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Does interaction matter? Testing whether a confidence heuristic can replace interaction in collective decision-making

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ABSTRACT

In a range of contexts, individuals arrive at collective decisions by sharing confidence in their judgements. This tendency to evaluate the reliability of information by the confidence with which it is expressed has been termed the 'confidence heuristic'. We tested two ways of implementing the confidence heuristic in the context of a collective perceptual decision-making task: either directly, by opting for the judgement made with higher confidence, or indirectly, by opting for the faster judgement, exploiting an inverse correlation between confidence and reaction time. We found that the success of these heuristics depends on how similar individuals are in terms of the reliability of their judgements and, more importantly, that for dissimilar individuals such heuristics are dramatically inferior to interaction. Interaction allows individuals to alleviate, but not fully resolve, differences in the reliability of their judgements. We discuss the implications of these findings for models of confidence and collective decision-making.

1. Introduction

There is a growing interest in the mechanisms underlying the "two-heads-better-than-one" (2HBT1) effect, which refers to the ability of dyads to make more accurate decisions than either of their members (e.g., Hill, 1982). One study (Bahrami et al., 2010), using a perceptual task in which two observers had to detect a visual target, showed that two heads become better than one by sharing their 'confidence' (i.e., an internal estimate of the probability of being correct), thus allowing them to identify who is more likely to be correct in a given situation. Sharing of confidence as a strategy for combining individual opinions into a group decision has also been established in non-perceptual domains (e.g., Sniezek & Henry, 1989). This

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tendency to evaluate the reliability of information by the confidence with which it is expressed has been termed the 'confidence heuristic' (e.g., Thomas & McFadyen, 1995).

A recent study has shown that a simple algorithm based on the confidence heuristic – always opt for the opinion made with higher confidence – can yield a 2HBT1 effect in the absence of any interaction between individuals (Koriat, 2012). Intrigued by this finding, we tested whether this algorithm could in practice replace interaction in collective decision-making. Importantly, such a formula for collective choice – if effective – would not be susceptible to the egocentric biases that may impair interaction (e.g., Gilovich, Savitsky, & Medvec, 1998), and could readily be used by decision makers, such as jurors, medical doctors or financial investors, who have to combine different opinions in limited time. Indeed, the implementation of heuristics inspired by individual decision-making has proved very useful within professional contexts (e.g., Gigerenzer, 2008).

1.1. Circumventing interaction

Building on Bahrami et al.'s (2010) study, Koriat (2012) asked isolated observers to estimate the degree of confidence in their perceptual decisions. Participants, all of whom had received the same sequence of stimuli, were afterwards paired into virtual dyads so that they matched each other in terms of their 'reliability' (i.e., the reliability of their individual decisions about the visual target). To remove individual biases in confidence, their confidence estimates were normalised, so that they shared the same mean and standard deviation, before being submitted to the Maximum Confidence Slating (MCS) algorithm, which selected the decision of the more confident member of the virtual dyad on every trial. While circumventing interaction, the MCS algorithm yielded a robust 2HBT1 effect. Interestingly, isolated observers' confidence estimates are negatively correlated with their reaction times when responses are given in the absence of speed pressure (e.g., Patel, Fleming, & Kilner, 2012; Pleskac & Busemeyer, 2010; Vickers & Packer, 1982), raising the possibility that a Minimum Reaction Time Slating (MRTS) algorithm may be sufficient to yield a 2HBT1 effect.

In this study, we tested the efficacy of the MCS and MRTS algorithms without matching dyad members in terms of their reliability, and compared the responses advised by the algorithms with those reached by the dyad members through interaction (henceforth 'dummy' versus 'empirical' dyads/decisions). In particular, we addressed three questions. First, does the success of the MCS and MRTS algorithms depend on the similarity of dyad members' reliabilities? Bahrami et al. (2010) found that the success of interactively sharing confidence was a linear function of the similarity of dyad members' reliabilities. For similar dyad members, two heads were better than one. However, for dissimilar dyad members, two heads were worse than the better one. Interestingly, Bahrami et al. (2010) found that these discrepant patterns of collective performance could be explained by a computational model in which confidence was defined as a function of the reliability of the underlying perceptual decision. We predicted that the efficacy of the MCS and the MRTS algorithms would also depend on the similarity of dyad members' reliabilities.

Second, do the algorithms fare just as well as interacting dyad members? People vary in their ability to estimate the reliability of their own decisions (e.g., Fleming, Weil, Nagy, Dolan, & Rees, 2010; Song et al., 2011); this ability is typically referred to as 'metacognitive' ability and, in social contexts, determines the credibility of people's confidence estimates. While the algorithms are prone to error when people misestimate the reliability of their own decisions, interacting individuals may take such misestimates into account (e.g., Tenney, MacCoun, Spellman, & Hastie, 2007). We predicted that interacting dyad members would take into account the credibility of each other's confidence estimates when making their joint decisions, and that interaction would be relatively more beneficial than the algorithms for dissimilar dyad members; they have more to lose from following the more confident but less competent of the two.

Third, what is the effect of normalising confidence estimates before selecting the decision made with higher confidence? Koriat (2012) reported that the MCS algorithm performed equally well when using raw and normalised confidence estimates as its input. However, this analysis was limited to (virtual) dyad members of nearly equal reliability. Even though people vary in the ability to evaluate the reliability of their own decisions, confidence estimates are rarely uninformative about underlying performance (e.g., Lau & Maniscalco, 2010). As a consequence, normalising confidence estimates may remove statistical moments that reflect actual differences in underlying performance (e.g. differences in average confidence due to differences in average performance). We therefore predicted that submitting normalised confidence estimates to the MCS algorithm would be relatively more costly for dissimilar dyad members.

2. Methods

2.1. Data and participants

To test our predictions, we analysed data from an experiment (Bahrami et al., 2012a) in which dyad members estimated their confidence in individual decisions on every trial, but were also required to make a joint decision whenever their individual decisions conflicted. We used data from two experimental conditions: a 'non-verbal' condition in which dyad members made their joint decisions only having access to each other's confidence estimates, and a 'verbal' condition in which dyad members also had the opportunity to verbally negotiate their joint decisions (the NV condition and the NV&V condition in Bahrami et al., 2012a, 2012b). In total, fifty-eight participants (29 dyads) took part in the non-verbal