

THE POSSIBILITIES OF DISJUNCTION IN THE MENTAL MODELS THEORY

LAS POSIBILIDADES DE LA DISYUNCIÓN EN LA TEORÍA DE LOS MODELOS MENTALES

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Recibido: 12/7/2017
Aprobado: 15/12/2017

ABSTRACT

Baratgin and colleagues have questioned certain aspects of the mental models theory related to disjunction. It is truth that, from this last theory, the paper authored by Baratgin et al. (2015) has already been responded. However, I try to further develop that response here by insisting in two important points of the theory: the role that modulation plays in it and the clear differences between its framework and standard logic. In this way, my main aim is to support to a larger extent, by means of theoretical arguments based on its general approach, the idea that the objections presented in the mentioned paper do not really impact the mental models theory.

Keywords: disjunction; mental models; modulation

RESUMEN

Baratgin y sus colaboradores han cuestionado ciertos aspectos de la teoría de los modelos mentales relativos a la disyunción. Es cierto que, desde esta última teoría, el trabajo de Baratgin et al. (2015) ya ha sido respondido. No obstante, aquí se trata de desarrollar en mayor medida tal respuesta insistiendo en dos puntos importantes de la teoría: el rol que la modulación desempeña en su seno y las claras diferencias que existen entre su marco y la lógica estándar. En este sentido, el objetivo principal es apoyar aún más, por medio de argumentos teóricos basados en su enfoque general, la idea de que las objeciones presentadas en el trabajo mencionado no tienen un impacto real en la teoría de los modelos mentales.

Palabras clave: disyunción; modelos mentales; modulación

Introduction

A very important framework explaining the human intellectual activity is nowadays the mental models theory (from now on, MMT). As shown by the literature on it, which is very large (just some examples of works about this theory are Johnson-Laird, 2004, 2006, 2010, 2012, 2015; Johnson-Laird, Khemlani, & Goodwin, 2015a, 2015b; Khemlani, Orenes, & Johnson-Laird, 2012, 2014; Oakhill & Garnham, 1996; Orenes & Johnson-Laird, 2012; Ragni, Sonntag, & Johnson-Laird, 2016), MMT can properly explain many cognitive facts that other approaches cannot. However, Baratgin et al. (2015) have raised some criticisms with regard to the way it deals with disjunction. In their view, there are a number of theoretical problems related to the sentences with the word 'or' that are unclear in the theory and that, therefore, allow questioning its accounts and results. The truth is that, from MMT, a

response to those criticisms has already been given (Johnson-Laird et al., 2015b). Nevertheless, I think that it is worth continuing to develop that response, since that can enable to show more clearly to what extent the machinery of MMT is powerful.

In this way, in this paper, I will mainly focus on the aspects questioned by Baratgin et al. (2015) in order to show that they are not really a problem for MMT, and that it can be even thought that some of them do not make sense under its framework. Nonetheless, to do that, I will firstly describe the general theses of MMT to which it is important to pay attention to achieve that aim. Then I will point out which the theoretical problems seen by Baratgin et al. are exactly. Finally I will argue that it is not hard to MMT to solve those difficulties and that some of them do not even exist in the theory.

MMT, Peirce, and disjunctions

Obviously, the part of MMT that is more interesting here is that related to disjunction. However, it cannot be ignored that it has a very strong philosophical basis coming from authors such as Peirce (1931-1958). Indeed, the concept of iconicity is very relevant for MMT (e.g., Johnson-Laird, 2012, p. 136) because one of its main ideas is that people do not usually relate sentences in natural language to logical forms or well-formed formulae in standard logic (e.g., Johnson-Laird, 2010), but to mental representations that reproduce different possibilities in reality. Those representations are named ‘models’, and the theory considers each connective joining clauses (e.g., the conditional, conjunction, disjunction,...) to have, in ideal circumstances, a set of ‘Fully Explicit Models’.

By way of example, I will comment on only the Fully Explicit Models of disjunction, which, besides, it is necessary to know to understand and analyze Baratgin et al.’s (2015) criticisms. According to MMT, given an expression such as ‘either p or q or both of them’, in principle, we can think about three possibilities or models (see, e.g., Johnson-Laird, 2012, p. 138, Table 9.2):

[A]: p	q
[B]: not-p	q
[C]: p	not-q

Evidently, an inclusive disjunction can be true when the two disjuncts are true [A], when the first disjunct is false and the second one is true [B], and when the first disjunct is true and the second one is false [C]. In this way, the only impossible situation is this one:

[D]: not-p	not-q
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And this is so because it is also evident that a disjunction can never be true when its two disjuncts are false.

Given the overlap with the cases in which disjunction is true or false in standard logic, it can be thought that MMT is akin to this last system. Nevertheless, really it is very far from that logic. On the one hand, [A], [B], [C], and [D] do not refer to cases in a truth table of standard logic. As said, they are iconic representations of the world describing the elements that can be possible in it. Thus, as I understand the theory, they all stand for the same world and the only difference between them is the presence or absence of ‘p’, ‘q’, or both of them.

But on the other hand, another relevant concept of the theory is that of modulation (e.g., Orenes & Johnson-Laird, 2012). Modulation refers to the fact that semantics and pragmatics can eliminate or change models. A clear example of its way of acting is given by this sentence:

Lucia watched the Barca or she watched football (Orenes & Johnson-Laird, 2012, p. 375).

However, MMT can respond to these objections in an easy way too. Firstly, an evident point in favor of it is that, as shown by Orenes and Johnson-Laird (2012), people really tend not to apply DIR, and this is a fact in which Johnson-Laird et al. (2015b) insist, as it seems that all the other cognitive approaches, including that of Baratgin et al. (2015), cannot account for it. As explained, according to MMT, ‘either p or q’ cannot be inferred from ‘q’ because the former enables the possibility [C], which is incompatible with ‘q’. Obviously, there is no doubt that this alone is already a good account of what the experimental results often reveal, but, besides, allows developing additional arguments against Baratgin et al.’s (2015) paper.

That ‘either p or q’ cannot be deduced from ‘q’ in MMT does not mean that ‘q’ must be consistent with ‘it is not the case that either p or q’. Indeed, in standard logic, it is absolutely true that, if a formula [x] cannot be derived from a formula [y], then the formula [\neg x] has to be consistent with [y]. Nonetheless, an important aspect of MMT is that, as shown, it is not standard logic and, therefore, should not be assessed based on this last logic. The relationships between formulae that are valid in propositional calculus do not necessarily hold in MMT, which appears to be a theory that just describes what people usually do, and not a normative framework indicating what individuals should do. From this perspective, it can be claimed that MMT is not a logical calculus and that Baratgin et al. (2015) seem to consider it to be that.

MMT is, as mentioned, about iconic possibilities, and not about logical forms. In this way, given that, as also indicated, in the case of DIR, ‘q’ is compatible both with [A] and with [B], the only conclusion that can be drawn from the fact that people usually do not apply this rule is just that ‘q’ is compatible with the opposite of [C] (i.e., with the opposite of the only model that is incompatible with it), and not with the opposite of ‘either p or q’ in entirety (i.e., of [A], [B], and [C] altogether). Certainly, the opposite of [C] is a scenario in which ‘p’ is false and ‘q’ is true, and such a scenario is clearly consistent with ‘q’. So, it can be thought that in MMT the impossibility to derive a sentence does not lead to assume consistency with the denial of that sentence, but simply with the denial of the model(s) that make(s) the derivation impossible.

Furthermore, the theory can explain the probabilities that people tend to attribute to sentences with the structures [p] and [p \vee q]. The former refers to one scenario and the latter to three possibilities. Hence it makes sense, from its point of view, that people think that the latter is more probable, because it is clearly more probable that one of three possibilities happens than that one possibility occurs. Thus, it can be stated that these objections raised by Baratgin et al. (2015) are not great problems for MMT either.

A last point is that Baratgin et al. (2015) also seem to claim that, given that a disjunction is true in MMT if its three models [A], [B], and [C] are possible, DIR should be always applied in the case of contingent disjunctions, which, as accounted for, can never be false, and it is clear that this does not happen. However, the reason of that is not hard to explain from MMT either. In DIR there is a premise, ‘q’, which causes one of the possibilities, [C], to be false, whether or not the content of the particular disjunction is contingent. Accordingly, in an inference with the structure of DIR, the disjunction is not true, since one of its models is not so.

Therefore, it seems that the arguments presented in Baratgin et al. (2015) against Johnson-Laird et al. (2015a) can be answered from the general approach of MMT without a lot of difficulties. Johnson-Laird et al. (2015b) already gave relevant responses in this regard. I have tried only to further develop such responses here.

Conclusions

This paper has addressed only a partial aspect of MMT, the one related to disjunction. As stated, the theory has a much broader scope, since, in addition to deal with other classical connectives habitually used in sentences, it has demonstrated that is able to explain the results in many experimental

reasoning tasks (see, e.g., all the literature on this theory cited above). Thus, MMT appears to have the potential to account for more phenomena than other alternative frameworks, as it solves problems impossible to explain for other approaches (e.g., the problems related to DIR).

Obviously, the theory is not perfect and still has details to face, as well as particular aspects that need to be reviewed. Nevertheless, this paper shows that such details and aspects do not refer to the objections presented by Baratgin et al. (2015). As argued above, these last objections are not obvious difficulties for MMT.

In this way, it can be thought that, given that, as mentioned, the literature on MMT reveals that it has an important empirical support, this framework can be used in different scientific fields such as, for example, philosophy, education, and linguistics. As also indicated above, the philosophical foundations of MMT are evident and, for this reason, it can become a very interesting tool of philosophical research. Nonetheless, it is even clearer that MMT can be of great help in activities and studies linked to the suitable interpretation of sentences, and the analysis of the real role that syntax, semantics, and pragmatics can play in communication.

Maybe it is only important not to forget two essential points of MMT to avoid criticisms such as those of Baratgin et al. (2015) and correctly use its machinery. On the one hand, the possibilities corresponding to sentences are not guaranteed, since modulation can modify them. On the other hand, certain properties such as consistency do not mean exactly the same in MMT as in standard logic, as the former is not the latter. MMT consistency is about particular models or possibilities, not about whole sentences or their logical forms. Probably, taking these points into account, it will be possible to continue to develop the theory and apply it in studies on different subject matters.

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