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RESEARCH

Fodor, Bruner and Beyond

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Abstract
This article presents an in-depth conversation with Peter Hagoort, a leading cognitive neuroscientist and director of the Max Planck Institute for Psycholinguistics. The interview explores the contrasting paradigms of Jerry Fodor and Jerome Bruner, focusing on their differing conceptions of the mind, including modularity, perception, and the role of cognitive processes. Hagoort reflects on Fodor's modularity theory and Bruner's New Look in Perception, examining their influence on his own research, particularly the language marker hypothesis, which highlights the symbolic and flexible nature of human internal models shaped by language. The discussion further addresses Fodor's critique of relativism, his scepticism about cognitive neuroscience, and the relevance of these foundational ideas to contemporary questions in cognitive science and artificial intelligence, including the distinctions between human cognition and large language models. Through this dialogue, the article revisits key debates in cognitive science while situating them within current research and theoretical developments.

Introduction

What does it mean for the mind to be modular? Can perception truly be independent of our thoughts, experiences, and culture? Or are our internal models so intertwined with the world around us that they shape what we see, hear, and feel? These are just some of the questions explored in this conversation with Peter Hagoort, a cognitive neuroscientist whose research bridges the boundaries of language, neuroscience, and philosophy. Reflecting on the ideas of Jerry Fodor and Jerome Bruner—two towering figures in cognitive science—Hagoort sheds light on their contrasting views and their enduring relevance to how we understand the human mind today.

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The conversation originates from a workshop held at the Max Planck Institute for Psycholinguistics in November 2023. During the interview, Hagoort reflects on Fodor's influential theory of modularity, which emphasises the autonomy of specialised cognitive systems, and Bruner's "New Look" approach, which highlights the integration of perception with cognition and action. Emerging in the mid-20th century, the New Look approach challenged traditional views of perception as a purely bottom-up process, arguing instead that perception is shaped by factors such as motivation, expectations, and prior knowledge. This perspective was pivotal in demonstrating how cognitive and social contexts influence even basic sensory processes.

Fodor's and Bruner's paradigms represent two distinct perspectives on how the mind processes and organises information, and Hagoort explores their implications for his own research, including his language marker hypothesis.[1] Hagoort also shares his intellectual journey, describing a gradual shift from a Fodorian modular framework toward a perspective more aligned with Bruner's emphasis on the interplay between internal models and sensory input. Alongside this, he offers a critical analysis of key debates, such as the modularity of perception, the influence of cultural and cognitive factors, and the relationship between neuroscience and cognitive science.

This interview revisits foundational ideas in cognitive science, offering insights into how they continue to shape our understanding of the mind and its mechanisms. By revisiting these paradigms in the context of modern developments in neuroscience and artificial intelligence, Hagoort sheds light on both the enduring significance of Fodor and Bruner's ideas and the ways they intersect with contemporary research challenges.

Interview

Could you explain the difference between Fodor's and Bruner's views of the mind? How have they been seminal and inspiring as paradigms, for instance, in relation to your language marker hypothesis?

In 1983, Jerry Fodor published The Modularity of Mind (Fodor, 1983), a monograph that became highly influential in cognitive psychology. It echoed the theoretical ideas of faculty psychology proposed by Franz Joseph Gall (1758–1828). Fodor argued that the human mind consists of specialised systems for specific cognitive functions. In other words, it is made up of a number of independent, relatively autonomous computational systems that collectively form its basic infrastructure. These systems are linked to distinct neural structures.

Fodor's view aligns with an idea proposed by Noam Chomsky, who wrote: "We may usefully think of the language faculty, the number faculty, and others as 'mental organs,' analogous to the heart or the visual system or the system of motor coordination and plan-

[1] To clarify to the reader, the language marker hypothesis suggests that human internal models of the world are significantly shaped and enriched by language, giving them a symbolic and elaborate character. Unlike the internal models of other species, which are based primarily on sensory input and basic learning mechanisms, human internal models incorporate linguistic structures that allow for more abstract and flexible engagement with the world. While this linguistic richness may sometimes come at the expense of perceptual accuracy, it provides humans with unique cognitive advantages, such as the ability to reason, plan, and communicate in complex ways. This hypothesis highlights the pivotal role of language in shaping the human mind and its interaction with the environment.

ning" (Chomsky, 1980, p. 3). Each of these systems operates according to its own organisational principles.

A key feature of Fodor's modularity theory is informational encapsulation. This means that, at least initially, sensory input cannot be influenced by expectations or other forms of top-down information. For Fodor, this is crucial for ensuring the veridicality of perception. For instance, if a lion were to enter your bedroom—an improbable event—you would still need to trust your sensory input and run for your life. Additionally, Fodor argued that modularity enables faster processing; if all background knowledge interacted with sensory input, processing might become too slow.

Fodor illustrated informational encapsulation with the Müller-Lyer illusion. In this illusion, participants perceive two line segments of equal length as differing in length when connected to end segments with different angles (sharp versus wide). Even after measuring the lines and knowing they are equal, participants cannot change their perception of the segments' lengths. However, contrary to Fodor's claims, research has shown that in some non-Western cultures, such as among hunter-gatherers from the Kalahari Desert, the illusion does not occur—they perceive the segments as equal. This suggests that cultural context influences perception, and the visual input system is diachronically penetrable (see McCauley & Henrich, 2006, and Segall et al., 1966).

Jerome Bruner, in contrast, emphasised the continuity of perception with cognition and action. He demonstrated how mental factors influence visual perception. In a famous study, Bruner and Goodman (1947) showed that poor children overestimated the size of larger coins compared to affluent children. This work inspired a new approach to perception, later known as "The New Look in Perception." In this view, input systems are cognitively penetrable.

In my own research, I gradually shifted from a Fodorian modular perspective to a view more aligned with Bruner's emphasis on the integration of perception and cognition. This shift coincided with a broader paradigm change in cognitive science. The current dominant paradigm conceptualises the mind and brain as a prediction machine, much in line with ideas originating from Kant and Helmholtz. This view holds that our interactions with the world are not purely input-driven or based solely on bottom-up sensory input. Instead, we engage with the world through internal models that guide our perception by making predictions about incoming sensory information.

When sensory input conflicts with our internal models, prediction errors occur, prompting potential updates to the internal models. In my language marker hypothesis, I have argued that language gives our internal models a much more elaborate and symbolic character compared to those of other species. This linguistic richness, while sometimes at the expense of perceptual accuracy, enables humans to engage with the world in far more flexible and abstract ways than species without such sophisticated internal models.

Fodor explicitly attacked Bruner's approach to perception, and it seems that Bruner did not consider the criticism. Could you comment on that?

In his 1985 paper, Fodor explicitly addressed the opposition between *The Modularity of Mind* and Bruner's *New Look* in cognitive science. According to the modularity theory, perceptual processes are computationally isolated from much of the background knowledge to which cognitive processes have access. Fodor criticised the *New Look* approach for making perception dependent on higher-level cognitive processes, thereby compromising the autonomy of the input systems that process sensory input.

Bruner never responded publicly to Fodor's critique of his *New Look* account of perception. Papers published in *Behavioural and Brain Sciences* (BBS), like Fodor's, allow other researchers to comment on specific articles. Fodor's 1985 BBS paper attracted no fewer than 25 commentaries, along with his replies to the issues raised. Bruner, however, was not among the commentators.

When I examined Bruner's personal copy of *The Modularity of Mind* in the Bruner library at the Max Planck Institute for Psycholinguistics in Nijmegen, I found that he had underlined a number of sentences in the first 13 pages, but the rest of the book contained no notes or markings. My conclusion is that Bruner never read the entire book, focusing instead on only the first few pages. The reason seems clear: by the time *The Modularity of Mind* and the BBS précis appeared (1983–1985), Bruner had shifted his focus to entirely different research topics, as described in his autobiography *In Search of Mind* (1983). He simply did not engage with debates he had left behind years earlier.

What does Fodor mean, in his 1985 article, by the predictive function of the recruitment of background information? How does this connect to his criticism of what he calls the "relativism" of theories of mind, such as Bruner's view that in the brain "everything affects everything else" and "everything is plastic"?

In his 1985 BBS article, Fodor wrote: "The thing is: I hate relativism. I hate relativism more than I hate anything else, excepting, maybe, fibreglass powerboats. More to the point, I think that relativism is very probably false. What it overlooks, to put it briefly and crudely, is the fixed structure of human nature… If there are faculties and modules, then not everything affects everything else; not everything is plastic. Whatever the All is, at least there is more than One of it."

According to Bruner's *New Look in Perception*, background information (such as wealth) can influence perception. In this view, background knowledge partially determines what one perceives, sometimes at the expense of perceptual accuracy. Fodor objected to this idea, arguing that background information cannot reliably predict what a person will perceive. As he put it: "…the issue is whether the recruitment of background information is predictive. Modularity theory says almost never. *New Look Cognitivism* says quite a lot of the time" (Fodor, 1985, p. 5). Fodor's position reflects his belief that modularity ensures perceptual processes remain insulated from higher-level cognitive interference.

In your talk, you mentioned that you interviewed Fodor in 1986. What was the subject of that interview?

In June 1986, Fodor visited Nijmegen as the speaker for the annual Nijmegen Lectures, a lecture series showcasing leading figures in cognitive science and linguistics. At the time, I was a student at Nijmegen University, where I was also running a series of book publications on topics in cognitive science and the social sciences. For an issue on the topic of mind, computers, and the arts, we interviewed Fodor in my modest student apartment.

As he was leaving, Fodor nearly fell down the stairs—Dutch houses are notorious for their steep and narrow staircases—which would have been a disaster for cognitive science and for me!

During the interview, we discussed Fodor's philosophical views and his modularity thesis. Topics included his Representational Theory of Mind, Intentionality, Functionalist Psychology, Perspectives for Artificial Intelligence, Simulation vs. Emulation, and *The Modularity of Mind*. The interview, along with an introduction to his work, was later published as the chapter *Minds*, *Machines and Modules* in Hagoort & Maessen (1986). Upon rereading it, I was struck once again by the clarity of Fodor's thinking.

What was Fodor's position on the role of cognitive neuroscience in understanding the structure of the human mind? What is yours?

Fodor was highly sceptical of the contribution of cognitive neuroscience. In 1999, he wrote in the *London Review of Books*: "If the mind happens in space at all, it happens somewhere north of the neck. What exactly turns on knowing how far north?" This view stemmed from his functionalist stance and the related claim of multiple realisability, which posits that the laws governing the mind are independent of, and irreducible to, the laws governing the biological or physical medium that implements the mind (in our case, the brain). As a result, Fodor believed that the brain reveals little about the organisation of the mind.

I disagree with Fodor on this matter for two reasons. First, the human brain is currently the only known medium for the human mind. As someone interested in the human condition, I see no reason not to be equally interested in the brain. My own PhD research focused on aphasia, a deficit caused by brain damage, demonstrating the close connection between brain and mind.

Second, on a more principled level, I believe that while the mapping between mind and brain may not be straightforward, there is a lawful relationship between the two. Understanding the brain has, in my view, sharpened cognitive models and deepened insights into the organisation of the mind. This is likely why Fodor's extreme scepticism is rarely shared today.

How do Fodor and Bruner's conceptions of the mind illustrate the differences between the architecture of the human brain and that of large language models (LLMs)? Can one think of the internal model built out of statistical regularities as the cognitive background influencing new sensory data?

LLMs, such as GPT, are not designed to reflect the architecture of the human brain; they are fundamentally different. These models are useful for quantifying information relevant to language, based on large text corpora, using measures from information theory, such as surprise and entropy. They can be valuable tools for decoding patterns of brain activity in relation to linguistic information like semantics, syntax, and phonology.

However, Fodor and Bruner were concerned with the *mind-world relationship*. LLMs are not. These models are trained on large text corpora, and the extent to which these corpora reflect the actual statistics of the world is unclear. In this sense, LLMs are akin to postmodern views, which emphasise intertextuality and question the possibility of referring to real-world states of affairs outside of language. One might even call GPT-3 "Derrida-2."

In short, LLMs reflect the statistical regularities of texts, while internal models, as conceptualised by thinkers like Kant and Helmholtz, embody certain built-in features that do not directly mirror the statistical structures of either the external world or textual corpora. Instead, they reflect the internal organisation of the brain and its sensory apparatus.

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