

Chapter 27

Vague Heuristics

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For some thinkers, the failure of either the principle of non-contradiction, or that of the excluded-middle, means that the corresponding theoretical developments are based on ‘trembling grounds’. But things are what they are, and the principles fail in many cases. Enric Trillas, [19, p. 1]

27.1 Introduction

Even when they are defined with precision, one can often read and hear judgments about the vagueness of heuristics in debates about heuristic reasoning.¹ This opinion is not just frequent but also quite reasonable. In fact, during the 1990s, there was a certain controversy concerning this topic that confronted two of the leading groups in the field of heuristic reasoning research, each of whom held very different perspectives. In the present text, we will focus on two of the papers published in *Psychological Review*, wherein the arguments of each of these groups were presented: on the one hand, Kahneman and Tversky (1996) [10], and, on the other, Gigerenzer ([3, 4, 5]) and Gigerenzer and Murray ([2]). Essentially, there are two reasons for carrying out an analysis of this controversy in this article: Firstly, because in the subsequent literature there is no analysis of the impact of those (allegedly opposed) positions on the development of both groups’ research programmes, especially in the case of the Adaptive Behaviour Cognition (ABC) research group at the *Max Planck Institute for Human Development*. The second reason is related to the perspective that will be proposed here to interpret those results. According to that perspective, if we take into account the scientific production

¹ The concept of ‘heuristics’ has been utilised in various disciplines and lines of research. This explains, at least partially, the plurality of perspectives from which certain questions are approached, such as the nature of the cognitive functions behind heuristics, whether they are used the same way in different knowledge domains, whether they guide a course of action in the same way as our acquisition of knowledge does in a specific environment, etc. Here we will try to demonstrate that the semantic or conceptual pluralism of the term ‘heuristics’ derives not just from the uses it acquires, but also from the different types of evidence that the process it refers to requires.

of Trillas regarding the meaning of terms such as ‘vagueness’ and ‘fuzziness’, there would be reason to believe that Gigerenzer’s [5] controverted response to Kahneman and Tversky allows, even today, for new interpretations to be made. This is the objective of the present paper. The interpretation proposed here intends to be evaluated taking into account whether or not it is relevant to explore the social dimension of heuristic reasoning. Nowadays, what we know as social heuristics are the subject of much debate and research.

According to the interpretation we propose, when Gigerenzer objected that the heuristic-and-biases program of Kahneman and Tversky was based on a vague conception of heuristics, he was not merely stating the truth but was also detecting a research niche of great interest.² In spite of the fact that, as far as we know, that niche has not been sufficiently explored. It is not the same to state that heuristics are vague if the author who makes this assertion is in favour of a semantic perspective (for example, because he or she supports a theory of truth degrees) as if the author is in favour of epistemicism in his or her perspective on vagueness. Nevertheless, before exploring those perspectives and the way in which they could affect the notion of heuristics, it is necessary to carry out a comprehensive interpretation of the debate between those psychologists of reasoning in 1996.

27.2 Reasoning with Content-Blind Norms?

If we could travel in time and go back to the date in which the controversy started – for the moment, therefore, we will not take into account those significant publications that have appeared subsequently – we could state, in general, that Kahneman and Tversky consider that the main goal of the heuristics-and-biases program has been to understand the cognitive processes

² Newell and Simon (1972) [15] used the term for the first time to denote procedures for solving problems in an easier way than using complex algorithms. Nevertheless they insisted that this procedure does not guarantee that a solution (correct or otherwise) will be obtained. Two years later, Tversky and Kahneman published “Judgment under uncertainty: Heuristics and biases”, in which they used the term to refer to normal procedures for guiding probabilistic judgment (their estimation); therefore, they also related it with the notion of “intuitive statistics”. However, for others, as is the case with Gigerenzer and Goldstein (2002) [8] (whose research program is generally presented as opposed to that of Kahneman and Tversky), the term refers to a specific type of strategy used to adapt to the environment. Although these strategies are not always correct – as occasionally better-suited ones can be found – what is important to the ABC group is to analyse the purported heuristics, to identify their ecological rationality via (computational) modelling that accounts for how those heuristics exploit the pattern of information in a determined context, and finally to show to what extent this heuristic procedure has produced suitable inferences.

that produce both valid and invalid judgments.³ That is how Gigerenzer described the research objective of the heuristic-and-biases program. Here we do not propose to make any detailed discourse analysis. For example, we will avoid examining if the one describing his opponents' program is incurring, or not, in the straw man fallacy.⁴ In order to satisfy the objectives announced in the previous section, it will suffice to detect the main differences between both research groups. According to that initial presentation, the second group would be characterised by their proposal of models of cognitive processes that predict when frequency and probability judgments are valid and when they are invalid according to certain norms and the fact that they also explain why. Indeed, this last question is considered essential in order to avoid both vagueness and excessively strict norms in the debate about what constitutes a good question and a satisfactory answer in psychological research on reasoning. The application of both criteria – narrow norms and vagueness – could produce a notion of heuristics that explains “too little and too much”. Gigerenzer constructs a complex argument from a set of simple arguments which, taken into account individually, can be described as two reasons.

The norms for evaluating reasoning are too narrowly drawn

Vague heuristics have directed attention away from detailed models of cognitive processes (...) and toward post-hoc accounts of alleged errors

Therefore

Judgments deviating from these norms will be mistakenly interpreted as ‘cognitive illusions’

³ In the literature on heuristics and cognitive biases, Kahneman, Tversky and Slovic's [12] programs and those of Gigerenzer [7] and Todd, Gigerenzer et al. [18], are generally presented as being in opposition, even if this opposition is in a certain sense a question of emphasis. A significant difference certainly exists in the fact that while the former investigate how the use of heuristics and biases produces mistakes, the latter believe heuristics make us more intelligent, which is why some authors ask whether they could even make us kinder. This last question would not be taken very seriously until the publication Sunstein [17]. In general, it can be stated that both groups believe that the use of heuristics gives rise to relatively valuable judgments within determined contexts. They also agree that determining the errors caused by the use of a heuristic in a determined context requires empirical research. Another identifying trait both programs have in common is that they take heuristics not as declarative propositions but as procedures that can be applied to very different problems that in fact present an unlimited variety of contents.

⁴ A straw man is a common type of argument and is an informal fallacy based on the misrepresentation of an opponent's argumentation or interpretation.

Gigerenzer refers to and describes several facts to justify his reasons and illustrate his main argument. The first one consists of appealing to a certain research practice common to specialists whom we consider to have a certain academic authority in their field:

The first issue on which Kahneman and Tversky and I disagree concerns the question of what counts as sound statistical reasoning. Most practicing statisticians start by investigating the content of a problem, work out a set of assumptions, and, finally, build a statistical model based on these assumptions.” [5, p. 592]

The author then insists on the fact that, in spite of the aforementioned practice, in Kahneman and Tversky’s work a quite peculiar fact is observed that is described in the following terms:

“The heuristics-and-biases program starts at the opposite end. A convenient statistical principal, such as the conjunction rule or Baye’s rule, is chosen as normative, and some real-world content is filled in afterward, on the assumption that only structure matters. The content of the problem is not analyzed in building a normative model, nor are the specific assumptions people make about the situation.” [5, p. 592]

With the aim of providing an example on which the previous objection can be based, and thus, in order to clarify the referred facts, Gigerenzer presents the results obtained by his colleagues concerning the famous Linda problem. He describes them in the following way:

For instance, consider the Linda problem, in which participants read a description that suggests that Linda is a feminist and are asked “Which is more probable? (a) Linda is a bank teller [T], or (b) Linda is a bank teller and active in the feminist movement [T&F].” Tversky and Kahneman’ [21] norm of sound reasoning here is the conjunction rule, and only the conjunction rule, which leads them to conclude that answering T&F is a fallacy.” [5, p. 592]

Gigerenzer maintains that, when his colleagues describe in that way the results they obtained for the Linda problem, they do so because they apply an interpretation criterion based on narrow norms. And he adds that there are two reasons to believe that the application of those norms is (excessively and unnecessarily) narrow:

1. Probability theory is imposed as a norm for a single event (whether Linda is a bank teller); this would be considered misguided by those statisticians who hold that probability theory is about repeated events.
2. The norm is applied in a content-blind way, with the assumption that judgments about what counts as sound reasoning may ignore content and context.

The counterargument used in this article to oppose the use of narrow norms to analyse the application of probability laws to singular events is as follows: because an adequate context can be created to introduce this norm

and obtain the indicated results, it is therefore not contradictory to assume that an adequate context could be described to introduce the norm in such a way that it does not lead interviewees to use the conjunction fallacy.

This counterargument presents a hypothetical situation in which the two fundamental notions of this polemical debate are used: single-event probabilities and content-blind norms, in order to reach a conclusion: the conjunction fallacy is not universally applicable as a sound reasoning norm. This could be stated in more precise terms: the application of probability laws to any type of propositions about singular events is not a good criterion to determine cognitive illusions because the norm or the criterion presumably used by people to solve the problem is not universally applied as a norm of sound reasoning.

As other scenarios could be considered that means other contexts linked to a different exposition of the case information, the strongest objection by Gigerenzer has to do with the (equivocal) assumption that there are content-blind norms in reasoning. His counterargument confronts the results of Kahneman and Tversky's with the support of two reasons: the application of single-event probabilities concerning any circumstance (i.e. single event propositions) is not well defined if the statistical principle is imposed as a norm, that means – and this would be the second reason –, if the content is not analysed, thus applying content-blind norms.

The second reason based on the idea that content-blind norms might exist, has more weight from an argumentative point of view. After all, if the meaning of 'probable' cannot be reduced to the case (e.g. to the application and meaning) of the conjunction fallacy this is due to the plurality of acceptations that the term 'plausible' has for all of us. The application of narrow norms such as interpretation criterion for the obtained results is inadvisable because people do not reason using content-blind norms.

In the case of the example, if we refer to the *Oxford English Dictionary*, interviewees might be reasoning taking into account, among others, one of these acceptations of probability:

- (i) "plausible"
- (ii) "having an appearance of truth"
- (iii) "that may in view of present evidence be reasonably expected to happen"

Gigerenzer's counterargument is summoned with a determining persuasive charge when he states that:

"These legitimate meanings in natural language have little if anything to do with mathematical probability. Similarly, the meaning of and in natural language rarely matches that a logical AND. The phrase T&F can be understood as the conditional "If Linda is a bank teller, then she is active in the feminist movement." Note that this interpretation would not concern and therefore could not violate the conjunction rule. (...) Semantic inferences – how one infers the meaning of polysemous terms such as probable from the content of

a sentence (or the broader context of communication) in practically no time – are extraordinary intelligent processes. They are not reasoning fallacies. No computer program, to say nothing of the conjunction rule, has yet mastered this form of intelligence. Significant cognitive processes such as these will be overlooked and even misclassified as “cognitive illusions” by content-blind norms.” [5, p. 593]

Up to this point, we agree with Gigerenzer’s counterargument. The psychologist uses an argument that coordinates two simple ones. Taken separately, they can be considered two good reasons as they lead to a representation of human reasoning that, apparently, fits better with the practice of ordinary reasoning. In the case of this latter fact, it is crucial to understand why it is persuasive. Nevertheless, our disagreement starts precisely in the point where this author accuses Kahneman and Tvesky’s proposal of being vague. I would contend that Gigerenzer does not notice the fact that his own proposal might be understood as an invitation to think about the role of vagueness in ordinary reasoning. This is precisely the point where, in my view, Trillas’ scientific production seems to me to be essential to carry out an interpretation based on arguments. According to the interpretation I am going to suggest, if I am not mistaken, in this important controversy a perfect opportunity was missed to explore the meaning and function of vagueness in our reasoning processes. Even though the year 1996 now seems quite far away, in my view, testing this interpretation is still relevant for current research on heuristics and, in particular, in the field that is related to the social dimension of this type of ordinary reasoning.

27.3 The Heuristics-and-Biases Program

We started with the affirmation that, even when defined with precision, in debates concerning heuristic reasoning it is frequent to find judgements concerning the vagueness of heuristics, and we also stated that this opinion is not only frequent but even seems reasonable. Research on heuristic reasoning as a type of cognitive process has developed in an especially significant way from 1970 onwards. In spite of the fact that many years have gone by since 1996, it is difficult to find a publication where the causes related to the vagueness of the heuristic-and-biases program are better described. There would be at least six reasons why that program is vague or even too vague to count as an explanation of the investigated phenomenon (heuristic reasoning). That program would be vague because of the following reasons and/or circumstances:

- The reluctance to specify precise and falsifiable process models
- Too vague to clarify the antecedent conditions that elicit various heuristics
- Too vague to work out the relationship between heuristics
- Connection between narrow norms and the absence of process models

- Kahneman and Tversky did not start with the content, but with a statistical rule
- They assumed that there is only one correct answer to be determined mechanically by plugging in values and computing outcomes

Some of these reasons would constitute a direct cause of the vagueness of the program, and others could be considered a consequence of the application of a program where the explanations concerning heuristic reasoning are excessively vague.

Table 27.1 The heuristic-and-biases program is too vague

Causes of vagueness	Consequences of the vagueness
Kahneman and Tversky did not start with the content but with a statistical rule.	Too vague to clarify the antecedent conditions that elicit various heuristics.
The reluctance to specify precise and falsifiable process models.	Too vague to work out the relationship between heuristics.
Connection between narrow norms and the absence of process models.	The assumption that there is only one correct answer to be determined mechanically by plugging in values and computing outcomes.

In the light of what has been previously stated, Gigerenzer affirms that in the analysed program there are methodological factors wherein not only vague criteria concur (e.g. they are not sufficiently demarcated), but also that they lead to a vague explanation concerning the described phenomena. Before explaining why I consider it important to demarcate the sense of the concept of vagueness in this debate, I will briefly refer to the range of problems (e.g. social, epistemic, learning-related, etc.) encompassed by research on heuristic reasoning. Only in this way it is possible to judge whether or not it is relevant to turn to this debate in order to analyse the use of the term ‘vagueness’. With the help of some graphics, we will present the most relevant conclusions reached by Gigerenzer while analysing Kahneman and Tversky’s program. It must not be forgotten that the objective of the program of the ABC research group at the Max Planck Institute is to present a conception of heuristic reasoning which is less vague than the previous one. Therefore, it seems reasonable to evaluate if they have succeeded or not.

27.3.1 Challenges Associated with Heuristic Reasoning

For some authors, the study of heuristics must be related to the goal of clarifying our theories about the world (e.g. popular conceptions about the laws of physics, folk conceptions, etc.). This is precisely the form it takes

in the work of Baron (1993), who introduced the term ‘moral heuristics’ to describe the norms that make up our naïve morality. Barons contribution was fundamental as it later instigated a perspective on moral judgment in which it was described as being associated with two different cognitive systems: an intuitive system and a rational system [9]. According to Sunstein [17], heuristics rely on system I, the intuitive system, which is why they are quick, do not demand a great cognitive effort, are in a certain sense inaccessible to the conscience, and entail a parallel process which some have related to emotions [9]. If heuristics are a type of strategy related to the natural capacity to value and to make judgments in order to produce an estimation or a prediction, how can we identify them? In Kahneman and Tversky, their detection is possible as they are identified with strategies that take the form of mental shortcuts used unconsciously (as there is no deliberate will to use these strategies) by people to solve specific problems.

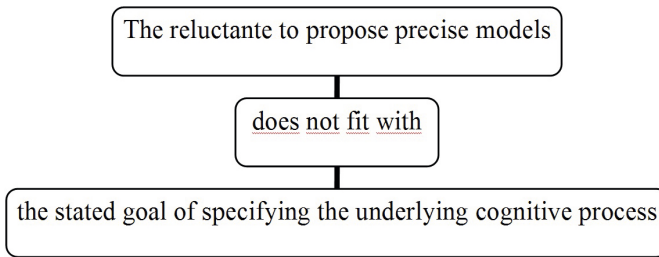


Fig. 27.1 One of the strongest Gigerenzer’s objection: the model is inaccurate

In 1974, Tversky and Kahneman maintained that people trust in a limited number of heuristic principles that reduce the complex tasks of assigning probabilities and predicting values to simpler judgment operations. Gigerenzer’s research program can be understood as a contribution to the set of controversies that the cited publication generated. According to what we have seen, their main objective is to detect these simple and frugal heuristics, to determine what role they play in each realm of knowledge and to describe their function without isolating them from the context in which they are used. The fundamental trait of the ABC Groups project focuses on a simple idea: that in the real world heuristics generally function well. Despite this simplicity, this is one of the most relevant objections to the early works on heuristics, as many of the findings on the purported cognitive errors people commit can be understood as consequences, i.e., diagnoses, constructs generated by the experimental design of unfamiliar problems, and their performance is the description of the use or application of heuristics as if these were somehow indiscriminate [6, 18]. An example of this critique is the assessment made of the acceptations of the availability and reess heuristics the use of which is presented *ad hoc*.

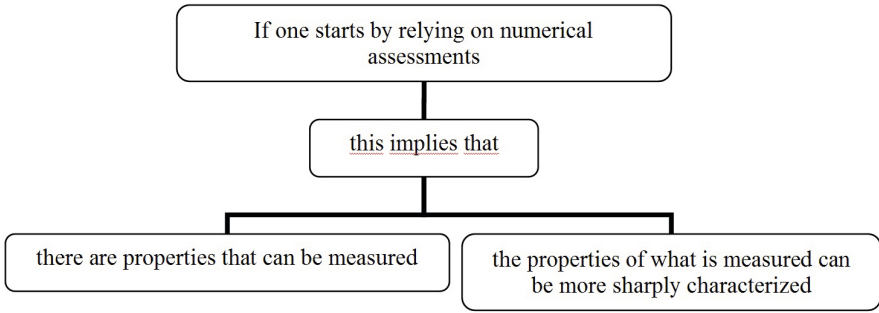


Fig. 27.2 Another famous objection about the model: the difficulty of making measurements and/or improve existing ones

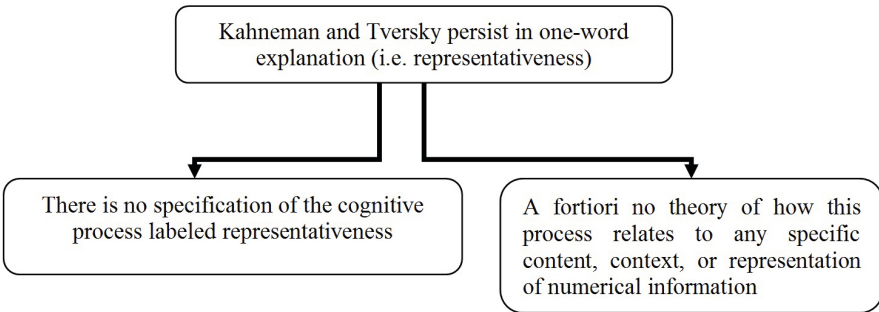


Fig. 27.3 In 1996 Gigerenzer argued that the fundamental weakness of the heuristics-and-biases program is the notion of ‘representativeness’

In response to the aforementioned objections, in 2002 Kahneman and Frederick published *Representativeness revisited: Attribute substitution in intuitive judgment*, a work in which they maintained that heuristics are mental shortcuts used when we are interested in evaluating what they call a “target” attribute. In these circumstances, people generally substitute a heuristic attribute of the object (that is presented to us) because it is easier to manage. Heuristics would therefore operate through substitution processes for an attribute.

27.3.2 *Collective Tools for Discussion and Social Change*

In the programmes that we have mentioned so far, one of the consistent defining characteristics of heuristics is the belief that they are not declarative propositions but rather procedures that can be applied to very different problems and these are precisely the ones that present an unlimited variety

of contents. However, the research results of several authors (some of them members of the ABC research group) can be used to establish a coordinated counterargument on this point. Using brief statements, I will enumerate the works that I have selected indicating very concisely why they could be used as counterarguments.

(A) *Reasoning heuristically based on (the content of) what is learned.*

Rieskamp [9] offers an interpretation of the learning processes by which this could be modelled (progressively) using the same selection strategies employed in learning. The results of his research make a clear appeal to the position of those who maintain that people are equipped with a repertoire of different cognitive strategies, and that we simply make use of them when we are called to make estimations or decisions. Learning precisely how to select strategies (which would improve and modify the results of our learning) would turn this perspective around, not just because it would introduce dynamism to this process, but because the subjective expectations (of the learner) would play a fundamental role in our heuristic reasoning (e.g., thereby selecting the most successful option according to the representation of the problem, recursively modifying the selection of applicable heuristics as a function of the learning opportunities experienced, etc.). Kunda's classic article [22] on motivated reasoning sheds light on the research context in which Rieskamp's research can be framed, beyond the ABC research program on ecological rationality.

It appears that learning is an important factor that needs to be taken into account when interpreting inferences in a situation in which outcome feedback is provided. Therefore the conclusions regarding how people make their inferences depend on the provided learning opportunity. Depending on whether the learning opportunities are sufficient to allow people to adapt to the specific environment, conclusions might differ concerning whether people make their inferences adaptatively [9, p. 274].

(B) *Reasoning heuristically based on (the content of) defeasible beliefs.*

Morado and Leah's perspective in the article Rationality, logic, and heuristics refutes Gigerenzer's vision of the role of logic not just when reasoning heuristically but also when selecting precise heuristics from our particular toolbox. Given that this selection depends on basic beliefs, and given that the structure of sociocultural contexts (to use Gigerenzer's terminology) in which our life unfolds can eventually bring about in us contradictory beliefs, our heuristic reasoning can be understood as part of a paraconsistent system geared towards processing information that arises from contexts, from

situations. Belief should be added to the concept of “context” in the ecological rationality model: our contexts are contexts of beliefs (e.g. which we are in, have been in, observe others to be in, etc.).

Human inferential systems are paraconsistent in the sense that we have contradictory beliefs yet reasoning continues through the use of heuristics without collapsing into triviality. [...] Many heuristics are content-specific or domain-specific. Some heuristics are learned from experience and many successful executions are due to familiarity with contextual parameters. These parameters are important if an agent is to react rationally to highly contextual “environment variables”, for instance those involved in natural language processing. [...] Heuristics often exemplify “nonmonotonic reasoning” because in many cases they produce defeasible beliefs, retractable in the face of new evidence. (Morado and Leah [14]).

(C) *Reasoning heuristically based on (the change and content of) the heuristics of folk psychology.*

If the analysis of the use of heuristics has to do with learning, the results in folk psychology research should be integrated within this vast set as through it we make use of a type of popular causation with which we also make use of our heuristics. This kind of popular causation may not allow us to make predictions or explanations in a strict sense (i.e. because they give reason to believe that something may occur or because they explain why something has occurred), but it does allow us to establish existent causal relationships between states of belief, desires, fears, etc.

And if this is true, then heuristic idealisations of common sense should be evaluated based on the successful or unsuccessful intentional predictions they lead to, no by the truth or falsehood of a description of reality that they do not make. [...] Of course, the history of our folk psychology has not concluded. The patrons of social interaction are in a permanent state of flux; also, there is no doubt that scientific development has a certain influence on the avatars of common sense. [13, p. 239]

Both the learning of strategies (whether later applied to the act itself of learning heuristics in determined contexts or not) and the learning (simulated or not) of folk psychology heuristics justify a review of the classical theories on heuristics from a social viewpoint. It is our view that the descriptive and normative perspective of heuristics cannot be reduced to the discussion of whether moral heuristics exist or whether these can be catalogued to make their use, for example, in the world of judicial argumentation more understandable. Because, even so, the task of learning how we forge our heuristics socially, whether or not these are unfair from an epistemic viewpoint, or whether social heuristics can be transformed using other socially constructed heuristics, thus relegating them to dialectics (where Aristotle placed them)

would still have to be undertaken in order to analyse them as (social and collective) tools for discussion and social change.

27.4 Coda

The acquisition of beliefs through learning processes, distinguishing states and relations of dependency between belief states, learning folk mental causation models, etc., they are all activities through which we reason with contents and, at the same time, they are activities through which we actively attend to the formation of cognitive processes. I have selected the Gigerenzer vs. Kahneman and Tversky controversy because I consider that, in some way, it is the result of considering vagueness in its relationship with temporality but not with the inherent vagueness of propositions, of the terms used in natural language, of the diffuse sets that people employ to reason and to use our socially constructed heuristics (through learning processes, folk mental causation theories for beliefs acquisition, etc.). What is missing in this controversy – which took place a decade after the publication of Zadeh's *Fuzzy sets and applications* (1987) – is a reflection on vagueness. Gigerenzer assumes that vagueness and lack of precision are negative terms. He does not think that vagueness might be a characteristic of heuristic reasoning but rather that it is (a) a pernicious property characteristic of Kahneman and Tversky's heuristic-and-biases program, and (b) a negative consequence derived from the application of their program to the study of heuristic reasoning. Against this conception of vagueness, other authors offer a description of human reasoning as a process that could not be understood without fuzziness as a principal trait of linguistic concepts. If I am not mistaken, this would be the case of Trillas.

Talking acquires full development with the typically social human manifestation called storytelling with, at least, its two modalities of discourse and narrative that, either in different oral, spatial hand signs, or written forms, not only support storytelling but, along with abstraction, could be considered among the highest expressions of the brain capability of thinking, surely reinforced during evolution by the physical possibilities of the human body to tackle and to consider the possible usefulness of objects. Storytelling can be roughly described as constructing chains of sentences organized with some purpose. Thinking and storytelling are merely names for abstract concepts covering the totality of those human actions designated by the verbs 'to think', 'to tell', and 'to discuss', of which only the two last can be directly observed by the layperson. [20]

These descriptions of human reasoning and of such common operations as dialogue, narration, telling (something to someone) are of enormous interest. This is so because taking them and the ideas that they set in motion as a starting point, the existing production in the field of the psychology of reasoning concerning heuristics could be re-interpreted. The use and function

of heuristics makes sense precisely because precision and certainty cannot be reached acritically by making predictions before seeing how people throw the dice and what problems each of us solve in the most complex game of all, that of communication. In that complex and daily game, the majority of inference processes are of a semantic than a syntactic nature. The meaning of sets (of the dices thrown into the air) should not be dissociated from the fuzzy traits implicit in the premises. Essentially, I think that in this controversy conjectures are made prematurely. It would have been desirable to establish an acceptance of vagueness in some sense. Saying that the Kahneman and Tversky's program is too vague because it explains too much could be used as an argument against Gigerenzer himself as the acceptance of vagueness he uses is too vague. But this is a secondary matter, related to the analysis of arguments. What I consider more important is the analysis of the consequences of his argument (which I consider to be weak) because it hindered his analysis of, at the very least, the following problems: (a) what is the function of heuristics in approximate reasoning, where imprecision and uncertainty are intrinsic attributes; (b) are heuristics intrinsically vague?; (c) is the use people make of certain heuristics in certain situations predictable? Even taking into account the great value of the subsequent contributions of the ABC group and their ecological rationality program, I consider that there is still much to do in this field. And I think that as Trillas says "at this point, human capability of conjecturing appears as something fundamental".

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