DO CONDITIONAL CONJUNCTIONS EXIST?
THREE POSSIBLE RESPONSES

MIGUEL LÓPEZ-ASTORGA

Abstract. It has been shown that conjunction in natural language can refer to interpretations akin to those of the conditional. This means that it can be thought that there are cases in which conjunction is true in exactly the same rows in a truth table in which the conditional is, that is, in situations similar to the ones indicated by Philo of Megara for the conditional. The philosophical, linguistic, and logical consequences of this are obvious. For this reason, this paper describes three ways to interpret that phenomenon. The first one is based upon the models of the mental model theory, which are iconic in the sense attributed to that word by Peirce. The second one tries to build logical formulae from such models. And the last one relates those very models to possible worlds such as those of modal logic.

Keywords: conditional; conjunction; iconicity; logical formulae; mental models.

INTRODUCTION

Nowadays, there is a theory intended to explain how human cognition really works. That theory is the mental model theory.[1] For that purpose, inter alia, its proponents have analyzed all of the traditional connectives in classical logic. As the literature reveals, this task has been very fruitful from the point of view of cognition and reasoning. However, at the same time, it appears to have caused important philosophical and logical problems, since it seems to have definitely proved that people do not tend to always interpret the traditional logical operators in a manner consistent with the semantics of classical logic and its truth tables.

The cases of the conditional and disjunction are especially representative in this regard. These two last connectives have been studied in depth from this perspective

Miguel López-Astorga ✉
Juan Ignacio Molina Institute of Humanities, University of Talca, Chile; e-mail: milopez@utalca.cl

both by adherents of the mental model theory and in works more or less distant from that theory.[2] As far as conjunction is concerned, it appears to have been considered to a lesser extent. Nevertheless, papers such as that of López-Astorga[3] have addressed it. In particular, this last study has raised the idea that 'and' in natural language can actually refer to the sixteen interpretations or combinations of truth values that can be assigned to logical functions linking two propositions.

Indeed, such possible interpretations or combinations are sixteen.[4] Nonetheless, perhaps the most important point here is that, as it will be shown below, most of the examples used by López-Astorga[5] to support his arguments do not lead to a clear rejection of conjunction as the basic formal structure of the sentences corresponding to those examples. This, in each case, for one of these two reasons: either they include words related to modal operators or their language is either figurative or metaphorical. The difficulties seem to be given only by certain kind of conjunctions that, having neither modal elements nor figurative or metaphorical language, appear to be linked to a combination of values very different from that assigned by classical logic to conjunction. That combination is the one that Sextus Empiricus attributes to Philo of Megara and that, at present, is considered as the standard one for the conditional in classical logic, that is, the combination referring to the material interpretation of the conditional.[6] The conjunctions of this type are those that this paper names 'conditional conjunctions'. Syntactically, they seem to be conjunctions. However, they appear to be true in the cases the conditional is true in classical logic, not in the cases in which conjunction is that.

All of this, being undoubtedly interesting from the cognitive and linguistic point of view, as indicated, causes important philosophical and logical consequences at once. Some of them will be analyzed in this paper. To do that, the paper will have three separate sections. The first one will describe what López-Astorga's work[7] was exactly and its relationships to the mental model theory. Then it will be accounted for how one of his results links conjunction to the conditional and hence raises problems. Finally, in the last section, three different ways to understand, interpret, and accordingly, solve those problems are presented.

---

[2] E.g., Philip N. Johnson-Laird, Ruth M. J. Byrne, "Conditionals: A theory of meaning, pragmatics, and inference", *Psychological Review*, vol. 109, nr. 4, 2002, pp. 646-678; Miguel López-Astorga, "The disjunction introduction rule: Syntactic and semantic considerations", *Pragmalingüística*, nr. 23, 2015, pp. 141-149; Miguel López-Astorga, "Logic, pragmatics, and types of conditionals", *Frontiers of Philosophy in China*, vol. 11, nr. 2, 2016, pp. 279-297; Isabel Orenes, Philip N. Johnson-Laird, "Logic, models, and paradoxical inferences", *Mind & Language*, vol. 27, nr. 4, 2012, pp. 357-377.

[3] Miguel López-Astorga, "'And' is not always a logical conjunction", *Khazar Journal of Humanities and Social Sciences*, vol. 22, nr. 2, 2019, pp. 5-19.

[4] See, e.g., Alfredo Deaño, *Introducción a la lógica formal*, Madrid, Alianza Editorial, 1999, p. 89.

[5] M. López-Astorga, "'And' is not always a logical conjunction", pp. 5-19.

[6] See, e.g., Jozef M. Bocheński, *Ancient Formal Logic*, Amsterdam, North-Holland, 1963, p. 89; Robert R. O'Toole, Raymond E. Jennings, "The Megarians and the Stoics", in Dov M. Gabbay, John Woods (eds.), *Handbook of the history of logic, Volume 1. Greek, Indian and Arabic logic*, Amsterdam, Elsevier, 2004, p. 479.

[7] M. López-Astorga, "'And' is not always a logical conjunction", pp. 5-19.

THE GENERAL STUDY BY LÓPEZ-ASTORGA

López-Astorga's analysis[8] is based upon the mental model theory. His goal is to present a linguistic study of the different functions that a sentence with 'and' can have, and he does it, obviously, by resorting to the mentioned theory. The result is that, as said, it is possible to find conjunctions referring to the sixteen combinations of truth values by means of which two propositions can be bound. However, before focusing on such results, maybe it is relevant to comment on some essential characteristics of the mental model theory.

That theory proposes that sentences are linked to possibilities that, in a way akin to the one pointed out by Peirce[9], are truly iconic pictures of the world representing it.[10] In ideal circumstances, although they are not that, the iconic pictures of a sentence often match the cases in which the main connective in that sentence is true in its truth table.[11] Nevertheless, semantics and pragmatics can have an influence on the pictures, removing or changing some of them.[12]

These last phenomena are precisely those that lead to different combinations and therefore, different interpretations of the connectives, which can be very distinct from the one assigned to them in classical logic. As indicated above, all of this has been studied in detail in the cases of the conditional and disjunction, and López-Astorga's paper[13] mainly deals with conjunction. His results, as also indicated, are that, depending on semantics and pragmatics, conjunction can refer to the sixteen possible interpretations. Nonetheless, for the sake of briefness and for not going beyond the goals of this paper, only four examples representative and relevant for the arguments and explanations below will be taken into account.

The first one is that describing the usual or regular conjunction. Of course, if conjunction can refer to the sixteen possible combinations of truth values that can be thought for two propositions, it is clear that one of those combinations is the one corresponding to it in classical logic, and López-Astorga's analysis does not ignore this fact. His example in this way is as follows:

---

[8] *Ibidem.*

[9] Charles S. Peirce, *Collected papers of Charles Sanders Peirce*, Charles Hartshorne, Paul Weiss, Arthur Burks (eds.), Cambridge, Harvard University Press, 1931-1958.

[10] E.g., Philip N. Johnson-Laird, "Inference with mental models", in Keith J. Holyoak, Robert G. Morrison (eds.), *The Oxford Handbook of Thinking and Reasoning*, New York, Oxford University Press, 2012, pp. 134-145; Philip N. Johnson-Laird, Sangeet Khemlani, Geoffrey P. Goodwin, "Logic, probability, and human reasoning", *Trends in Cognitive Sciences*, vol. 19, nr. 4, 2015, pp. 201-214.

[11] E.g., Philip N. Johnson-Laird, "Inference with mental models", in Keith J. Holyoak, Robert G. Morrison (eds.), *The Oxford Handbook of Thinking and Reasoning*, New York, Oxford University Press, 2012, pp. 134-145.

[12] E.g., Ana Cristina Quelhas, Philip N. Johnson-Laird, "The modulation of disjunctive assertions", *The Quarterly Journal of Experimental Psychology*, vol. 70, nr. 4, 2017, pp. 703-717; Ana Cristina Quelhas, Philip N. Johnson-Laird, Csongor Juhos, "The modulation of conditional assertions and its effects on reasoning", *Quarterly Journal of Experimental Psychology*, nr. 63, 2010, pp. 1716-1739.

[13] M. López-Astorga, "'And' is not always a logical conjunction", pp. 5-19.

[I]   "This is a car and that is a bicycle"[14].

Clearly, [I] can only be the case in one situation: when this is really a car and that is actually a bicycle. Following the general tendency in papers supporting the mental model theory, that only possibility can be represented, for example, in a similar (although not totally identical) manner as the iconic images are represented in works such as that of Khemlani, Hinterecker, and Johnson-Laird[15]:

[II]   Possible (car & bicycle).

Certainly, although represented not exactly in the same way, López-Astorga states that [II] is the only mental picture that can be associated to [I].[16] This is not obviously a problem, since one can think that [II] corresponds to the only row in a truth table in which conjunction is true. However, other examples do cause difficulties. For example, the following:

[III]   "It works and I will eat my hat"[17].

This example derives from another one with the same content expressed with a conditional structure in a paper by Johnson-Laird and Byrne[18]. Nevertheless, according to López-Astorga, the key point here is that a sentence such as [III] is not true in the same case in which a conjunction is usually so, even if it contains the word 'and'. What the speaker wants to transmit is that he or she knows for sure that it will not work, and that hence he or she will eat his or her hat in no way. Thus, continuing with a way of expression akin to the one used to [II], it can be said that the real iconic image that can be linked to [III] is this one:

[IV]   Possible [not-(it works) & not-(I eat my hat)]

As it has been said for [II] and it can be said for the other representations of iconic pictures below, [IV] stands for the mental image indicated by López-Astorga,[19] although not with the same words and symbols. Nevertheless, maybe what is truly important now is that, as mentioned, [III] is not true when its two conjuncts are so, which is what is provided by classical logic, but precisely in the contrary case: when its two conjuncts are false.

Nonetheless, there are also more problematic examples, and one of them is clearly the following:

---

[14] *Ibidem*, p. 6.

[15] Sangeet Khemlani, Thomas Hinterecker, Philip N. Johnson-Laird, "The provenance of modal inference", in Glenn Gunzelmann, Andrew Howes, Thora Tenbrink, Eddy J. Davelaar (eds.), *Computational Foundations of Cognition*, Austin, Cognitive Science Society, 2017, pp. 663-668.

[16] M. López-Astorga, "'And' is not always a logical conjunction", pp. 7-8.

[17] *Ibidem*, p. 9.

[18] P. N. Johnson-Laird, R. M. J. Byrne, "Conditionals: A theory of meaning, pragmatics, and inference", p. 663.

[19] M. López-Astorga, "'And' is not always a logical conjunction", p. 9.

[V]   "There is a house and there may be a river"[20].

The case of [V] is even more complex, since, as shown by López-Astorga, it does not only refer to the same combination of truth values in which conjunction is true, but, in addition, it also refers to other possible interpretation or combination of values:

[VI]   Possible (there is a house & there is a river) &

[VII]   Possible [there is a house & not-(there is a river)]

Indeed, [V] is compatible with two iconic pictures: [VI] and [VII], which means that, in a sense, it is even further from conjunction than [III]. However, in López-Astorga's paper, there are examples that are even further from that very connective than [V] too, as they can be linked to even more iconic pictures. This is one of them:

[VIII]   "You come and I leave"[21].

Clearly, the iconic possibilities for [VIII] are three:

[IX]   Possible (you come & I leave) &

[X]   Possible [not-(you come) & I leave] &

[XI]   Possible [not-(you come) & not-(I leave)]

As it can be noted, [IX], [X], [XI] together represent the cases corresponding to Philo's criterion for the conditional, which, as stated, matches its material interpretation. Nevertheless, perhaps, what is more problematic with this is that, as explained below, it stands for the kind of interpretation, between the ones offered by López-Astorga, which really raises difficulties. Truly, beyond [I], which, as claimed, leads to the traditional interpretation of conjunction, the other fifteen examples of combinations of values presented by López-Astorga[22] share essential characteristics with [III], [V], or [VIII]. And, as argued in the next section, only [VIII], which can be related to the conditional, and the one that can be linked to the biconditional, which will not be directly dealt with here because the arguments that will be used for [VIII] clearly apply to the biconditional as well, and maybe it would be trivial to show why that is so, cause real problems.

FIGURATIVE LANGUAGE, MODAL OPERATORS, AND CONDITIONAL RELATIONSHIPS

That [I] is not a problem is evident. The difficulties are caused by cases in which a sentence with 'and' refers to combinations of truth values different from that in which

---

[20] *Ibidem*, p. 10.
[21] *Ibidem*, p. 15.
[22] *Ibidem*, pp. 5-19.

conjunction is true in classical logic. Nevertheless, [I] is true in exactly this last combination.

As far as [III] is concerned, maybe its difficulties are not hard to overcome. As explained, it is a sentence using figurative, ironic, or metaphoric language. So, it is clear that it does not literally say what it actually intends to say. In this way, pragmatics reveals that, when somebody resorts to a language of that type, he or she often wishes to express precisely the opposite of what is explicitly transmitted. Thus, anybody can understand, after listening to or reading a sentence such as [III], that what the speaker or writer really wants to state is that, as indicated above, with absolute certainty, it will not work, which in turn means that he or she will not eat his or her hat.

However, if this is so, one might think that the problem with [III] is not real. It can be enough to assume, almost as an algorithm to translate, that, when irony is used, what is affirmed should be understood as negated, and what is negated should be interpreted as affirmed. In this manner, by applying this sort of algorithm, [III] can be translated into:

[XII]   It will not work and I will not eat my hat.

There is no doubt that the only iconic picture corresponding to [XII] is [IV] as well. Accordingly, it can be stated that, semantically, [III] and [XII] are identical (even if in one of them the conjuncts are affirmed and in the other one the conjuncts are negated). In fact, it can be thought that [XII] is just [III] expressed without irony. In this manner, the point to be noted here is that [XII] continues to be a conjunction, a conjunction whose truth table shows that it can only be true in the case described by [IV] (note that in [IV] the two conjuncts of [XII] are true, which is what is required in classical logic for a conjunction to be true). Therefore, it can be claimed that the only difficulty associated to [III] is the way it is expressed, and that, in its deep structure, which is actually linked to [XII], it keeps being indisputably a conjunction.

Similar explanations can be used to account for several examples indicated by López-Astorga in which figurative or ironic language is used too.[23] Nevertheless, there is also an important group of examples that do not resort to a language of that kind. One of them is precisely [V].

But, in the case of [V], there is another element playing an important role as well: modality. As explicitly acknowledged by López-Astorga, words such as 'may' can lead to think about modal logic.[24] This being so, one might consider the possibility to resorting to a modal language to solve the problem. Thus, as usual in modal logic in general, the following equivalence can be assumed:

[XIII]   P(a) = a is possible, i.e., there is at least a possible world in which a is true.

And, in this way, understanding that 'p' refers to the fact that there is a house and 'q' stands for the fact that there is a river, one might also come to the conclusion that the real logical structure of [V] is not just 'p and q' but:

---

[23] *Ibidem.*
[24] *Ibidem*, p. 11.

[XIV]   p & P(q)

The strengths of [XIV] are that, while it continues to be a conjunction, it is, at the same time, totally consistent with the set of iconic images consisting of [VI] and [VII]. Clearly, [VI] can be deemed as a possible world and [VII] as another possible world.[25] And, thus, [XIV] makes it evident that the underlying structure of [V] is, again, a conjunction.

As in the case of figurative or ironic language, arguments akin to the last one can also be applied to other examples given by López-Astorga[26] in which the modal elements are present. In this way, if the examples that can be explained by means of an account similar to that offered for [III] and the examples that can be explained by means of an account similar to that offered for [V] are summed, and, at once, [I] is added, the result is that only two examples proposed by López-Astorga[27] remain without explanation: [VIII] and the one referring to the same truth values as the biconditional. As indicated, this last example will not be addressed here, as his account can be obvious after dealing with [VIII]. However, this last interpretation, [VIII], is by itself a big problem, since, unlike the other cases, it does not seem possible to find a deep or underlying conjunction under its surface structure. But, in spite of this, there are other ways to remove its difficulties. In fact, there are at least three manners to do that. The next section comments on them.

THREE ACCOUNTS INTERPRETING THE PROBLEM OF [VIII]

Indeed, there is not only one way to face the problem of [VIII]. After a review of the literature, at least three can be considered. They are explained hereunder.

[Account 1]   The first way is very simple and perhaps the most reasonable one from a strictly cognitive point of view. It is just to adopt the mental model theory. According to this theory, people reason paying attention basically to iconic pictures that can be related to sentences such as [II], [IV], [VI], [VII], [IX], [X], and [XI]. Hence, classical logic can be ignored and the problem disappears, because what is interesting is the possibilities or iconic images to which sentences refer, regardless of the connective (whether 'and' or any other) in them and, therefore, their logical form.[28] So, it can be thought that, from this perspective, classical logic is just an abstract system built by human beings that does not describe the way people truly make inferences at all. To support this theoretical position, the proponents of the mental model theory generally present experimental data that, usually, seem to prove that its predictions are correct.[29]

---

[25] For relations between the mental model theory and modal logic, see, e.g., Miguel López-Astorga, "Iconic representations, possible worlds, and system K", in *Analele Universitatii din Craiova, Seria Filosofie*, vol. 42, nr. 2, 2018, pp. 120-136.

[26] M. López-Astorga, "'And' is not always a logical conjunction", pp. 5-19.

[27] *Ibidem*.

[28] See also, e.g., Philip N. Johnson-Laird, "Against logical form", *Psychologica Belgica*, vol. 50, nr. 3/4, 2010, pp. 193-221.

[29] See, e.g., any of the works in favor of the theory cited in this paper.

[Account 2]   However, a second option can be, acknowledging the experimental data supporting the mental model theory, to try to link it to classical logic. This proposal[30] is not difficult to understand either. Based mainly upon the idea that expressions in natural language such as 'and' cannot always be related to the same logical operator,[31] this framework attempts to transform possibilities such as [II], [IV], [VI], [VII], [IX], [X], and [XI] into cases in which a formula is correct in a truth table, and, from this task, to detect the real logical forms of expressions. Thus, what must be done is, again, to ignore the literal words used in sentences and pay attention only to the possibilities to which they refer. And this should be done taking into account principles derived from the truth tables in classical logic too, such as these ones:

[XV]   It can be claimed that 'a' and 'b' are linked by means of a conjunction if and only if the entire sentence resulting from the union of 'a' and 'b' is true only when both 'a' and 'b' are true at the same time.

[XVI]   It can be claimed that 'a' and 'b' are linked by means of a conditional if and only if the entire sentence resulting from the union of 'a' and 'b' is false only when 'a' is true and 'b' is false at the same time.

From principles such as [XV] and [XVI], one can, for example, try to find the real logical form of [VIII]. Thus, [XV] clearly reveals that its form is not the one of conjunction, since, if it were so, it could be true only in the case of [IX]. Nevertheless, it can be correct in the cases of [X] and [XI] too. In this way, [XVI] is the principle that shows the authentic logical form, since [VIII] can be true in all of the scenarios that are not forbidden by [XVI] (i.e., [IX], [X], and [XI]), and it cannot be true in the only one that is not allowed by [XVI] (i.e., the one in which you would come and I would not leave). Therefore, the problem is solved: although expressed by means of 'and', [VIII] is a conditional and its logical behavior should be that of a material conditional.

[Account 3]   But there is even a third alternative. This approach[32] also considers the empirical data that appear to demonstrate that the mental model theory can be correct. Nonetheless, under this framework, the iconic images such as [II], [IV], [VI], [VII], [IX], [X], and [XI] are linked to modal logic and, in particular, to a system akin to system K. The general idea is easy to understand here as well. Given that the iconic images are possibilities and the mental model theory tend to deem them as conjunctions,[33] it is not difficult to transform them into well-formed formulae under the perspective of the mentioned system. With regard to [VIII], this means, obviously, that [IX], [X], and [XI] should be transformed into these formulae:

[30] Described, e.g., in M. López-Astorga, "The disjunction introduction rule: Syntactic and semantic considerations", pp. 141-149.

[31] See, e.g., A. Deaño, *Introducción a la lógica formal*.

[32] Presented, e.g., in M. López-Astorga, "Iconic representations, possible worlds, and system K", pp. 120-136.

[33] E.g., Sangeet Khemlani, Thomas Hinterecker, Philip N. Johnson-Laird, "The provenance of modal inference", in Glenn Gunzelmann, Andrew Howes, Thora Tenbrink, Eddy J. Davelaar (eds.), *Computational Foundations of Cognition*, Austin, Cognitive Science Society, 2017, pp. 663-668.

[XVII]   P(a & b) &

[XVIII] P(not-a & b) &

[XIX]   P(not-a & not-b)

Where, evidently, 'a' represents the fact that you come and 'b' refers to the fact that I leave.

In this way, now, [XVII] indicates that there is at least a possible world, for example, W_1, in which [VIII] is true because you come and I leave. On the other hand, [XVIII] claims that there is at least a possible world, for example, W_2, in which [VIII] is true because you do not come and I leave. Finally, [XIX] states that there is at least a possible world, for example, W_3, in which [VIII] is true because you do not come and I do not leave. Of course, those worlds can also be expressed in a semantic manner as follows:

[XX] W_1 (a, b); W_2 (not-a, b); W_3 (not-a, not-b)

And, likewise, it can be thought even that, actually, W_1, W_2, and W_3 are not simple worlds, but set of worlds.[34] In particular, W_1 would be the set of worlds in which you come and I leave, W_2 would be the set of worlds in which you do not come and I leave, and W_3 would be the set of worlds in which neither you come nor I leave.

Be that as it may, what is absolutely clear is that this perspective share with the previous one the idea that the way a sentence is expressed in natural language does not have a real influence on its logical form. But the difference is that it links sentences to formulae such as [XVII], [XVIII], and [XIX], and possible worlds such as those in [XX]. Undoubtedly, given the importance of the concept of possibility in the mental model theory, one might think that this third account is coherent with that theory. However, as said, the proponents of the aforementioned theory reject logical forms and deny that purely syntactic or formal structures lead human thought[35], even if such logical forms and syntactic structures come from modal logic.[36]

CONCLUSIONS

Therefore, it cannot be said that the difficulties caused by [VIII] cannot be removed. There are, as shown, at least three ways to do that, and, as it can be checked in the literature cited above, those three ways seem to be consistent with the empirical results obtained to date. Nevertheless, undoubtedly, there is something that the three approaches have in common as well: the prior acceptance of the main theses of the mental model theory about the iconic pictures that correspond to each sentence.

[34] E.g., M. López-Astorga, "Iconic representations, possible worlds, and system K", p. 131.
[35] E.g., P. N. Johnson-Laird, "Against logical form", pp. 193-221.
[36] E.g., Sangeet Khemlani, Thomas Hinterecker, Philip N. Johnson-Laird, "The provenance of modal inference", in Glenn Gunzelmann, Andrew Howes, Thora Tenbrink, Eddy J. Davelaar (eds.), *Computational Foundations of Cognition*, Austin, Cognitive Science Society, 2017, pp. 663-668.

[Account 1] is just the acceptance of the mental model theory, and hence a manner of understanding language and cognition that is basically semantic, and in which logic plays no role. Nevertheless, [Account 2] and [Account 3] mover forward more syntactic positions (as it is explicitly mentioned in works such as the cited ones). But, as shown, both of them previously accept the mental model theory too.

And this leads to an obvious conclusion: the theses of the mental model theory must be first accepted to be able to solve problems such as the one addressed here. Only after that, as a second stage, it is possible to take syntax and formal logic into account (as [Account 2] and [Account 3] do), and, basically, by adding more assumptions to which the mental model theory has already raised.

Of course, [Account 2] and [Account 3] have important strengths. They reveal that it is still absolutely possible to think about relationships between human thought and logical syntax, since it is always feasible to build explanations consistent with logic, whether the classical one or the modal one.[37]

However, an important question coming from papers supporting the mental model theory[38] and that, in general, López-Astorga does not usually ignore in his works remains: if it is possible to account for reasoning and language only based upon the main principles of the mental model theory and ignoring logic, is it actually necessary to make the explanations more complex by summing syntactic and formal logical elements (as in [Account 2] and [Account 3]), which, ultimately and from a strict point of view, are not required at all to understand the intellectual phenomena? The truth is that it is enough to say that sentences such as [VIII] refers to scenarios such as the three iconic scenarios [IX], [X], and [XI], without the need to admit, at once, theses related to the material conditional, a system such as K, or a semantics of possible worlds. And that is enough because it alone, by itself, can already explain most human intellectual activities, perhaps including even those linked to emotions.[39]

---

[37] E.g., M. López-Astorga, "The disjunction introduction rule: Syntactic and semantic considerations", pp. 141-149; M. López-Astorga, "Iconic representations, possible worlds, and system K", pp. 120-136.

[38] E.g., P. N. Johnson-Laird, "Against logical form", pp. 193-221.

[39] M. Bucciarelli, P. N. Johnson-Laird, "Deontics: Meaning, reasoning, and emotion", pp. 89-112.