Adaptive attentional prioritisation of advice for decision making

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Abstract

When we have limited access to reliable information, we are encouraged to seek advice from others to help us make an informed decision. Yet, not all advice is good. Here, we investigated whether people can learn about adviser characteristics and prioritise advice accordingly using a collaborative decision making task combined with eye-tracking. Across two experiments, we showed that participants prioritised advice from those who were more accurate on average and those more confident in the moment. While generally gathering more information when they were most in need of advice, participants strategically sought out information on adviser confidence when advisers disagreed with one another. The current findings show that people learn about adviser characteristics and use them to prioritise the relevant information to support goal-directed decision making.

Keywords: decision making; advice; confidence; attention prioritisation

Introduction

We often need to collaborate with others to achieve goals beyond our individual ability. It is often thought that two heads are better than one but this is not always the case (Bahrami et al., 2010; Koriat, 2012; Pescetelli & Yeung, 2021). To make informed decisions, we must learn to identify and seek better contributions and discount worse contributions. Previous research suggests that people are more likely to ask for advice rather than forgo it when it is given by advisers who perform better at a task and are generally more confident, (Desender et al., 2018; Pescetelli & Yeung, 2021; Schultze & Loschelder, 2021). In the absence of feedback to evaluate adviser characteristics, people strategically rely on participant-adviser disagreement to learn about advisers (Carlebach & Yeung, 2023).

Here we build on this work to investigate how people prioritise and integrate advice from multiple advisers, testing the hypothesis that people learn and use adviser characteristics to predict the quality of their advice.

Across two eye-tracking experiments (Exp 1 N = 35; Exp 2 N = 35), we manipulated the accuracy (Exp 1 & 2) and confidence (Exp 2) of two advisers per block (10 blocks total with 20 trials each) who provided information simultaneously after participants judged the direction of random dot motion stimuli and rated their confidence. Following the advice participants made a final decision and confidence judgement on the dot motion and received feedback. We varied dot motion coherence (high/low) to manipulate participants' need for advice. Adviser confidence was varied in two ways: Average confidence (confidence bias) varied between advisers and for each adviser trial-by-trial confidence varied around their mean such that they were more confident when they were accurate and less when they were inaccurate (+/-0.15 + normally distributed noise), respectively, to ensure adviser confidence was calibrated with accuracy. We hypothesised that participants would seek information from advisers that are more accurate on average and when they are more confident, particularly when there is disagreement amongst advisers and when their need for advice is high.

Results

People prioritise information from more accurate advisers. In both studies, we confirmed our hypothesis as participants were more likely to change their response in accordance with the advisor who was more accurate (i.e., the good advisor). The good advisor's contributions influenced final choice significantly more than the bad advisor's (Exp 1: $\chi^2(1) = 22.90$, $p < .001$; Exp 2: $\chi^2(1) = 12.47$, $p < .001$). Fixation patterns also show a positive relationship between adviser accuracy and the proportion of fixations on the more accurate advisor (Exp 2: b = 0.02, $p = .029$). This relationship was qualitatively similar, but not significant in Experiment 1 (b = 0.03, $p = .221$), which may be because differences in advisor accuracy were zero in half of the blocks (instead varying overall accuracy of advice), and thus less pronounced than in Experiment 2. Overall, participants prioritised the more accurate adviser which indicates that they learnt about adviser accuracy and leveraged it to make an informed decision.

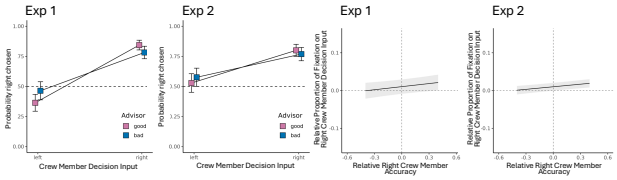

Figure 1: **Adviser accuracy shapes decisions.** Changes in response and fixation prioritisation is shaped by learning of adviser accuracy.

Adviser accuracy is a noisy predictor of advice quality in a given instance which raises the question of whether people can use alternative information, such as advisers' confidence to more reliably predict advice accuracy and support decision making.

People prioritise advice given with greater confidence. Contributions from advisers who were more confident overall (i.e., confidence bias) ($\chi^2(1)$ = 11.57, p < .001) and independent of bias ($\chi^2(1)$ = 60.14, p < .001), were more likely to influence final choice. Participants were more likely to fixate on the more confident adviser (b = 0.03, p < .001), and also on the adviser who displayed greater confidence relative to their own average (b = 0.09, p < .001), thus prioritising information that is more likely to be accurate. Taken together these results show that participants learned critical characteristics, accuracy and confidence bias of advisers and used them to prioritise information that is more likely to be helpful.

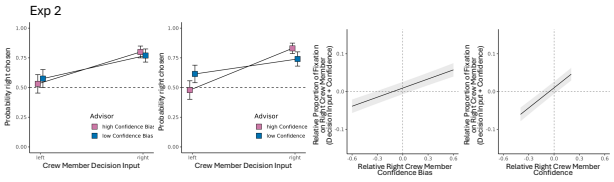

Figure 2: **Adviser confidence shapes decisions.** Changes in response and fixation prioritisation is shaped by more confident advisers (both bias & independent of bias).

People strategically sample adviser confidence to resolve conflicting advice. In both studies, when participants made their final choice, they were less accurate, slower, and less confident when advisers disagreed with one another (all ps < .01). This indicates that participants had difficulty deciding when there was a lack of consensus amongst advisors.

Across both studies, participants dwelled more on advisers' information when motion coherence was low and when advisers disagreed (all ps < .001), that is when advice was needed more and when it was more uncertain. Crucially, in Experiment 2, this effect was primarily driven by strategic sampling of adviser confidence. When participants could use advisers' confidence to infer the accuracy of their advice, they allocated more attention to confidence (b = 0.03, p < .001), and less to decision input (b = -0.03, p < .001), specifically when motion coherence was low and when there was disagreement. This behavior is adaptive in our task where deviations from advisers' average confidence are predictive of advice accuracy.

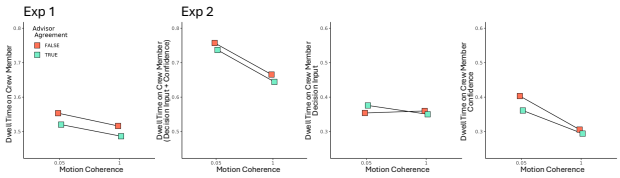

Figure 3: **Strategic confidence prioritisation.** People sample more advice when there is greater uncertainty and when they need more information (panels 1-2). When given confidence information, they sample that information more when uncertainty is greater and there is conflict (panels 3-4).

Conclusion

Across two experiments we showed that people prioritise advice from those who are more accurate and more confident. This indicates that people can learn about adviser accuracy and confidence to help them seek out the relevant help to make better decisions. When confidence is a reliable indicator of adviser accuracy, as in this study, people strategically prioritise how much confidence an adviser has in their decision to resolve conflict, particularly when they are uncertain and are provided with conflicting advice. Our findings show that people can flexibly adjust how they sample and integrate information based on learned adviser characteristics, momentary confidence cues for advise accuracy, and the need to resolve uncertainty or conflict during choice.

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References

Bahrami, B., Olsen, K., Latham, P. E., Roepstorff, A., Rees, G., & Frith, C. D. (2010). Optimally Interacting Minds. *Science*, *329*(5995), 1081-1085. https://doi.org/10.1126/science.1185718

Carlebach, N., & Yeung, N. (2023). Flexible use of confidence to guide advice requests. *Cognition*, *230*, 105264. https://doi.org/10.1016/j.cognition.2022.105264

Desender, K., Boldt, A., & Yeung, N. (2018). Subjective Confidence Predicts Information Seeking in Decision Making. *Psychological Science*, *29*(5), 761–778. https://doi.org/10.1177/0956797617744771

Koriat, A. (2012). When Are Two Heads Better than One and Why? *Science*, *336*(6079), 360–362. https://doi.org/10.1126/science.1216549

Pescetelli, N., & Yeung, N. (2021). The role of decision confidence in advice-taking and trust formation. *Journal of Experimental Psychology: General*, *150*(3), 507–526. https://doi.org/10.1037/xge0000960

Schultze, T., & Loschelder, D. D. (2021). How numeric advice precision affects advice taking. *Journal of Behavioral Decision Making*, *34*(3), 303–310. https://doi.org/10.1002/bdm.2211