RUCH FILOZOFICZNY
LXXV 2019 2

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Contextual Facilitation of Colour Recognition: Penetrating Beliefs or Colour-Shape Associations?*

DOI: http://dx.doi.org/10.12775/RF.2019.029

According to Jerry Fodor[1] and Zenon W. Pylyshyn,[2] the early visual system – whose function is to produce primal sketches of distal layouts – is cognitively impenetrable. To call it cognitively impenetrable or informationally encapsulated is to maintain that its operations cannot be affected by what the subject beliefs, expects and desires.[3] That is to say, the computational process that mediates the production of primal sketches has no access to the subject's central database or his background beliefs. Rather, the only non-sensory information the system can use comes from its private or local database. In other words, it is

* The work on this paper was supported by a scholarship from the Bednarowski Trust to the University of Glasgow (8th April–19th May 2010). A more elaborated version of this paper has been published in Polish under the title "Jakie skojarzenia ma umysł obliczeniowy? W obronie tezy o informacyjnej izolacji systemu wczesnego widzenia" (2012a). I would like to thank the anonymous reviewer for his/her helpful comments which help to improve the quality of this paper.

1 Jerry Fodor, *The Modularity of Mind* (Cambridge, Mass.: MIT Press, 1983).

2 Zenon Pylyshyn, "Is vision continuous with cognition? The case for cognitive impenetrability of visual perception", *Behavioral and Brain Sciences* 22 (1999): 341–423; idem, *Seeing and Visualizing* (Cambridge, Mass.: MIT Press 2003).

3 Maciej Witek, "Jakie skojarzenia ma umysł obliczeniowy? W obronie tezy o informacyjnej izolacji systemu wczesnego widzenia", *Studia z Kognitywistyki i Filozofii Umysłu* 6, no. 2 (2012): 67–82; idem, "Tacit Mechanisms and Heuristic Theorizing", *Filozofia Nauki* 77 (2012): 33–44.

an input-driven process whose job is to integrate the transduced signals coming from the subject's senses into what Fodor calls *shallow outputs* or *percepts*: information-carrying states that represent their distal objects in terms of their locations, sizes, shapes and colours.

Admittedly, Fodor adds that percepts represent their object in terms of what he calls "basic perceptual categories", e.g. "dog".[4] However, let us assume, following Athanassios Raftopoulos,[5] that early vision – as far as it is consider as an encapsulated process – involves no categorisation or object recognition at all; that is to say, its proper products are shallow in that their phenomenal character involves only shapes, sizes, locations and colours.

To argue for the cognitive impenetrability of early vision is to reject the popular idea that there is a continuity between perception and cognition or, in other words, that the process of perceptual integration is top-down through and through. It is also to claim that there is a level of perceptual representation which is (*a*) shallow, (*b*) phenomenally conscious[6] and (*c*) cognitively impenetrable in that its phenomenal content or character cannot be affected by the top-down processes. The paradigmatic examples of such representations are provided by the so-called persistent visual illusions, that is, by visual experiences whose phenomenal content remains unchanged despite strong beliefs to the contrary. For example, even though the subjects know that the Müller-Lyer lines are not equal in length, they cannot stop seeing one line as longer than the other. Consider, by analogy, the checker shadow illusion: despite their knowing that there is no difference in shade between the shadowed square and the non-shadowed one, the subjects cannot help seeing them as different in shade. Let us assume that the overall phenomenal content of a visual experience – or, for simplicity, the experience as such – comprises two aspects: shallow and deep. The former represents the relevant distal stimulus in terms of its size, shape, location, colour and luminosity, whereas the latter represents it as falling under certain categories, such as "dog", "rabbit", "duck", and so on. The proponent of the modular account of early vision would say, therefore, that only deep aspects of visual experiences are cognitively penetrable; their shallow aspects, by contrast, result from informationally encapsulated, data-driven computations.

There are, however, some experimental results that seem to undermine the idea of the cognitive impenetrability of early vision. There have been reported cases of (*a*) shallow and (*b*) phenomenally conscious vi-

[4] Fodor, *The Modularity of Mind*, 94–97.

[5] Athanassios Raftopoulos, "Is perception informationally encapsulated? The issue of the theory-ladeness of perception", *Cognitive Science* 25 (2001): 423–451.

[6] Urszula Żegleń, *Filozofia umysłu* (Toruń: Wydawnictwo Adam, 2003), 264–277.

sual representations that seems to be (*c′*) affected by the top-down factors, *i.e.*, by what the subjects believe, expect or desire. Typically, these cases involve two subjects focusing their visual attention on the same distal stimulus but having different visual experiences or, more precisely, producing visual experiences that differ significantly in their shallow aspects. One reaction to such findings is to account for the reported differences in terms of beliefs that penetrate the process of early perceptual integration; that is to say, the subjects produce experiences that differ in their shallow aspects *because* the subjects have different beliefs about what they see. Of course, the proponents of the modular account of early vision attempt to defuse such counterexamples by arguing that the allegedly *penetrating* beliefs affect either the (*i*) pre-perceptual or (*ii*) post-perceptual stages of vision, that is, either (*i*) manipulate the subject's visual attention or (*ii*) contribute to what we call the deep aspect of experience or even to the reportable content of the subjects' introspective judgements.[7]

In one of her papers Fiona Macpherson argues that there is one case of alleged cognitive penetrability of visual experience that cannot be explained away along the lines of the modular theory.[8] What she has in mind is the effect reported by John L. Delk and Samuel Fillenbaum[9] that suggests, it seems, that the subject's colour experiences are sensitive to the subject's beliefs about the typical colours of objects. Delk and Fillenbaum:

> took a sheet of paper of a uniform orange colour. They cut out shapes of various objects from it. Some of these objects were characteristically red: a heart (a love-heart shape), a pair of lips, an apple. Some were not characteristically red: an oval, a circle, a square, an ellipse, a horse's head, a bell, a mushroom. One at a time, the cutout shapes were placed in front of a coloured background that could be altered. The background could be changed from a yellow colour through orange to a red colour by twisting a nob. The subjects were told to instruct the experimenter to make the background colour more yellow or more red until it was the same colour as the cutout shape in front of it, so that the cutout shape could no longer be distinguished from the background. When the cutout shape of an object that had a characteristically red colour was placed in front of the background, the subjects selected a background colour that was more red

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[7] Pylyshyn "Is vision continuous with cognition? The case for cognitive impenetrability of visual perception".

[8] Fiona Macpherson, "Cognitive Penetration of Colour Experience: Rethinking the Issue in Light of an Indirect Mechanism", *Philosophy and Phenomenological Research* LXXXIV, No. 1 (January 2012): 24–62.

[9] John L. Delk, and Samuel Fillenbaum, "Differences in Perceived Color as a Function of Characteristic Color", *The American Journal of Psychology* 78, No. 2 (1965): 290–293.

> than the colour that they selected the background to be when the cutout shape was of an object that didn't have a characteristically red colour. When the cutout shape was of an object that didn't have a characteristically red colour the subjects' instructions yielded a background that was less red and more yellow.[10]

In short, depending on the shape of the cutouts, the subject see some of them as orangish and others as reddish. According to Macpherson, one way to explain this observed regularity is to acknowledge that the subject's visual experiences are penetrated by his or her beliefs about the typical colours of objects (more specifically, Macpherson argues that the regularity in question can be best understood in terms of a two-step mechanism of indirect cognitive penetrability). In other words, it is to agree that the shallow aspect of visual experience is cognitively penetrable.

In my view, however, it is also possible to argue that what is responsible for the regularity reported by Delk and Fillenbaum are not the subject's cognitive states but, rather, the internal organization of his or her early vision system. Admittedly, the subject may possess beliefs to the effect that hearts and tomatoes are characteristically red and ovals and bells are not. This fact, nevertheless, has nothing to do with the effect described by Delk and Fillenbaum. Therefore, rather than explaining away the case by arguing that the penetrating beliefs bears on either the pre-perceptual or post-perceptual stages of visual information processing, I claim that the mechanism that mediate colour recognition involves no penetrating beliefs at all. Undoubtedly, the mechanism is sensitive to the shape of the processed object. To acknowledge this, nevertheless, is not to say that it is affected by the subject's beliefs about the typical colours of objects. The mechanism is like priming in that it employs the subject's implicit rather than explicit memory. That is to say, it is autonomous and sub-personal rather than cognitively penetrable and personal.

In what follows I offer a sketchy model of the autonomous mechanism of colour recognition. I also suggest how the model can be tested empirically. It is worth stressing that with this model in hand not only are we in a position to explain the Delk and Fillenbaum effect away, but we are able to consider it as a positive evidence for the modular account of early vision.

Let me start with an analogy. Studies on speech perception show that the reaction time for lexical decisions (*i.e.*, word/non-word decisions) depends on whether the target words are predictable in the sen-

[10] Macpherson "Cognitive Penetration of Colour Experience: Rethinking the Issue in Light of an Indirect Mechanism", 38.

tential contexts in which they occur.[11] For example, "rope" is recognized as a word more quickly when it follows the phrase "The guide threw the lady a …" than it follows the phrase "The priest threw the lady a …".[12] The cloze value of "rope" – that is, the value that reflects its predictability in a given context – is high in the first case whereas it is low in the second. At first sight, the data under discussion seem to support the view that language perception is cognitively penetrable, that is, that the process whose job is to represent linguistic stimuli in terms of their phonetic, lexical and grammatical properties can be affected by semantic or background information. One can maintain, for example, that the process that mediates the subject's lexical decisions is penetrated by his or her beliefs, *e.g.*, by his or her belief to the effect that priests, unlike guides, have to do with ropes. In short, one can conclude that lexical decision is informed by top-down information flow. It turns out, however, that we can escape this conclusion and stick to the view that language perception is a purely bottom-up process. In *The Modularity of Mind* Fodor puts forth the hypothesis according to which lexical analysis has access to a local database that he calls the *mental lexicon*. The mental lexicon can be depicted as a network of lexeme-to-lexeme associations that mediate our lexical access:

> Suppose the mental lexicon is a sort of connected graph, with lexical items at the nodes and with paths from each item to several others. We can think of accessing an item in the lexicon as, in effect, exciting the corresponding node; and we can assume that one of the consequences of accessing a node is that excitation spreads along the pathways that lead from it. Assume, finally, that when excitation spreads through the portion of lexical network, response thresholds for the excited nodes are correspondingly lowered. Accessing a given lexical item will thus decrease the response times for items to which it is connected.[13]

Let us assume that the language perception system computes a hierarchy of intermediate representations – phonetic, lexical and syntactic – that are subsequently integrated in a linguistic percept or structural description. The job of the mental lexicon, then, is to facilitate the pro-

[11] David A. Swinney, "Lexical Access during Sentence Comprehension: (Re)Consideration of Context Effects", *Journal of Verbal Learning and Verbal Behavior* 18 (1979): 645–659; K. I. Forster, "Priming and the effects of sentence and lexical contexts on naming time: Evidence for autonomous lexical processing", *The Quarterly Journal of Experimental Psychology Section A* 3, No. 4 (1981): 465–495; Fodor, *The Modularity of Mind*, 76–82; Jerry Fodor, "Modularity if Mind: Jerry Fodor's Response", in *Meaning and Cognitive Structure*, ed. Z. W. Pylyshyn, W. Demopoulos (Norwood, New Jersey: Ablex Publishing Corporation, 1986), 130–135.

[12] Fodor, "Modularity of Mind: Jerry Fodor's Response", 131.

[13] Fodor, *The Modularity of Mind*, 80.

duction of the lexical representation of a verbal stimulus. Let us also take for granted that utterances are processed one word at a time. Therefore, the lexical analyses of the phrase "The guide threw the lady a …" results, among others, in accessing the node GUIDE and, consistently, in exciting a number of its neighbouring lexical nodes. In particular, it results in exciting the node ROPE, which becomes highly accessible or, in other words, is assigned a high cloze value. In short, the subject's lexical decisions are contextually facilitated. Appearances to the contrary, however, the mechanism that mediates this facilitation is associative rather than intelligent; that is to say, it makes use of the associated relations between lexical items – the totality of which makes up the mental lexicon – rather than of the beliefs that form the subject's background knowledge. The structure of the mental lexicon is shaped by the subject's linguistic experience and as such mimics the structure of his or her knowledge. It is the former, not the latter, however, that underlies the fast and subpersonal process of lexical analyses. The process, let us add, that is cognitively impenetrable.

Let us return to the issue of colour recognition. In my view, the Delk and Fillenbaum effect can be accounted for by adopting a strategy similar to the one successfully used by Fodor. I assume, namely, that the early vision system computes a collection of intermediate information-carrying states that represent a distal object in terms, respectively, of its size, shape, location, colour and luminosity, and, next, integrates these representations into a percept or primary sketch. Following Fodor,[14] I also assume that there is top-down information flow *within* the system; for example, the intermediate representation that identifies the processed stimulus by its colour can affect the representation that identifies it by its shape, and *vice versa*. What mediates these interactions, I think, is the system's *local* database that can be called the *mental pallet*. We can think of it as a network or graph whose nodes stands for shapes or colours. More precisely, the mental pallet consists of a number of shape-colour associations that make up its associative structure. Some of the associations are strong, whereas others are weak. For example, the node standing for the leaf-like shape is strongly associated with the node representing green and weakly associated with the nodes that stand for yellow, red and brown, respectively. Note that the associations under discussion reflect regularities to be found in nature. That is to say, most leaves we encounter are green and some leaves are yellow, red or brown. Consider now a subject who is shown a leaf-shaped cutout and recognizes its shape. Assume that one of the consequences of recognizing the shape is that of exciting the relevant shape-node in the system's mental pallet. The excitation spreads along the relevant shape-colour associations. As

[14] Ibidem, 76.

a result, the colour-nodes that are linked with the excited shape-node become accessible and ready for use by the colour recognition subsystem.

Now, let us reconsider an example of the Delk and Fillenbaum effect: a subject who is presented with a heart-shaped orangish cutout sees it as reddish (that is, he or she alters the background in front of which the cutout is placed so that the background is more reddish than orangish). How is it possible? According to the mental pallet hypothesis, the subject's early vision system recognizes the shape of the cutout and, as a result, excites the node HEART-SHAPE of the subject's mental pallet. The excitation spreads along the relevant shape-colour associations. In particular, it makes the node RED highly accessible and ready for use by the colour-recognition subsystem. That is to say, the response threshold for red is significantly lowered and, as a result, the subject sees the cutout as reddish. His or her colour-recognition mechanism is influenced by the information of the typical colour of heart-shaped objects. Note, however, that the information does not take the form of a penetrating belief; rather, it is coded in the form of a relevant shape-colour association that is built in to the architecture of the subject's mental pallet. Therefore, if the mental pallet hypothesis is true, the Delk and Fillenbaum effect has nothing to do with the alleged cognitive penetration of early vision. What it suggests, rather, is that there is top-down information flow *within* the early vision system; the flow, let us add, that is mediated by the associative structure of the mental pallet. In other words, the colour recognition tasks are contextually facilitated. What underlies the facilitation, however, is an associative rather than intelligent process that can be likened to perceptual rather than conceptual priming (*i.e.*, to those forms of priming that depend on implicit rather than explicit memory). Note that this moral can be easily reconciled with what Delk and Fillenbaum's experiment suggests. They conclude:

> One is led to the conclusion that past association of color and form does in some way influence perceived color, since that is the one respect in which the figures did clearly differ.[15]

Note that offering the modular account of the Delk and Fillenbaum effect I assume that there are two *parallel* or *twin* databases that store roughly the same information of the typical colours of object. The first database is local. It takes the form of the mental pallet, that is, of a network of the colour-shape associations. The second database is global or central. It takes the form of a body of beliefs about the typical colours

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[15] Delk, Fillenbaum, "Differences in Perceived Color as a Function of Characteristic Color", 293.

of objects. One can ask, therefore, what is the point of having these two twin databases since, it seems, one would suffice?

Note, first, that the associative mechanism that uses the mental pallet works faster than its intelligent counterpart. It works faster for two reasons. First, it does not involve the identification of the stimuli it processes in terms of such categories as “heart”, “leaf”, “tomato”, and so on; that is to say, it operates on the shallow aspects of visual experiences, since it associates colours with *shapes* rather than with *objects*. Second, it does not face the frame problem, that is, the information that can influence its operations is constrained by the associative architecture of the mental pallet. The intelligent mechanism, by contrast, would have to decide which beliefs about the possible colours of, say, hearts, have to be regarded as bearing on the process of visual integration. That is why it is good to have such an associative and unintelligent system. It works fast and facilitate our performance on the colour recognition tasks (note, for example, that in poor light conditions it is easier to recognize an object’s shape rather than its colour).

Second, it is worth noting that even though the structure of the mental pallet results from learning by conditioning,[16] it cannot be modified by our experience in a flash. Normally, it takes time to alter some of the shape-colour association and, as a result, to revise the structure of the mental pallet. That is why it is good to have the second, intelligent mechanism. It learns faster, accommodating the structure and content of its database to new evidence. Its function is to evaluate and, if it is necessary, to correct the outputs of the early vision system.

Let me end with two methodological remarks.

Note, first, that if the Delk and Fillenbaum effect is persistent – that is, if it does not disappear when the subject is told that the cutouts are in fact orangish – it can be regarded as *supporting* rather than *undermining* the modular account of early vision.

Second, the mental pallet hypothesis can be empirically tested. (*i*) One can check whether some amnesic patients – more precisely, patients that are unable to recollect beliefs about the typical colours of objects – are sensitive to the Delk and Fillenbaum illusion. If they are, then it is reasonable to suppose that the mechanism that is responsible for the Delk and Fillenbaum effect is autonomous, that is, that it performs its operations independently of our central processes. In this respect, it can be likened to implicit rather than explicit memory. (*ii*) One can also ask the normal subjects to learn a number of propositions about the typical colours of cutouts whose shapes are artificial though easily recognizable. Next, the subjects’ explicit memory can be tested, that is, they can be asked to recollect the colours of the cutouts they were informed of.

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[16] It is not precluded, however, that the central part of the pallet is innate.

It would be very interesting to check whether the new beliefs so formed are likely to influence the subjects' performance on the Delk and Fillenbaum task. If they are not, then it is reasonable to suppose that the colour recognition system works independently of the subject's explicit memory or, in other words, that it is cognitively impenetrable.

Bibliography

Delk L. John, Samuel Fillenbaum. 1965. "Differences in Perceived Color as a Function of Characteristic Color". *The American Journal of Psychology* 78, no. 2: 290–293.

Fodor Jerry. 1983. *The Modularity of Mind.* Cambridge, Mass.: MIT Press.

Fodor Jerry. 1986. "Modularity of Mind: Jerry Fodor's Response". In: *Meaning and Cognitive Structure*, ed. Zenon W. Pylyshyn, W. Demopoulos, 129–135. Norwood–New Jersey: Ablex Publishing Corporation.

Forster K. I. 1981. "Priming and the effects of sentence and lexical contexts on naming time: Evidence for autonomous lexical processing". *The Quarterly Journal of Experimental Psychology Section A* 33. No. 4: 465–495.

Macpherson Fiona. 2012. "Cognitive Penetration of Colour Experience: Rethinking the Issue in Light of an Indirect Mechanism". *Philosophy and Phenomenological Research Philosophy and Phenomenological Research* LXXXIV. No. 1: 24–62.

Pylyshyn Zenon W. 1999. "Is vision continuous with cognition? The case for cognitive impenetrability of visual perception". *Behavioral and Brain Sciences* 22: 341–423.

Pylyshyn Zenon W. 2003. *Seeing and Visualizing*. Cambridge, Mass.: MIT Press.

Raftopoulos Athanassios. 2001. "Is perception informationally encapsulated? The issue of the theory-ladeness of perception". *Cognitive Science* 25: 423–451.

Swinney David A. 1979. "Lexical Access during Sentence Comprehension: (Re)Consideration of Context Effects". *Journal of Verbal Learning and Verbal Behavior* 18: 645–659.

Witek Maciej. 2012. "Jakie skojarzenia ma umysł obliczeniowy? W obronie tezy o informacyjnej izolacji systemu wczesnego widzenia". *Studia z Kognitywistyki i Filozofii Umysłu* 6. No. 2: 67–82.

Witek Maciej. 2012. "Tacit Mechanisms and Heuristic Theorizing". *Filozofia Nauki* 77: 33–44.

Żegleń Urszula. 2003. *Filozofia umysłu* (*Umysł. Prace z Filozofii i Kognitywistyki*). Toruń: Wydawnictwo Adam Marszałek.

Summary

My aim in this paper is to defend the view that the processes underlying early vision are informationally encapsulated. I take early vision to be a perceptual process that takes sensory information as its input and produces the so-called primal sketches or shallow visual outputs: informational states that represent visual objects in terms of their shape, location, size, colour and luminosity. Recently, some researchers have attempted to undermine the idea of the informational encapsulation of early vision by referring to experiments that seem to show that colour recognition is affected by the subject's beliefs about the typical colour of objects. In my view, however, one can reconcile the results of these experiments with the position that early vision is informationally encapsulated. Namely, I put forth a hypothesis according to which the early vision system has access to a local database that I call the mental palette and define as a network of associative links whose nodes stands for shapes and colours. The function of the palette is to facilitate colour recognition without employing central processes. I also describe two experiments by which the mental palette hypothesis can be tested.

Keywords: early vision, modularity, informational encapsulation, cognitive penetrability, phenomenal content

Streszczenie

Kontekstowe wspomaganie rozpoznawania barw: przekonania przenikające czy asocjacje między kształtami a barwami?

Artykuł przedstawi obronę tezy o informacyjnej izolacji procesów wczesnego widzenia. Wczesne widzenie rozumie się jako proces percepcyjny, którego danymi wejściowymi są informacje sensoryczne, a danymi wyjściowymi są tzw. pierwotne szkice lub płytkie reprezentacje wzrokowe: stany informacyjne reprezentujące obiekty wzrokowe ze względu na ich kształt, położenie, wielkość, barwę i jasność. Niektórzy badacze kwestionują tezę o informacyjnej izolacji wczesnego widzenia, odnosząc się do danych eksperymentalnych, które zdają się sugerować, że rozpoznawanie barw zależy od przekonań podmiotu postrzegającego o typowych barwach określonych przedmiotów. Wydaje się jednak, że takie doniesienia można uzgodnić z tezą, o której mowa. W artykule wysuwa się hipotezę, w myśl której mechanizmy wczesnego widzenia mają dostęp do lokalnej bazy danych, którą można nazwać paletą mentalną. Paleta mentalna ma postać sieci asocjacyjnej, której węzły reprezentują kształty oraz barwy. Paleta mentalna bierze udział w rozpoznawaniu barw, wspomagając ten proces, choć nie korzysta z centralnych przekonań o typowych kształtach określonych przedmiotów.

Słowa kluczowe: wczesne widzenie, modularność, rozpoznawanie barw, izolacja informacyjna, efekt Delka–Fillenbauma