Linguistics based modularity and the structure of the cognitive field

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During the last thirty years, roughly corresponding to the time I have known Martin Prinzhorn, a rather dominant approach to the mental organization of language has been the modular one. My intellectual contacts with Martin in a peculiar way always centered on this issue, both in linguistics and in the broader issues of the organization of the mind. The first time we talked about these issues came after the publication of Fodor's (1983) vision of the modular organization of the mind. Fodor basically proposed that most of the human mind is organized into specific systems specialized for certain types of information that are domain or content specific, like a perceptual 'input system'. This is a mental extension of the idea that vision deals with light, hearing with sound etc., familiar from 19th century physiology.

In a little paper I wrote about Fodor (Pléh 1985) – much discussed with Martin – I emphasized that it is important to remember that this entire issue is related to multilayer level ideas about perception already introduced by Helmholtz. According to Helmholtz perception is a two level process. On the lower level, there is an automatic (modular) form of reaction in the nervous system that does not result yet in representations, which only emerge in a higher level of interpretation. Helmholtz combined the nativist inspirations from his teacher Johannes Müller with strict and extended empiricist principles. In this view, the basic qualities of sensation are provided by the structure of the sensory apparatus. "The qualitative difference of pitch and quality of tone is reduced to a difference in the fibers of the nerve receiving the sensation" (Helmholtz 1875, 148). This is the level that would be referred to by Fodor (1983) as the level of transducers. Higher organizations, however, are all results of experiential factors according to Helmholtz.

The first innovation of Fodor was that in his vision higher organizations are also prefabricated along the lines of his *Language of Thought* (Fodor 2008). His other innovation was in going against a belief held by the entire tradition of perceptual learning research, the belief in an automaticity of processing, with no intervention from 'knowledge' and inference, as Helmholtz has claimed. Hacker (1995) in a detailed philosophical critique, takes issue specifically with the notion of inference as used by Helmholtz. Hacker basically claims that Helmholtz committed several category mistakes in his treatment of sense data, sensation and perception. One of the faults he finds in Helmholtz is the incor-

rect use of the notion of inference. Inferences, according to Hacker, only work over propositions, and the unconscious inference schools all the way down to Helmholtz tried to base mistakenly inferences on sensations.

In the recent modular theories, some aspects that Helmholtz would have claimed to be higher based are also presented as specialized systems, specialized in the sense of being automatic, and sometimes postulated to be innately organized. A picture of the architecture of the mind is proposed where specialized systems would deal with language, faces, melodies etc. (Fodor 1983). This attitude has led to several different proposals regarding the role of knowledge in information processing. Fodor and his followers listed an entire series of features that would characterize modular processing: fast work, automatic, mandatory (reflex-like) processing, encapsulation, domain specificity, and innateness. In a peculiar way, Fodor takes over the inferential metaphor of Helmholtz, while he criticizes the perceptual learning tradition based on Helmholtz. For Fodor (1983, 42), inferences are from proximal stimulus configurations to the distal organization of the external world. At the same time, this architectural model would pack general knowledge related pragmatic aspects of language use under the rubric of the mushy General Problem Solver component of the architecture, thus extracting it from considerations of modularity altogether.

Many discussions in empirical studies of cognition, like developmental revisions of modular theses, and the debates about how to treat the impact of knowledge on processing in a modular frame, are pertinent to the issue of whether these factors are of equal importance. Coltheart (1999) in a survey proposed that they are not of equal importance. In his view, the original modular proposal was too restrictive. The ongoing debates concentrate on whether something is under a top-down influence or not showing signs of an innate organization, and in the case of top-down effects and effects of experience, the processes involved should be excluded from being modular. Coltheart proposed a rethinking, where not all aspects should be treated equally: the definitive feature of modularity would be domain specificity: "a cognitive system is domain specific if it only responds to stimuli of a particular class" (Coltheart 1999, 118), rather much like Helmholtz proposed 150 years ago. All the other features would be considered to be secondary compared to this core one, as Győri (2006) also pointed out for developmental studies.

Mandatory processing and encapsulation would not mean an exclusion of all top down effects from modular systems. They would only imply that a module-based processing is impossible to disengage. Likewise, following Coltheart, the issue of innateness and "rigid" cerebral localization would not be crucial to modularity: one could very well imagine, as Karmiloff-Smith (1992) did, arriving at modules as the result of a process of modularization rather than starting off with them. In the same way, one could very well imagine, according to Coltheart, having modular systems with more distributed processing rather than strictly and narrowly localized processing. The central issue remains domain specificity.

Interestingly enough, this would satisfy many of the proponents of an overall modular approach (referred to by Fodor as the massive modularity thesis) who identify modularity with domain specificity. It would not satisfy, however, Fodor, who claims that domain specificity tends to be circular when it talks about 'reactions to a stimulus class' (Fodor, 2000, 113), or else, it navigates on uncertain waters when it tries to exchange the notion

of modularity related to types of information with a notion of processing modularity (*ibid.*, 55-62).

Domain specificity would be too loose a criterion with no consequence regarding other features of modularity. For Coltheart (1999), however, this is the essential point: modularity (understood as domain specificity) would stand even without claiming innateness.

The classical modular view regarding language understanding started by claiming that context, even syntactic context, and frequency have no immediate effects on word recognition. All the classical data to the contrary could be interpreted as the results of post-perceptual guessing strategies, which only have a *post hoc* effect modulating the ease of word use. Similarly, in this view there is no on line interaction between the lexical, syntactic and semantic components of understanding. All of them operate as self-contained systems. Interactions only appear on the level of their outputs, over the results of their computations.

1.   Ambiguities of linguistic modularity

For about three decades, we have been trying to test these ideas regarding the supposed automaticity and encapsulation of language processing using Hungarian morphological ambiguities. Gergely and Pléh (1994) used the multiple marking of Hungarian noun phrases and the combined ambiguity of some Verb/Noun stems and verbal and nominal affixes between some of the forms like those in (1).

(1)   *fej* N: head, V: to milk
        fej-em N: my head, V: I milk it, transitive, definite
        fej-sz only Verb meaning: you milk, intransitive, indefinite

In a cross-modal lexical decision task, where subjects listened to sentences and then had to name (read) a presented word, the target words were either related in meaning to the critical word in the sentence, or they were related to the meaning of the word that was irrelevant in the given sentence, as in (2).

(2)   Elhatároztam, hogy megnézlek, ahogy a tehenet FEJED.
        'I decided to watch as you MILK (YOUR HEAD) the cow.'
            relevant: *tejed* 'your milk'; irrelevant: *nyakad* 'your neck'
            control: *képed* 'your image'

Basically, we found support for strong automatic processing with ambiguous words. The stems, the ambiguous suffixed words and even the target words following a disambiguating suffix showed facilitation of 40-50 ms compared to controls, i.e. unrelated words. So modular processing was supposed to work independently of the grammatical disambiguation possibility. However, our later studies showed serious constraints on this automatic activation of both meanings. Thuma and Pléh (2000) using both noun interpretation and verb interpretation priming sentences showed that automaticity was only valid for noun targets. It seems to be that in Noun/Verb ambiguities the noun meaning is activated even if the grammatical analysis should in principle cancel it. With further studies controlling

for frequency effects – since in the above cases the noun meaning was always more fre-
quent – Thuma had shown that though one is entitled to differentiate between a fast and
slow cycle, "the fast cycle is also sensitive to grammatical features. The issue of modular
processing is thus related to the literature on automaticity-consciousness-metacognition
and the issue of slow and fast in processing" (Pléh & Thuma 2013, 65) Contextually ir-
relevant meanings continue to be active for longer times – few hundred ms – if they do
belong to the dominant, more frequent meaning of the word. There is sensitivity to long
term effects with an apparent insensitivity to immediate contexts. This seems to be re-
lated to the issue of consciousness. Irrelevant meanings are active in the 200-400 ms
window. During this time the connection with sentential level and background informa-
tion and the accompanying suppression has not yet taken place. This window is similar to
the one proposed by Dennett & Kinsbourne (1992) for conscious integration. Meunier &
Longtin (2007) believe that in the early stages of processing automatic morphological
analysis applies to every form that is decomposable into legal morphological forms in the
given language. This would be followed by an integration of elements, which also entails
a mutual inhibition between incompatible elements. The ease of combination might be a
factor in the 'survival' of word form representations. The maintenance of the ambiguous
form may locally support processing. The entire issue of this kind of modular processing
becomes an issue of relating long term effects (dominant meaning) and short term con-
textual and grammatical processing information where the long term information is used
first. This questions the 'blind processing' commitment of traditional modularity theories.

2.   Modularity and ambiguities in the visual arts

The modular approach as such is not limited to language: it is a claim of general validity.
In my vision, this is the aspect that connects the two seemingly separate modules of the
mind of Martin Prinzhorn, the linguist, and Martin Prinzhorn the art theorist and curator.
Thanks to him I was forced to consider the modular vision of art several times (Pléh 2008
presents these excursions).
     The application of the concept of modularity to art is itself multiply ambiguous. One
can talk about the modularity of the art in terms of autonomy with regard to social pres-
sures. One could also interpret autonomy as related to the functional independence of art.
And finally, architectural autonomy. "Roughly conceived, this idea would suggest two
possible, but necessarily contradicting ideas about mental architecture and the cognitive
foundations of art: (1) Art is a special form of cognition which is relatively independent
of other forms of cognition. Therefore, the unfolding of art (art history) is a saga about
the recognition of this autonomy. (2) Art is part of a decomposed view of cognition. Art
might relate to different aspects of experience, not necessarily to one single aspect.
Therefore, the history of art is a history of experimenting about which aspects of (visual)
cognition to connect to artistic expression" (Pléh 2008, 240).
     This second architectural interpretation of modularity appears in the neuroscience in-
terpretation of art and is again related to ambiguity. In the ultra-modular view professed
by neuroscientists, in particular by Zeki (1999), visual representation would be the com-
posite result of a large number of modular processes. Art in this vision would be a series
of attempts to render different aspects of the variety of this multitude of processing.
There would be no privileged type of representation for art to grasp. The artist would be

peculiar in the sense that the artist tries to grasp processes and representations that are normally not available to conscious experience. Otherwise, however, art and science would be doing similar things: trying to decompose the complexities of visual experience. "[A]rtists are in some sense neurologists, studying the brain with techniques that are unique to them, but studying unknowingly the brain and its organization nevertheless" (Zeki 1999, 10). Art would thus be the unfolding of a bioprogram, with its special, if you like, autonomous methods.

In this process, ambiguities play a central role. "Some artists such as Arcimboldo and Salvador Dali deliberately made of ambiguity an artistic form. It is rather the capacity of multiple experiences, even though we are conscious of only one at any given moment, that a stimulus can provide" (Zeki 2004, 291f.). Zeki especially gives tribute to Dali for his facing ambiguities as essential aspects of the world itself. Dali "was using the capacities of the visual brain to perceive two or more images in a single painting, which he subsequently interpreted as a delve into the sub-conscious? […] I am inclined to the view that Dali actually accepted contradictions because he did not consider them to be contradictions, but rather the inevitable consequence of our psychological make-up, which I interpret to be the constitution of our brains. Dali, by contrast [with the Surrealists], wanted to maintain the apparent contradiction, or opposition, between the rational and the irrational, not merge one into the other" (Zeki 2017, 9, 12).

Thus, just as Martin Prinzhorn does with his complex interests and activities, the mind, while modular, teaches us with its complex workings to tolerate ambiguities and cross-talks across disciplines and domains.

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