simulation system based on perceptual representations can make representations and understandings of perceived objects or events, and can make relevant inferences and simulations of objects that are not perceived or experienced. Clearly, the integration of perceptual symbols allows us to make possible conceptual understandings of different ways and aspects of the known and unknown world. The integration of simulation systems in combination and recursion makes infinite simulations possible. The association between introspective state symbols and the external physical world provides possible implementation strategies for the expression of abstract concepts. Through simulation systems similar to conceptual systems, and the infinite simulations they generate, it can be assumed that multi-modal, multi-level, multi-structured understandings and knowledge of the world can be made.

Of course, the simulations constructed by the concept/simulation system for the perceived object need to satisfy certain constraints on the basis of which a reasonable understanding of the world can be made. The type-differential mapping established by the mapping between the simulation system, the simulation, and the perceived object enables an intrinsically simple expression of the proposition. The satisfaction of the mapping relation between the simulated system and the perceived object that intrinsically expresses the truth/falsity of the proposition. Clearly, while the simulation system is capable of constructing a simulation for the perceived object, this simulation matching is not entirely subjective and arbitrary. Only after the simulation system has constructed a successful simulation of the perceived object can it be said to be able to make sense of the world in some sense. Barsolou argues that there is reason to believe that cognition is essentially perceptual. According to the perceptual symbol system, human cognition can be understood as essentially perceptual. Cognition and perception share the same expression system at the cognitive and neural levels. There is no strict division between perception and cognition; they are interactive and continuous, and the theory of knowledge based on perceptual expression reflects the characteristics of perception. At the same time, Barsolou points out that people's understanding of concepts, i. e., simulations, is also incomplete, approximate, not fully real, and biased, where genetic mechanisms have a strong constraining effect on the construction and operation of the simulation system. When the simulation constructed by the simulation system conflicts with the perceptual experience from the perceptual object, the upward information usually prevails, suppressing the downward information and playing a decisive role. In a sense, this makes a strong constraint for empirical observation on belief acquisition. In contrast, in the absence or incomplete presence of upward information, downward information processes (e. g., imagination, conceptual expression) play a dominant role. When the two are coordinated, they can work together to accomplish the task. Clearly, it is not a purely empirical or rational process to gain a rational understanding of the world. The complementarity and interaction of upward and downward processes provides the possibility for human cognition. Thus, on the one hand, the analogy between perceptual symbols and perceptual states provides a constraint on the nature of knowledge expression; on the other hand, a conceptual system built on top of perceptual symbols needs to satisfy the constraint of successful simulation of the perceptual object in order to be able to make a reasonable understanding and knowledge of the world. Thus, through the analysis of different theoretical expression mechanisms mentioned above, this paper argues that the process of cognition acting on perception is constrained, on the one hand, the structure and form of the input has constraints on the cognitive expression, on the other hand, the access of cognition to perception is not arbitrary and completely subjective, the process of information extraction and configuration needs to be matched between the analog construction and the stimulus input, and this matching requirement needs to be coordinated with the structural and constraining relations in the frame expression. This matching requirement needs to be reconciled with the structural and constraint relations in the frame representation, which provides a strong support for expression-based cognitive constraints. In this way, an analysis of the relationship between perception and cognition based on expression above provides not only an intrinsic mechanistic account of the penetration of theory into observation, but also a plausible support for the reliability of observation through the cognitive constraints to which expression is subject in its generation and understanding. If this support is adequate, it will provide a highly illuminating dimension of reflection for examining the observation-theory relationship based on above expression.

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