Two Routes for Bipolar Information Processing, and a Blind Spot in Between

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Abstract

This position paper addresses the question of why, whilst the human brain is apparently geared to process information of mixed polarities, human reasoners sometimes fail to deal appropriately with simple instances of mixed evidence or mixed prospects. From a dual-process perspective to thinking, two mental routes for bipolar information processing are identified. One is biologically acquired and evolution-tied, the other is the product of a cultural elaboration of rational norms. In between the two routes, a blind spot accounts for failures of bipolar information processing.

1 Introduction

The opening joke of Woody Allen's (1977) *Annie Hall* offers an unexpectedly light introduction to the pitfalls of bipolar information processing. Two elderly women at a mountain resort are having lunch, and one of them says: "Boy, the food at this place is really terrible." The other one retorts, "Yeah, I know, and such ... small portions."

The joke, of course, plays on the bipolarity of the second woman's comment. Small portions can be a blessing as well as a curse, and sometimes a bit of both. More generally, information will be qualified as bipolar when it comes as a mixed bag of evidence for or against a claim, of pleasant and unpleasant feelings, or of positive and negative prospects. This is only one among different cases of bipolarity, however, one that we might call 'ambivalent bipolarity'. For the sake of brevity, I will write of 'bipolarity' or

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'bipolar information' in the rest of this article, but my claims will actually be restricted to bipolar information of the ambivalent kind.

There is ample evidence (see Raufaste & Vautier, this volume) that the mind can recruit specific processes when dealing with bipolar information. The question remains, though, of whether these processes are systematically (and successfully) activated when needed. I will suggest in section 2 that they are not, and cite experimental findings that cast serious doubts on our successful apprehension of even very simple cases of bipolarity. Hence a second question: How come that we can process bipolar information so efficiently in some cases, and then so poorly in other cases?

Section 3 will summarize the theoretical framework that can help to explain this discrepancy, namely, the distinction between automatic, evolution-tied mental processes, and reflective, culturally elaborated norms for rational thinking. Section 4 will then apply this general framework to the specific issue of bipolar information processing.

2 Bipolarity *incognito*

What might count as a failure to process bipolar information? Arguably, to only address one side of the information when both are relevant amounts to a failure to apprehend its bipolar nature. Thus, to consider solely the evidence against a claim, although the evidence is mixed, is inappropriate bipolarity processing. Likewise, to consider solely the positive prospects of a decision, when it also has its negative side, counts as an instance of inappropriate processing of bipolar information.

The fact is, we do often consider solely one side of mixed evidence, or one side of mixed prospects. The latter was brilliantly demonstrated by E. Shafir [15] in a series of experiments showing that the one of two options we choose can also be the one we would reject. Participants were presented with a pair of options, one of which (the enriched option) had both stronger positive and stronger negative features than the other (the impoverished option). For example, subjects had to imagine they served on the jury of an only-child sole-custody case, and read a description of each of the two parents. The first parent (the impoverished option) was average in every respect: average income, average health, average working hours, reasonable rapport with the child, relatively stable social life. The description of the second parent (the enriched option) came as a mixed bag of positive and negative features: above-average income, very close relationship to the child, extremely active social life, lots of work-related travel, minor health problems.

When asked to which parent they would *award* sole-custody, a majority of respondents chose the second parent. When asked to which parent they would *deny* sole-custody, a majority of respondents chose. . . this same second parent. In other words, people decided as if they largely neglected one side of the parent's description: the negative side when asked to award custody, the positive side when asked to deny custody. This phenomenon was by and large replicated in a number of decision domains, from holidays destinations to candidates at a local election.

While E. Shafir demonstrated a failure to apprehend mixed prospects, a number of authors investigated the failure to apprehend mixed evidence, as in the phenomenon known as *group polarization* [7]. In their princeps study, Lord, Ross, and Lepper [11] presented participants with (fictitious) mixed evidence regarding the effectiveness of the death penalty to deter murder. Participants read some statistics that supported this effectiveness (murder rates in given states before and after adoption of death penalty), but also statistics that suggested the opposite (murder rates in states with or without death penalty). Consideration of this set of information only reinforced the initial attitude of participants. Participants who originally thought the death penalty was an (in)effective deterrent were even more convinced of this (in)effectiveness after reading of the mixed evidence. (Meszaros and colleagues [12] report similar findings regarding the belief in the effectiveness of vaccination.)

Arguably, had participants appropriately grasped the bipolar character of the information, they would have ended up *less* sure of their beliefs (if anything), rather than more. This is not as straightforward a prediction as one might wish, however, as capital punishment is an issue participants might have given quite a lot of thinking before being presented with the experimental material. As a consequence, it is possible that participants recruited from memory a number of additional arguments when processing the experimental material. Moreover, some participants might have adopted a moral stance to this topic, from which considerations of effectiveness are quite moot.

Those problems are avoided, however, in another classic study of mixed evidence processing [14], in which participants observed sequences of red and black balls randomly drawn from an urn (each ball was returned to the urn after being drawn), and had to judge whether the proportion of red balls in the urn was 60% or 40%. Once participants form a likely hypothesis about this proportion, a sequence of two balls of different colors should not increase or decrease the subjective probability attached to this hypothesis: However, this subjective probability actually increased after such sequences. Again, this result clearly denotes some inappropriate pro-

cessing of the bipolar information provided by the 2-ball sequence.

We are left with a paradox. Although humans appear to expertly process bipolar information in a number of occasions, they also fare badly in other, apparently simple settings. As I will now argue, this contradiction can be tentatively explained by drawing on a widely accepted approach to human rationality, based on the coexistence of two mental systems for processing information.

3 Dual-process theories of rationality

Bipolar information processing is but one example of a domain wherein human performance can starkly contrast from one occasion to another [16]. To accommodate these contrasted findings, a number of authors [6, 18, 19] have elaborated dual-process theories of human thinking where responses can reflect, at different times, the operation of one system or the other.

All these theories contrast one system (System 1) that operates automatically and unconsciously, to another system (System 2) that operates slowly and deliberately. The fast, association-driven System 1 fires whenever it encounters information it can process, and is rather undemanding of cognitive resources. The analytic, reason-oriented System 2 must be deliberately engaged and controlled, is slow, and demanding of capacity.

K. E. Stanovich [19, 20] has related Systems 1 and 2 to *evolutionary adaptation* and *normative rationality*, respectively. The features of System 1 are biologically acquired, and optimize survival probability at the level of the gene. The processes that form System 2 are acquired by cultural immersion or formal training, and are meant to maximize personal utility (*i.e.,* they optimize at the level of the individual rather than that of the gene). That is not to say, of course, that System 2 is not an evolutionary product. Rather, it is the result of humans living on a "long genetic leash": To enhance their probability of survival and replication, genes have endowed us not only with built-in, myopic cognitive processes (System 1), but also with flexible, all-purpose powers of abstraction and reasoning, which ultimately led to the development of rational, personal utility maximizing tools such as formal logics or probability theory.

Such a perspective on evolution and rationality help to explain why human performance can vary from the impressively good to the confusingly poor within a range of apparently related tasks. When the task can be construed so that it fits one among System 1's built-in algorithms, performance is expected to be very good.(That is, inasmuch as the criteria for performance match the criteria for evolutionary fitness. I do not address

here situations in which the survival goals of the genes may clash with the rational goals of the individual.) However, when no such fit exists, performance becomes entirely dependent on the capacity (and willingness) of an individual to recruit the abstract, decontextualized forms of thinking that are appropriate to the task at hand.

In sum, poor performance is expected when, at the same time, no dedicated System 1 algorithm exists for the task at hand, and one is unwilling or unable to recruit an abstract System 2 strategy. In such a situation, either an inappropriate System 1 algorithm or an inappropriate System 2 strategy is likely to be used, resulting in poor performance. These are the 'blind spot' situations I will get back to in the final section of this article.

Having introduced this dual-process framework, together with its evolutionary reformulation, I will now get back to the specific topic of bipolar information. More precisely, I will draw a tentative line between the kind of bipolar information System 1 is geared to handle, and the kind of bipolar information for which we have to resort to System 2 processing, with the potential for failure this entails.

4 Hardwired vs deliberate bipolarity processing

There is a convincing argument that the whole affect system processes positive and negative stimuli in parallel, and that it does so as a consequence of evolution and natural selection [4, 5]. At every level of analysis (*i.e.,* from brain imagery and neurotransmitters studies to paper-and-pencil self-reports), positive and negative affects appear to be processed and experienced in uncoupled fashion. From an evolutionary perspective, such separability bears a clear benefit to the species, in that sense that organisms can quickly and flexibly process complex stimuli, as long as said stimuli can readily be translated into affects.

Studies of impression formation provide a striking example of the fine-tuning of the affect system to the bipolar nature of a kind of stimulus that is both very specific and nevertheless central to human evolution. It has been argued that the capacity for social interaction is at the core of our evolutionary history [10], and is principally a matter of System 1 processes [19]. Essential to social interaction are the mechanisms by which we form an impression of unknown others, and these mechanisms have been found to be a subtle combination of a *positivity offset* [3, 9] and a *negativity bias* [1, 17] (see also [8] for research on both phenomena, which may generalize to the whole affect system).

The positivity offset refers to the (weak) positive impression we form

of others when very little (or none) information is available about them. From an evolutionary standpoint, this positivity offset fosters social cohesion and encourages us to consider cooperating with unknown conspecifics. The negativity bias refers to the greater weight we attribute to negative behaviors when inferring personality traits: For example, fewer negative behaviors are needed to infer a negative trait, compared with the number of positive behaviors we need to infer a positive trait. The negativity bias can be conceived as a safeguard for a species that exhibits a positivity offset: Whilst cooperation with unknown others is encouraged by the positivity offset, the negativity bias ensures that untrustworthy partners are quickly detected and unprofitable cooperation promptly forsaken.

We can thus assume that the evolution-tied, biologically acquired processes in System 1 are fine-tuned to at least one category of bipolar information, namely, that which comes in the guise of affects. There is no clear indication, though, that System 1 processes can deal with any other bipolar input than affects.(Which is not to say that System 1 cannot process anything but affects! System 1 can of course process affect-lean information – as long as it is unipolar.) Hence, the more difficult it is for some information to be translated into affects, the less likely it is that it can be System 1 processed. (Think of the red and black balls experiment reported in section 2, which hardly involves any affect.) Where System 1 cannot fire for lack of proper input, System 2 must be deliberately engaged. But there is the rub: The rules of System 2 must be acquired either by formal training or by cultural immersion, and there is no guarantee that our culture and education have equipped us with rational norms for dealing with bipolar information.

Parts of decision theory (or parts of probability theory) are of course applicable to bipolar information processing. Such is not, however, their explicit focus. Mastering these sophisticated tools (a feat few people achieve) seems too large an effort simply to apply them to everyday situations of bipolar information; one thus wonders whether simpler (yet rational) schemes for bipolarity processing can be designed, which could then make their way into System 2.

As System 2 is not only a matter of formal theories, but also of cultural norms, the possibility remains that different cultures will offer different takes on how best to address bipolar information. And indeed, differences exist in the way Westerners and Easterners react to mixed evidence [13]. The holistic Eastern culture makes it possible (and encourages) to retain basic elements of two opposing perspectives, and to believe that both perspectives might contain some truth – even at the risk of tolerating a contradiction. This approach to mixed evidence is explicit in the Chinese principle

of contradiction (*Mao Dun Lu*), which broadly states that reality being full of contradictions, everything is a mix of apparently opposite elements – in other words, that everything in the world is of bipolar nature. Westerners, raised in a culture dominated by principles such as the law of noncontradiction or the law of the excluded middle, find it difficult to conceptualize such generalized bipolarity. As a consequence, their reaction to mixed evidence is often to polarize their view, as reported in section 2. (Chinese emphasis on bipolarity also has echoes in self-reports of emotions: When individuals estimate the frequency and intensity of their own emotions, negative and positive emotions are positively correlated for Chinese subjects, but negatively correlated for American subjects [2].)

5 Conclusion

Although there is little doubt that our brain is geared to process information of mixed polarities, we often fail to deal with simple instances of mixed evidence or mixed prospects. I have suggested looking at this apparent paradox from the perspective of dual-process theories of thinking.

This perspective helps to distinguish two routes we can take in order to process bipolar information. The biologically-designed, evolution-tied System 1 route is the one we automatically take when encountering affect-laden information. The normatively rational, culturally elaborated System 2 route is the one we may deliberately take when encountering affect-lean information.

And in between the two routes lays the blind spot. In some occasions, neither the first route nor the second will be practicable, that is, when we are too affectively detached for System 1 to fire, and at the same time unable to recruit or to correctly apply an explicit System 2 reasoning norm. In these occasions, we will either trust an inappropriate System 1 algorithm (that will only process one side of the information), recruit an inappropriate System 2 norm, or inappropriately apply the correct System 2 norm. Those are the occasions when, just as the old lady of *Annie Hall* fame, we find ourselves complaining about being served a small portion of some despicable food.

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