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'I've Just Been Pretending I Can See This Stuff!': Group member voice in decision-making with a hidden profile

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This research seeks to expand our knowledge of what underlies group performance in Hidden Profile decision tasks, adopting a mixed methods approach. We created a new mental simulation intervention designed to improve group decision outcomes and information exchange and tested it across two studies. We supplemented our quantitative statistical analysis with Thematic Analysis, to explore and better understand the motivations and utterances of individual group members, which we contend are key to increasing understanding of the challenges operating at individual and group levels in Hidden Profile decision tasks. Much group decision-making research uses quantitative methodologies, searching for causal explanations of why things happen as they do in group processes. As a subset of this area, existent Hidden Profile research is centred in the quantitative domain. Yet qualitative research can improve the understanding of group phenomena, such as communication style, which is important in groups' decision-making. To our knowledge, no Hidden Profile research has taken a similar approach, so this paper makes a unique contribution. Results indicated the mental simulation had a positive effect on information exchange and decision quality in a Hidden Profile hiring task.

At an organizational level, groups are ubiquitous and deployed in numerous tasks (Morgeson, DeRue, & Karam, 2010), including decision-making. Yet evidence suggests groups can struggle in these tasks. Reasons for this vary, including problems such as social loafing (Latané, Williams, & Harkins, 1979), group polarization (Bettenhausen, 1991), and groupthink (Janis, 1982). Poor decision-making in groups has been shown to negatively impact a wide range of outcomes, for example medical decision groups (Hopthrow, Feder, & Michie, 2011) and hiring decisions, most of which are made by a panel following a lengthy interview process. Harvard Business Review estimated as much as 80% of employee turnover is due to bad hiring decisions; for example, Zappos CEO Tony Hsieh estimated bad hires cost his company 'well over $100 million' (Wei, 2010).

Research from the consulting firm, McKinsey (2009), found 60% of senior executives believed bad strategic decisions were as frequent as good ones. Notwithstanding, group decision-making remains the norm rather than the exception, principally because in

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organizational contexts, group decision-making has advantages beyond decision quality, for example legitimacy and acceptance (Kämmer, Gaissmaier, & Czienskowski, 2013); level of commitment to the decision (Bowman & Wittenbaum, 2012; Levine & Moreland, 1990); and higher acceptance and better implementation of the decision, (Brodbeck, Kerschreiter, Mojzisch, & Schulz-Hardt, 2007). Getting to the heart of understanding good group decision-making is therefore imperative.

Information asymmetry and the hidden profile

Brodbeck et al. (2007) argued that failures in organizational group decision-making could be counteracted in certain circumstances, such that groups could outperform individual decision-makers. These circumstances require the interaction of: (1) specific types of information asymmetry being present in the group; and (2) specific types of asymmetries in information processing being absent from the group.

At its simplest, information asymmetry can be defined as a condition where 'different people know different things' (Stiglitz, 2002, p. 470), a very common situation in group decision-making. In social psychology, asymmetric information has been conceptualized in group decision-making research using Hidden Profile decision tasks (Stasser & Titus, 1985). Such tasks are characterized by the fact that they always have an 'optimal' answer. However, the optimal answer is opaque by the fact that information is distributed asymmetrically between group members: some being shared with all members, whilst other information is partially shared or unique, perhaps known to only one group member. Only if groups pool information well enough to highlight the critical unique information possessed by each member (whether positive or negative), can they hope to arrive at the optimal solution. This task is further complicated by the fact that individual information sets held by each group member typically point to a different decisional outcome than the group's full information set (Brodbeck et al., 2007), with individual group members being oriented towards an initial, suboptimal solution.

Such suboptimal decisions can be attributed in part to the fact that decision-making groups favour shared rather than unique information – the *collective information sampling* bias: (CIS: Stasser, Taylor, & Hanna, 1989). The existence of the CIS has been demonstrated in much Hidden Profile research: shared information is discussed more readily than unique information, leading decision-making groups to suboptimal decision outcomes (e.g., Larson, Christensen, Abbott, & Franz, 1996; Larson, Foster-Fishman, & Keys, 1994; Wittenbaum, Hollingshead, & Botero, 2004). Unsurprisingly, solving a Hidden Profile decision task with asymmetric information is more difficult when group members focus predominantly on shared information. For example, Van Swol, Savadori, and Sniezek (2003) found the probability of switching from an inferior to a superior decision in a Hidden Profile task was higher when shared information was *not* repeated.

Information exchange and use in hidden profiles

Lu, Yuan, and McLeod (2012) meta-analysed 65 Hidden Profile studies conducted over 25 years, concluding that information coverage, the extent to which group members pooled unique information, was significantly and positively correlated with decision quality, $r = .56, p < .01$ – a large effect size. Discussion focus, the extent to which group members concentrated their discussion on unique information, was also correlated with decision quality, with a medium effect size, ($r = .25$, $p < .01$). This is consistent with previous meta-analytic findings from Mesmer-Magnus and DeChurch (2009): Information

Sharing was a positive predictor of team performance, with heavy emphasis on the uniqueness of the information shared.

Research has also shown information use is important in solving Hidden Profiles (Xiao, Zhang, & Basadur, 2013). Both use and sharing may be down to the critical role of the motivation, actions, and processing of the individual group members. For example, in the context of regulatory focus theory, Burtscher and Meyer (2014) found that groups with a promotion focus (i.e., able to gain/not gain money by solving tasks) outperformed groups with a prevention focus (i.e., able only to lose/not lose money for failing to solve a task). The authors attributed this outcome to groups with a promotion focus being more likely to favour a risky strategy, including exploring and searching out alternative options. Conversely, groups with a prevention focus were more likely to be more risk-averse, therefore less likely to be explorative and more likely to focus on their immediate environment. Thürmer, Wieber, and Gollwitzer (2015) added to this through an examination of a self-regulation perspective. Groups who added 'if-then' plans to review all of the advantages of the non-preferred alternatives prior to making their final decision outperformed groups who simply committed to review all of the advantages of the non-preferred alternatives. Consequently, examining individual group member motivation further may provide additional valuable insights into how groups can improve decision-making outcomes.

The human factor in group decision-making

Much quantitative research has examined the manifold reasons behind groups' failures to solve Hidden Profiles and identified biases and heuristics operating within the group, influencing both information selection and sharing (see Brodbeck et al., 2007). For example, groups may not discuss X and Y (i.e., discussion bias) or properly evaluate X and G (i.e., evaluation bias). They may also focus on the negotiation per se rather than sharing important information (i.e., negotiation focus). These are processes largely driven by the actions and motivations of individual group members. Further significant challenges exist at the individual group member level. These include evaluation bias, leading group members to favour shared and preference-consistent information (Brodbeck et al., 2007). Information shared is largely based on individual (suboptimal) preferences and opinions (Gigone & Hastie, 1997) and shared information supporting those preferences. The Individual Preference Effect (IPE: Faulmüller, Kerschreiter, Mojzisch, & Schulz-Hardt, 2010; Greitemeyer & Schulz-Hardt, 2003; Greitemeyer, Schulz-Hardt, & Frey, 2003), a form of confirmation bias (see below), whereby individuals are drawn to information consistent with their own pre-formed preferences, has also been suggested as a further powerful individual-level explanation for Hidden Profile failures. Faulmüller et al. (2010) calculated that almost half of all groups would fail to solve the HP, even when all information was exchanged and no co-ordination losses occurred, as a consequence of the IPE.

Mojzisch and Schulz-Hardt (2010) gave participants bogus information about (fictitious) fellow group members preferences. Participants who received no preference information were more likely to solve Hidden Profiles (61%) than those who were made aware of other group members' preferences (28%), even when one of those preferences favoured the optimal solution. This was replicated in face-to-face groups: Hidden Profile groups in the 'no-preference exchange' condition (instructed to firstly exchange *attributes of the alternatives* prior to exchanging their preferences) were more likely

to solve the Hidden Profile than groups who *firstly* exchanged their preferences, *followed by* attributes of the alternatives (40% vs. 7%).

Prior research has also shown that unhelpful behaviours arise when group members believe their initial preferences align. For example, research conducted with pseudo dyads, consisting of a naïve participant and a bogus partner, showed group members evaluated each other more positively when they mentioned information *confirming* rather than *disconfirming* the recipient's preference (Mojzisch, Kerschreiter, Faulmüller, Vogelgesang, & Schulz-Hardt, 2014). Furthermore, higher quality was ascribed to lists communicated by the partner when they were predominantly preference-consistent. Recipients of preference-consistent feedback also evaluated themselves and their partners as more competent than recipients of non-consistent feedback. Compounding this, Mojzisch et al. found that positive feedback for preference-consistent information also led to the discussion of *more* preference-consistent information.

Cognitive biases in human reasoning

Cognitive biases – cognitions or mental behaviours that can lead to prejudiced decision-making – can significantly impair decision quality (Arnott, 2006, p. 59). *Confidence biases* are particularly damaging: not only can they increase a person's belief in their own decision-making ability but they can also curtail the search for new information pertinent to the decision. Russo and Schoemaker (1992) identified one key cognitive cause of overconfidence as *confirmation bias*: as humans, we seek evidence to confirm our initial view, rather than disconfirm it. In the case of asymmetric information distribution, where information may be hidden and hard to identify and extract, this individual bias, combined with the curtailment of the search for new information, may create a perfect decision-making storm.

As explanations for groups' failures to solve Hidden Profiles, these challenges particularly resonate at the level of the individual group member, highlighting the importance of our contention that insufficient attention has been paid, in previous group decision-making research, to the individual group member voice. The qualitative Thematic Analysis element of the present study seeks to redress this problem, examining and interpreting the voice, motivations, and actions of the individual group members, beyond the boundaries of an exclusively quantitative approach. To our knowledge, no HP research has so far taken a similar approach. Thus, combining both exploratory qualitative analysis with quantitative analysis makes a unique contribution to research on the Hidden Profile and group decision-making.

Improving group decision-making: Overcoming hidden profile challenges

Achieving superior decision-making is the principal goal of forming decision-making groups (Brodbeck et al., 2007). This entails training; and interventions to overcome the challenges of solving Hidden Profiles should, primarily, be aimed at achieving better group decision outcomes. Broadly, empirically tested interventions break down into three categories: (1) those that have achieved no improvement of information exchange or decision quality, (e.g., varying group size and the amount of information shared: Stasser et al., 1989; increasing group accountability to an external audience: Stewart, Billings, & Stasser, 1998); (2) those that have improved information exchange (e.g., the introduction of dissent: Greitemeyer, Schulz-Hardt, Brodbeck, & Frey, 2006; the introduction of decision-making training to increase 'information-vigilance': Larson et al., 1994); and (3)

those that have achieved improvement in *both* information exchange and decision quality (e.g., the introduction of minority dissent: Brodbeck, Kerschreiter, Mojzisch, Frey, & Schulz-Hardt, 2002; forced ranking of the alternatives: Hollingshead, 1996; increased transparency of which group members know what: Stasser, Stewart, & Wittenbaum, 1995).

As noted, dissent has also been shown to play a role in reducing the emphasis of the group discussion on shared information. Greitemeyer et al. (2006) instructed each member of a three-person group to act as an advocate for each alternative candidate, to argue in favour of that candidate and against the other two, versus free-discussion groups with no such procedure. Advocacy facilitated an increase in unshared information, but decision quality was unaffected. However, contrived dissent, such as devil's advocacy, has been shown to have downsides in decision-making groups. Waddell, Roberto, and Yoon (2013) found groups who underwent a devil's advocacy procedure showed improvement in decision quality – but participants in those groups reported higher levels of 'Affective Conflict' (Amason, 1996) than free-discussion groups, indicating more personal friction and personality clashes amongst group members within the group. In a similar vein, Postmes, Spears, and Cihangir (2001) found that groups with a critical norm, promoting independence and critical thought, outperformed groups with a consensus norm in a Hidden Profile decision task.

Mental simulations and counterfactual thinking in group decision-making

Mental simulation, 'the imitative representation of real or imagined events' (Rivkin & Taylor, 1999, p. 1451), provides a potentially powerful solution to improving group decision-making under conditions of information asymmetry. Crisp, Birtel, and Meleady (2011) noted, 'mental simulation is an essential element of the human experience and, as such, a correspondingly critical component of behavioural change strategies' (p. 261). The use of mental simulation gained prominence in the sports fields (e.g., Feltz & Landers, 1983) and health domains (e.g., Greitemeyer & Würz, 2005) and has also proven effective across many psychological domains (e.g., prejudice: Crisp & Turner, 2012; and social judgments: Hopthrow, Hooper, Mahmood, Meier, & Weger, 2017).

Counterfactual thinking – 'thoughts of what might have been, invoked by an event that nearly occurred' – has also achieved positive results on decision quality in Hidden Profile tasks. For example, an individual who misses the train by a few minutes may go into a thought pattern of 'what if' or 'if only'. Galinsky, Moskowitz, and Skurnik (2000) contended that the idea of considering more than one possibility was primed by the perception of counterfactual alternatives (see also Galinsky & Kray, 2004). This suggests considerations of alternative outcomes may debias likelihood judgments, encouraging a more thorough evaluation of evidence during judgment (e.g., Hirt & Markman, 1995, Study 2). A counterfactual mindset (CFM) is induced via a 'what-if' scenario, unconnected to the decision task facing the group and its members. In contrast, Hirt, Kardes, and Markman (2004) found that alternative generation tasks *did not* activate a CFM in individuals high in need for structure. Ditrich, Landkammer, and Sassenberg (2019) also noted the effect of counterfactual thinking may be more complicated than previously elucidated, conditioned on, for example, the type of CFM induced, (e.g., additive vs. subtractive) and its relation to the subsequent task; levels of activation (e.g., group vs. individual) and the focus induced (e.g., interpersonal vs. intrapersonal). This recent work (recognizing limitations due to low power – 67%) suggests that CFMs may actually be detrimental in certain social situations, including group decision-making. This is because

it may increase *both* biased communication and decision-making. This finding indicates the importance of researching and exploring alternative mental simulation interventions.

Mental simulation and the premortem. A Premortem (Klein, 2003, pp. 98–101), a form of mental simulation, has previously been identified as a way to reduce bias in organizational decision-making (Hunt, Layton, & Prince, 2015) – although it has not, to our knowledge, been empirically tested. Deployed as an exercise for 'real-life' groups to challenge and refine implementation plans, the Premortem asks groups to look into the future and imagine the plan they are about to implement has failed, resulting in poor outcomes. They are then asked to generate reasons for this failure, through which they undertake an effective critique of their own plan.

Mental simulation versus CFM. Although at first glance they may seem alike, there are more differences than similarities between the mental simulation tested here versus a CFM. Firstly, our mental simulation relates *directly* to the decision task, rather than being disconnected from it, as in a CFM. Steinmetz, Tausen, and Risen (2018) noted that 'mentally simulating an experience by imagining it in detail can evoke the same consequences as actually experiencing it, albeit to a lesser extent' (p. 407). The mental simulation tested here also asks participants to imagine that their decision has gone badly wrong, resulting in poor organizational outcomes. Kappes and Oettingen (2011) noted that positive fantasies idealizing a positive future result could actually result in lower achievement when experimentally induced. They attributed this to a decrease in participants' motivation and effort, stemming from their being allowed to 'mentally experience a desired future in the present, thereby concealing the need to invest effort to attain it' (p. 724). In short, imagining success can lead to a reduction in the energy and motivation needed to 'go for it'.

Linked to this is the concept of prospective hindsight (Mitchell, Russo, & Pennington, 1989). Unlike a CFM, requiring past reconstructions of events unconnected to the decision task, our mental simulation makes the future event (decision failure) certain and asks participants to generate the reasons why. Mitchell et al. asserted that participants would work harder to explain a sure event more thoroughly than an uncertain one. Accordingly, we speculate that imagining an undesirable outcome, such as failure of the decision, may lead decision-makers to work harder to avoid it.

Finally, Szpunar, Spreng, and Schacter (2014) suggested that mental simulation requires a 'detailed representation' of the simulated event, which Steinmetz et al. (2018), in interpreting their own research findings, suggested could '[lead] to more elaborate engagement than [would] occur in the absence of such prompts' (p. 414).

Given these qualities, we assert that mental simulation can be effective in overcoming the well-known challenges of eliciting and integrating unshared (vs. shared) information, and the bias towards preference-consistent information, which past research has shown to be key predictors of success in improving group decision-making outcomes (e.g., Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006).

The current study

Russo and Schoemaker (1992) suggested several mechanisms to combat overconfidence: (1) *accelerated feedback*: using a known outcome to get immediate feedback on the

decision; (2) *counterargumentation*: thinking up reasons why initial beliefs might be wrong; (3) *paths to trouble*: identification of all paths to a specific fault or problem, including listing additional causes of the problem; and (4) *paths to the future*: explicit scenario analysis setting out how the future might play out in one or other specific direction. The mental simulation tested here incorporates these mechanisms: as noted, groups and their members are asked to look into the future and receive immediate feedback that the decision they have made has failed (i.e., *accelerated feedback*). They are then asked to generate reasons for this failure (i.e., *counterargumentation*; *paths to trouble*) and consider remedial actions to overcome the problems identified (i.e., *paths to the future)*.

In the current studies, groups are confronted with the imagined outcome of a failed decision. Subsequently, they are asked to engage in mental simulation as the collaborative, problem-solving process through which they can work together to (potentially) change their decision and the imagined outcome. We believe this should enable group members to improve analytic and problem-solving processes, leading to better decision outcomes for the group. Given that we are testing a new intervention, with the outcomes relatively uncertain, Study 1 begins by testing our data for relationships between the key variables and the principle dependent variable – that is, whether or not groups correctly identify the Optimal Candidate at T2, following the mental simulation, in a binary logistic regression. We also examine whether the mental simulation can positively impact information exchange, evidenced by groups reporting a greater proportion of time discussing the Optimal versus Suboptimal Candidate at T2. In Study 2, we test the mental simulation in an experimental design, comparing its effect on group decision outcomes against a Control Group. For Study 1, we hypothesize the following:

H 1a. We anticipate a significant positive relationship between the proportion of time discussing the Optimal Candidate and whether or not the HP was solved at T2.

H 1b. We anticipate a significant negative relationship between whether or not the HP was solved at T1 and T2.

H 2. We expect the mental simulation to trigger increased discussion of the Optimal Candidate.

Thematic analysis

Given the novelty of our intervention, untested in Hidden Profile research, we see merit in extending our exploration beyond quantitative statistical analysis. Vallaster and Koll (2002) noted most extant group decision-making theories focus on a static rather than dynamic analytic perspective, notwithstanding that the factors affecting group decision-making outcomes are themselves dynamic (e.g., cognitive, affective, and communicative variables, principally operating at the individual group member level). We concur with their view that a research approach allowing for a 'richer understanding of the phenomena observed' (p. 42) can add to our understanding of group performance in Hidden Profile tasks, allowing a deeper exploration of the impact of individual and social processes in Hidden Profile decision-making groups.

Eden (2017) highlighted the value of a mixed methods approach, including both experimental and qualitative studies. He noted that this approach is particularly common in organizational research, and that qualitative methods can help to bring 'arid statistics to life, [enrich] understanding and [spice-up] research reports' (p. 103).

Given we are examining a mental simulation intervention new to Hidden Profile research, qualitative analysis may also be useful to inform our future research approach in testing and refining the intervention in this context. We therefore combine our quantitative analysis with Thematic Analysis of the group member exchanges during the decision task, to explore the dynamic operating between members of Hidden Profile decision-making groups – and the potential moderating effect of the mental simulation. Incorporating Thematic Analysis allows a greater focus on the voice of the individual group members, moving beyond simply quantitatively analysing the words or information elements that they contribute to, we hope, offer valuable insights into their actions and motivations.

STUDY 1

Method

Participants and data collection

Participants were first-year psychology undergraduate students from a university in Southeast England ($N = 224$, 30 males, 193 females, one undeclared; randomly assigned to groups of four $N = 56$) who participated in the experiment as part of the requirements of a First-Year Psychology Research Class. No payment or course credit was given.

Materials

Face-to-face groups of four undertook a Hidden Profile hiring decision task, adapted from Baker (2010). Participants were told they were recruiting for the position of president of a new campus of their own university (to increase relevance and reality) and asked to select their preferred candidate for the role from a choice of three – Roberts, Stevens, and Jones. Participants received a job description, key selection criteria, and highlights from each candidate's CV. In addition to the CV highlights, each candidate had 16 items of information drawn from interviews, references, personal observations, etc. Roberts ('Optimal Candidate'): eight positive, four neutral, and four negative characteristics; Stevens/Jones ('Suboptimal Candidates'): four positive, eight neutral, and four negative characteristics, distributed amongst group members asymmetrically (i.e., a Hidden Profile – Table 1).

Negative information items for the Optimal Candidate were largely shared amongst all group members, whilst those for the Suboptimal Candidates were shared between two group members(semi-unique). Conversely, positive items for the Optimal Candidate were largely unique, known to only one group member, whilst those for the Suboptimal Candidates were shared by all group members. Thus, individual participants were oriented towards a Suboptimal Candidate selection, as is typical in Hidden Profile decision tasks.

Procedure

Participants were randomly assigned to groups, told they were participating in a study of group decision-making processes, then taken to small group laboratories. Participants

Table 1. Candidate attributes for the hidden profile group decision task and distribution by group member (1–4)

	Candidate		
Characteristic	Stevens	Roberts	Jones
CV	Provost (1,2,3,4)	Political leader (1,2,3,4)	Senior Manager (1,2,3,4)
	Former Dean (1,2,3,4)	Former Dean at 2 universities (1,2,3,4)	Steering Committee (1,2,3,4)
	Plans for money/donations (1,2,3,4)	Raised money (1,2,3,4)	Argued in High Court (1,2,3,4)
	Full professor (1,2,3,4)	Full professor (1,2,3,4)	Visiting Professor (1,2,3,4)
Unfavourable	Seen drinking heavily (3,4)	Aloof (1,2,3,4)	Temper (1,2)
	Left without raising funds (1,3)	4 years out of Higher Education (1,2,3,4)	Tension with provost (3,4)
	Discourages innovation (2,4)	Lacks campus/student life experience (1,2,3,4)	High turnover, abrasive leader (1,3)
	Not responsible for donations (1,2)	Accused of changing positions (1)	Reduced success rate in court (2,4)
Favourable	Nationally recognized researcher 1,2,3,4)	Volunteer (1,2)	Pleasant personality (1,2,3,4)
	Recognized by business leaders (1,2,3,4)	Influential contacts (1)	Strategic thinker (1,2,3,4)
	Emphasized collaboration (1,2,3,4)	Thoughtful leader/listener (2)	Active trustee (1,2,3,4)
	Oratory skills (1,2,3,4)	Collaborative decision-maker (2)	Students like as a teacher (1,2,3,4)
		Excellent teacher (1,2,3,4)[1]	
		Faculty research productivity increased (3)	
		Diversity increased (4)	
		Secured grant (1,2,3,4)	
Neutral	Spouse teaches Spanish (1)	Apartment in Spain (1,2)	Lives in area (1)
	Teaches one module (1)	Divorced, remarried, 2 children (3,4)	Grown up child (1)
	Family nearby (2)	Plays golf and tennis (2,4)	2 dogs/2 cats (2)
	Married, 3 children (2)	Vegetarian (1,3)	Spouse is a physician (2)
	Enjoys sports (3)		Plays Bridge (3)
	Biking and running (3)		Likes travelling (3)
	Consulting work (4)		Enjoys mystery novels/biographies (4)
	Likes to garden (4)		Loves to cook (4)

Note:. This distribution of favourable/unfavourable characteristics is designed to orientate participants towards the selection of a Suboptimal Candidate.
[1]Switched to unique information in Study 2 to strengthen the Hidden Profile.

were deliberately not told that they had different information, nor that any one candidate was better suited to the role.

Once the study began, participants firstly indicated their individual candidate selection from the three job applicants (the pre-discussion decision), then, following a group discussion, made a group candidate selection decision (Time 1 [T1] decision). After this, groups engaged in a mental simulation (MS). In the MS, groups were asked to imagine that they had proceeded with the hiring of the group's chosen candidate and that the next 12 months had gone badly, resulting in poor group and organizational outcomes. Groups were asked to discuss and generate reasons for these problems, which one group member, randomly designated by seat, documented in a free form list (this was to ensure the group members engaged fully with the MS). After the MS, groups were asked whether they wanted to maintain or change their T1 chosen candidate decision and recorded their Time 2 (T2) group decision and the other group and individual measures. Geographic references were changed and minor language modifications made from the original Baker (2010) material, so as to be UK-specific.

All groups were required to complete the study tasks within certain time frames, otherwise group discussions were free form and leaderless. Group discussions were audio-recorded, spread across five separate data collection sessions, run consecutively on 1 day.

Measures

Pre-discussion: Individual measures. All participants worked individually to select and record which candidate they thought should be offered the position.

Information exchange. Information exchange was operationalized as group time spent in discussion, as per Schulz-Hardt et al. (2006). Each group was asked to record the approximate proportion of time spent discussing each candidate (to sum to 100% of the discussion time) at T1 and T2.

Decision quality – information processing. Each group was asked to select and record their preferred candidate for the role at T1 and T2. Decision quality was a dichotomous measure: whether groups selected the Optimal Candidate, solving the HP (coded 1) or selected a Suboptimal Candidate, failing to solve the HP (coded 0).

Results

Quantitative analysis

Pre-discussion preferences. Initial individual participant hiring selections showed 62.33% of participants favoured a Suboptimal Candidate (i.e., Stevens or Jones), compared with 37.67% selecting the Optimal Candidate, Roberts. A chi-square goodness of fit test confirmed the observed frequencies did not differ significantly from expected frequencies, χ^2 (1, N = 223) = 1.89, p = .170.

Predicting the solution: Was the hidden profile solved at time 2 (T2)?. H1a anticipated a significant positive relationship between the proportion of time discussing the Optimal

Table 2. Summary of binary logistic regression for variables predicting Hidden Profile Solved at T2

Variable	*B*	S.E.	Wald	df	*p*-value	Exp(*B*)	95% CI Lower	95% CI Upper
Constant	−1.38	.57	5.97	1	.015	.251		
T1 Group HP Resolved	−2.83	1.11	6.57	1	.010	.059	0.007	0.513
T2 Proportion of time discussing Optimal Candidate	.056	.017	10.69	1	.001	1.057	1.023	1.093

Candidate and whether or not the HP was solved at T2 and H1b a significant negative relationship between whether or not the HP was solved at T1 and T2. The data supported this.

We conducted multiple binary logistic regression to explore the relationships between our key variables and the principle dependent variable, that is, whether or not the Hidden Profile was solved at T2. We simultaneously entered the measurement variables: (1) T1 Group HP Resolved; (2) the proportion of Time discussing the Optimal Candidate at T2; and (3) the proportion of Time discussing the Suboptimal Candidates (averaged over the two Suboptimal Candidates [Stevens and Jones]) at T2 into the equation.

Results showed the overall model was significant, χ^2 (2, N = 56) = 15.16, p = .001 (Nagelkerke R^2 = .318). Further decompositions showed two variables: (1) the proportion of time discussing the Optimal Candidate at T2; and (2) T1 Group HP resolved, were significant predictors of T2 decision quality. A one-point increase in the proportion of time recorded discussing the Optimal Candidate after the mental simulation was associated with a 1.057 times *increase* in the odds of solving the Hidden Profile at T2. Conversely, a one-point increase in solving the Hidden Profile at T1 was associated with a .059 times *decrease* in the odds of solving the Hidden Profile at T2 (Table 2).

Group information exchange. Mean proportion of group discussion time

H2 predicted the MS would prompt groups to spend a greater amount of time discussing the Optimal Candidate at T2. The data supported this. We collapsed the data to analyse choices as either Optimal (Roberts) or Suboptimal (Stevens or Jones). A two (Time 1 vs. Time 2) by two (Optimal vs. Suboptimal Candidate) repeated measures ANOVA yielded a significant main effect of Time: F(1, 54) = 4.75, p = .034, ηp^2 = .08, and of Candidate, F(1, 54) = 5.77, p = .020, ηp^2 = .09, qualified by a significant Time × Candidate interaction, F(1, 54) = 4.57, p = .037, ηp^2 = .08.

Post-hoc analysis of this significant interaction showed groups reported spending a significantly greater proportion of time discussing the Optimal Candidate at T2, after the MS, versus at T1, t(54) = −2.15, p = .036, *Cohen's d* = 0.33 (M_{T2} = 44.55, SD = 32.63 vs. M_{T1} = 35.84, SD = 16.92). Conversely, groups reported spending a significantly reduced proportion of time discussing the Suboptimal Candidate at T2 versus at T1, t (54) = 2.11, p = .039, *Cohen's d* = 0.33 (M_{T2} = 27.73, SD = 16.32 vs. M_{T1} = 31.99, SD = 8.62). In other words, groups reported spending a significantly lower proportion of time discussing the Suboptimal versus the Optimal Candidate at T2, after the MS, t (55) = 2.71, p = .009, *Cohen's d* = 0.65. There was no significant difference at T1.

Group decision quality. Solving the Hidden Profile at T1 emerged as a significant *negative* predictor of solving the Hidden Profile at T2, so we set to explore this finding further. A chi-square test of association showed no significant difference in the frequencies with which groups solved the Hidden Profile at T1 versus T2, χ^2 (1, N = 56) = .02, p = .877, Φ = −.02. We then examined our results for decision quality differences, isolating our analysis based on whether groups firstly solved the Hidden Profile at T1 or did not. This revealed a conflicting picture: 25 groups failed to solve the Hidden Profile at T1. Of these groups, 44% then switched to the Optimal Candidate at T2, following the mental simulation. A McNemar's test was significant, p = .001. Conversely, 31 groups solved the Hidden Profile at T1, but 58.10% of these switched to a Suboptimal Candidate (B or C) following the mental simulation. A McNemar's test was also significant, p < .001.

Exploratory qualitative analysis

We turned to the Thematic Analysis to seek greater insight into the interaction between the group members and the potential impact of the mental simulation. The audio recordings of the group discussions (see Procedure above) were transcribed verbatim by a wholly independent transcription service. A representative sample (approximately 20%) of the transcripts was checked directly against the audio tapes through play back of the group discussion and found to be valid and accurate across this sample.

Selecting the data corpus. Sample size guidelines were determined following reference to Clarke, Braun, and Hayfield (2015). This suggests for focus groups in study with a unique data source (most closely aligned to the group study examined here) 10 + groups are a sufficient sample size. Nonetheless, we recognize the challenges involved in identifying a 'correct' sample whose selection is grounded in the availability of research participants and sufficient resources to analyse the resulting qualitative data set. Previous critical analyses indicate that this is an acceptable practice in this type of research (Braun & Clarke, 2019). Groups were randomly selected using an online tool ('Random-picker' [Random picker tool: https://www.miniwebtool.com/random-picker/]).

Analytic procedure. Thematic analyses (Braun & Clarke, 2006) of the group discussion data was used to identify common themes and salient issues across the dataset of the group discussions, following these steps:

1. Transcripts were firstly printed and repeatedly read by the lead researcher, to identify initial themes and get a clear sense of the whole dataset.
2. Transcripts and audio files were then imported into NVivo software (version 11, 2015) for coding against an initial codebook, developed by the lead researcher (Table 3). This allowed meaningful organization of the data, with a specific focus on data items pointing to consistent themes and patterns across the dataset.
3. The lead researcher worked using NVivo to code the transcripts, searching for potential themes, whilst collating the relevant coded extracts into these same themes. This procedure allowed identification of the relationship between codes, themes, and sub-themes. The lead researcher reviewed the themes for overall

Table 3. Nodes and thematic coding framework

Node title	Themes
Confidence in Group Decision:	(i) Dissent:
High	Decision Choice
Low	Within the group
Different Information Realized	
Not realized	
Realized	
Dissent	
Little Dissent	
Significant Dissent	
Group Member pretending to recognize unique information	(ii) 'Communication Apprehension' (CA): Group member(s) pretence levels re: unique information.
Individual Preference Effect	(iii) Individual Preference Effect: Impact of pre-discussion choices.
Leadership within the group	
Unique information emerging	
Pre-Mental Simulation	
During/Post-Mental Simulation	
Unique information ignored	
Unique information not applied to the decision	
Unique information supporting/ refuting candidate selection	

meaningful coherence and to ensure they were well distinguished. Themes were named in order to clearly identify what they encapsulated.

4. Themes were discussed and agreed with the wider research team, who ensured objective challenge and oversight was applied.

Thematic analysis results. *Overview*. Of the 17 groups reviewed, 10 (58.82%) solved the HP at T1, correctly identifying the Optimal Candidate. Since most group studies involving a Hidden Profile task achieve a correct result of only 20–30%, we note our result is an unusually high proportion of correct responses. This suggests a ceiling effect, in all likelihood due to the fact that the Hidden Profile was not particularly difficult to resolve in Study 1. Of the remaining seven groups who chose incorrectly at T1, four switched to the optimal solution at T2 and the remaining three either maintained their initial incorrect choice or switched to another incorrect choice at T2.

Analysis showed 14 of the 17 groups began their group discussion by directly asking each individual group member to state their pre-discussion choice, underscoring the significance of this initial, individual decision. One group actively chose not to do this (their initial group selection was a Suboptimal Candidate but switched to Optimal following the intervention), and the remaining two groups did so less overtly, with one member rushing to identify their pre-discussion choice. Of these two groups, one selected and maintained a Suboptimal Candidate choice and the other initially selected the Optimal Candidate, then switched to a Suboptimal Candidate following the mental simulation.

Thematic analysis. The Thematic Analysis in this subsection is focused around two key themes identified following review (Table 3). These themes either add to extant evidence or provide deeper understanding for the reasons behind groups' failure to solve Hidden Profile decision tasks. They also complement the quantitative analysis above. The themes are as follows: (1) pre-discussion preferences (including the Individual Preference Effect) and dissent amongst individual group members; and (2) 'Communication Apprehension' (CA: McCroskey, 1977): individual group members' ability/willingness to acknowledge unique information. By examining these themes prior to and during/after the MS intervention, we determined to investigate qualitatively the efficacy of the intervention as a potential tool to improve group performance in Hidden Profile decision tasks.

The individual preference effect in action. In the following exchanges, group members exchange a mix of shared, semi-unique and unique information. Excerpt 1 reflects dialogue focused on the group members' individual preferences (underscoring the Individual Preference Effect), with the discussion emphasis placed on shared information. The selection of Jones (a Suboptimal Candidate) is based wholly on shared information, repeated more and more frequently, as the group reach their decision. Excerpt one takes place prior to the intervention and displays a pattern that should, broadly, be expected based on extant Hidden Profile research, that is the semi-unique/unique information *is* mentioned by group members (italics), but it is largely ignored, even when repeated.

Excerpt 1: Group 8(b) (Time 1)

> *F2::* Basically, because I saw that Roberts hasn't been working in higher education for four years, so I don't know, maybe he could be a bit outdated about his knowledge about how it's run. And for Jones, *it says tension between the Head and Jones*, so maybe he's not that good relations-wise.
>
> . . .
>
> *F2::* Yeah, and he has *a harsh and arrogant leadership style*, so I don't know.
> *F1::* I didn't pick Stevens because I thought the bit where it says *'Tends to discourage new innovative ideas,'* is a bit of a negative, . . . which one did you go for?
> *M1::* I put Jones.
>
> . . .
>
> *F2::* I chose Stevens. What do you guys think about Stevens?
> *F3::* I think that he's assertive, but the fact that *he discourages new ideas* is kind of bad.
> *F1::* Yeah, I thought that was quite negative.
> *F3::* And the fact that *he gets drunk at university events* isn't very good as well. Well, that's why I didn't pick him. I don't know about the rest of you.
> *F3::* I picked Roberts. Did you pick Roberts?
>
> . . .
>
> *F3::* I agree with the point you're saying with that. I picked Roberts because I think the positives about her overshadowed the rest. The only thing that I don't really like was *how there was tension between her and the Head*, but I don't think that's such a big deal because it's probably because they're in competition.

In excerpt two, we see group members moving from an incorrect to a correct decision, following the mental simulation. During the mental simulation, group members are forced

into a deeper examination of the failures of Jones, their chosen candidate. It is this closer interrogation of the earlier group decision that leads to the critical recognition of the fact that the group members have unique information (italics):

Excerpt 2: Group 8(b) (Time 2)

F1:: So, on here you've got '*A temper that flares suddenly*,' so that could have been an issue.
F3:: Pardon?
F1:: They've got a temper that flares suddenly.

. . .

F1:: On mine it says, '*Following a High Court appearance, Jones's success rate in employment law cases fell*.' Have you guys got that on yours?
M1:: Yeah.
F1:: So I don't know what caused that but it could have been the same issue again. It could be related to that.
F2:: Or it could be the way that she leads people. It says here that she's *arrogant and harsh in the way that this person leads people*.

. . .

F3:: It doesn't say that he's harsh.
F1:: I think we've all got different ones.
F2:: Yeah, got different ones.

. . .

F3:: I think I'd have picked Roberts after Jones.
F1:: Yeah, I think I'd pick Roberts.
F3:: I was thinking Stevens *but the fact that he doesn't encourage new ideas does stand out*.
F1:: Yeah, Roberts has got *a collaborative decision-making style*, so yeah.

The second excerpt suggests the intervention caused group members to return to the semi-unique information previously ignored and give it proper focus and attention, fully *integrating* it into their decision-making process. Coupled with the emergence of unique information regarding Roberts' decision-making style, this enabled Group 8b to convert their initially incorrect selection to the correct one. This exemplifies group members' improving performance in uncovering, recognizing, and integrating critical unique/semi-unique information following the mental simulation.

Confidence and the individual preference effect. Of the 17 groups scrutinized, only one group had the same unanimous Suboptimal Candidate (Stevens) as a pre-discussion choice. The data for this group shows the first group exchange is short, focused *exclusively* on shared information. It illustrates the unhelpful influence of overconfidence, which the IPE engenders amongst group members, as the highlighted comments of M1 in the excerpt below make clear:

Excerpt 3: Group 9(a) (Time 1)

F1:: Well I think we should pick Stevens.
F2:: I put Stevens.
M1:: The same.
F3:: So did I.
M1:: Okay, let's go with it? ((laughter)).

F1:: But why did we pick Stevens? I picked Stevens because he has experience in a medium-sized university and this one is. . .

. . .

F1:: Yes, so it's relatively small so. . . ((?)). So he obviously has experience as. . . he has experience in the Business Dean of a large Gloucestershire university and Chair of the Information Technology Department.
M1:: Yes, he was into IT and all that, which helps.

. . .

M1:: ((?)) already – *the other [group]s are just not good*. So yeah, I think we go for it. That was a hard decision. . . Jeez. . . I think we just get up and leave. . .

. . .

M1:: I'm 100% sure on Stevens but obviously it's a huge decision.

The mental simulation changes all of this, enabling the group to recognize the presence of unique information, which emerges quickly once the discussion gets into full flow during the intervention phase:

Excerpt 4: Group 9(a) (Time 2)

F2:: We all have different things on our sheets.
F3:: Do we?
M1:: Game changer. . .

. . .

F1:: I haven't got that he's a drinker.
M1:: That's why I was going on about him drinking; I wasn't just saying it like, you know. . .

. . .

M1:: And that he discourages new innovative ideas. . .

. . .

M1:: Yes, why did we hire this guy? What were we thinking?

. . .

F1:: So have we all got different things for the others as well?
M1:: I guess so.

. . .

F2:: Well Roberts might be good because he's had numerous influential contacts as Counsellor. . .
F2:: Yeah, I think. . . I'd go for Roberts.
M1:: I'd go for Roberts as well.
F1:: Okay. Why would you go for him?
F2:: . . .Roberts has previous experience as Dean and he's raised significant amounts of campaign funds for political parties. *He's made numerous influential contacts as Councillor* and that's all in the required qualifications and experience for the job. Um, but. . . he hasn't worked in higher education for 4 years though.
F2:: And fund-raising and ((?)).
F1:: But it does say Jones is kind of aggressive and harsh, abrasive, sorry. . .
F1:: So I think Jones has a temper. Roberts would be better.

F2:: I think Roberts because he has made *numerous influential contacts* and he's got. . . Jones has been on the Board for UKF but he hasn't really done anything like university ((?)) so he's not really experienced.

. . .

Communication Apprehension. Group 8a had a 3:1 initial majority in individual pre-discussion decisions in favour of Jones. This led to a quick consensus-driven T1 group selection decision, coupled with much self-congratulation amongst group members who thought they had successfully worked out that the underlying rationale of the study was 'How we come to a decision and see how smart we all are!' (F3).

The mental simulation quickly changes this, offering a valuable insight as to why the unique/semi-unique information may have been allowed to pass unchallenged. One explanation suggested by the verbal exchanges is that Communication Apprehension (CA) amongst the group members played an important role, highlighted by the following group exchange, triggered by the mental simulation:

Excerpt 5: Group 8(a) (Time 2)

M1:: And say the harsh, arrogant bit.
F3:: Where does it say he's harsh and arrogant?
F1:: 'Abrasive leadership style.'
F3:: I actually can't see it. Wait, have you got a different one? Have you all got ...? Loves to cook. Why have we all got ...? Guys, I think I now see it!
F1:: Yeah!
F3:: *I've just been pretending I can see this stuff!*
F1:: *Me too! One of you guys said something about being an alcoholic and I was like, 'Yeah!'*

The realization of the presence of unique information also triggers embarrassment in the group members:

Excerpt 6: Group 8(a) (Time 2)

F3:: Oh for God's sake, it's going to be like, 'How long did it take them to figure out they've all got different sheets?' Right, 23 minutes and we're actually 'spastics'! Come on, read!

This group fails to correct their initial Suboptimal Candidate selection decision, although there is a clear suggestion that at least some group members are not comfortable with this outcome, with F1 noting: 'now I feel bad that we liked Jones' and 'I'm so annoyed!'

Excerpt 6 provides qualitative support for Communication Apprehension (CA: McCroskey, 1977) as one reason why group members struggle to bring out unique information during their discussions in Hidden Profile tasks. Communication Apprehension has been negatively related to both critical thinking and oral communication (Blume, Dreher, & Baldwin, 2010). These challenges all need to be overcome if groups are to be successful in solving Hidden Profile decision tasks.

Even when unique information did emerge, approximately 30% of the groups in this study failed to acknowledge its presence during their initial group discussion. The mental simulation provided a framework where realization – and acknowledgement and integration – of the existence of unique information could occur.

Study 1 Conclusions

Our analysis indicated an increase in the proportion of time discussing the Optimal Candidate to be a significant predictor of solving the Hidden Profile at T2. Further analysis suggested the mental simulation led to greater discussion of the Optimal versus Suboptimal Candidates at T2. Regarding decision quality, a significant proportion of groups switched to the Optimal from the Suboptimal Candidate following the intervention. At the same time, however, a significant proportion of groups undergoing the mental simulation also switched their selection decision away from the Optimal to a Suboptimal Candidate.

Thematic Analysis suggested two clear factors at work: (1) the strong effect of group members' commitment to their initial individual selection decision; (2) group members' reticence in raising unique, disconfirming information. The mental simulation appeared to attenuate both of these, although we cannot draw clear conclusions given the limitations of the study design.

Study 2

Study 1 offered indicative positive outcomes for the ability of mental simulation to improve information exchange and decision quality in face-to-face groups engaged in Hidden Profile decision tasks. However, Study 1 lacked any form of valid control and saw a significant proportion of groups solve the Hidden Profile at T1, correctly identifying the Optimal Candidate (almost 60%), which potentially confounded the results. The work in Study 1 was largely exploratory; Study 2 extended results from Study 1, offering the first real test of mental simulation against a valid control condition and allowing us to formulate a number of hypotheses.

Study 2 allows us to replicate, and empirically test against a Control, some of the positive effects noted in Study 1. In addition, we wanted to extend extant research by examining the effect of mental simulation on confidence biases, which, as Arnott (2006) noted, have the doubly negative effect of curtailing the search for new information, whilst increasing individuals' beliefs in their decision-making capability.

Accordingly, we hypothesize:

H 1. Groups in the mental simulation condition making an initial Suboptimal Candidate selection will demonstrate improved decision quality, selecting the Optimal Candidate at T2, more frequently than Control groups.

H 2a. MS Groups will report significantly higher mean group confidence in the Optimal Candidate between T1 and T2 versus Control groups.

H 2b. MS Groups will report significantly lower mean group confidence in the Suboptimal Candidates between T1 and T2 versus Control groups.

H 3. Participants in MS groups will be more likely to realize they hold different (unique) candidate information compared to Control group participants.

Method

Participants and data collection

Participants were drawn from two separate data collection sessions, set out below:

Session 1: First-year psychology undergraduate students from a university in Southeast England (N = 180, 28 males, 152 females; randomly assigned to groups of four N = 45) who participated in the experiment as part of the requirements of a First-Year Psychology Research Class.

Session 2: Second-year Business/Economics students from a University in Portugal (N = 120, 48 males, 72 females; randomly assigned to groups of four N = 30) who participated in the experiment as part of the requirements of their course.

No payment or course credit was given.

These studies were identical, except that material was translated into Portuguese for the second session. For the purposes of our quantitative analysis, we have therefore aggregated these two samples for a total of N = 300 (76 males, 224 females; age range 17–54, M = 19.37, SD = 2.68), randomly assigned to groups of four (N = 75).

A 2 (Intervention Condition (Between): Mental Simulation (MS) vs. Control) × 2 (Time (Within): T1 vs. T2) mixed factor experimental design was conducted.

Materials

The Hidden Profile material was as Study 1. In a change from Study 1, participants were asked to *rank order* their preference for hiring the three candidates for the role – Roberts, Stevens or Jones – following Hollingshead (1996).

Candidate attribute information was as Study 1, save that we adjusted the distribution of the attributes for the Optimal Candidate to increase the difficulty level of the Hidden Profile. Specifically, one positive attribute of the Optimal Candidate was switched from shared, known to all group members, to unique, known only to one group member, to ensure that the correct solution was obscured (Table 1).

Procedure

As Study 1 with the following changes.

Task 1 – pre-group discussion individual measures. As before except participants recorded their individual preferred candidate *rank* decision (1 = most preferred; 2 = second preference; 3 = least preferred).

Task 2 – groups. Participants discussed and agreed in groups a T1 group candidate rank decision (1, 2, 3 – as above), then responded to the measures below.

Task 3 – groups. Following the initial group candidate rank exercise, groups undertook a mental simulation (MS)/Control task. In the MS, groups followed the same procedure as Study 1, but with reference to the hiring of the group's *first-ranked* candidate. Groups in the MS Condition were also asked to complete an additional step: as well as identifying

reasons for the failure of their preferred candidate, they were asked to extend the mental simulation to identify solutions to mitigate or remediate the situation caused by the failure of their first-ranked candidate (e.g., to provide the candidate with management, communications or presentation training). Control groups worked together on a word task.

After the tasks, all groups were asked whether they wanted to maintain or change their T1 candidate rank decision and recorded their T2 group rank decision and the other measures.

Measures

Decision quality. The same measures were used as Study 1.

Group measure: Confidence in suboptimal/optimal candidate. Groups were asked to (i) record at T1 and T2 whether they thought that Roberts ('Optimal Candidate'), Stevens or Jones ('Suboptimal Candidate(s)') was the best person for the job, responding to the statement 'As a group, we are confident Stevens/Roberts/Jones would be the best person for this job', on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*).

Post-discussion measures. Participants were asked whether they realized they had different candidate information from their other group members, scored on a 7-point Likert scale (1 = *not at all* to 7 = *absolutely yes*).

Finally, Participants provided demographic data on gender and age.

Results

Pre-discussion preferences

Initial individual participant hiring selections showed 79.00% of participants favoured a Suboptimal Candidate (i.e., Stevens or Jones), compared with 21.00% selecting the Optimal Candidate, Roberts. A chi-square goodness of fit test confirmed observed frequencies differed significantly from expected frequencies, χ^2 (1, N = 300) = 20.53, $p < .001$: the solution was obscured by the Hidden Profile. This was also the case when we examined the split by experimental condition: Control Condition: χ^2 (1, N = 148) = 12.57, $p < .001$ and Experimental Condition: χ^2 (1, N = 152) = 8.23, $p = .004$.

To test our hypotheses, we excluded those groups who correctly identified and first-ranked the Optimal Candidate, thereby solving the Hidden Profile. This left 59 groups in the analysis, 26 and 33 in the Control and Mental Simulation Condition, respectively. This subset of the data was used for all subsequent analysis.

Decision quality. H1 was supported by the data. Ten MS groups (30.30%, N = 33) selected the Optimal Candidate at T2 compared to none in the Control Condition. The Chi-square test revealed that the assumption that the value of the cells expected should be five or more in at least 80% of the cells was violated – one cell (25%) had an expected count of less than five. We therefore applied the maximum likelihood ratio test (McHugh, 2013)

which was significant, $\chi^2\,(1, N = 59) = 13.21, p < .001, \Phi = .40$. (Based on the achieved effect size, *post-hoc* testing in G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) suggested this to be indicative of achieved power of approximately 87%).

Decision confidence. *Group Confidence in Optimal Candidate:* H2a was supported by the data. MS groups reported significantly higher mean group confidence in the Optimal Candidate at T2 versus Control groups, $t(57) = -2.45$, $p = .017$, with no significant differences at T1 (Figure 1)

Group Confidence in Suboptimal Candidate (C) H2b was supported by the data. MS groups reported significantly lower mean group confidence in the Suboptimal Candidates (aggregated) at T2 versus Control groups, $t(50.52) = 3.46$, $p = .001$, with no significant differences at T1.

Participant awareness of different information. H3 postulated that participants in groups undergoing a MS would be more likely to realize they held different (unique) candidate information from Control groups. This was not supported by the data: an independent *t*-test was not significant, $t(31.68) = -1.33$, $p = .193$.

Discussion

To succeed in decision tasks, particularly those involving asymmetric information, group members must both uncover *and* assimilate information. Unfortunately, as Stigler (1961) noted, 'the assimilation of information is not an easy or pleasant task for most people' (p. 222). It is not surprising, therefore, that group decision-making research has focused on

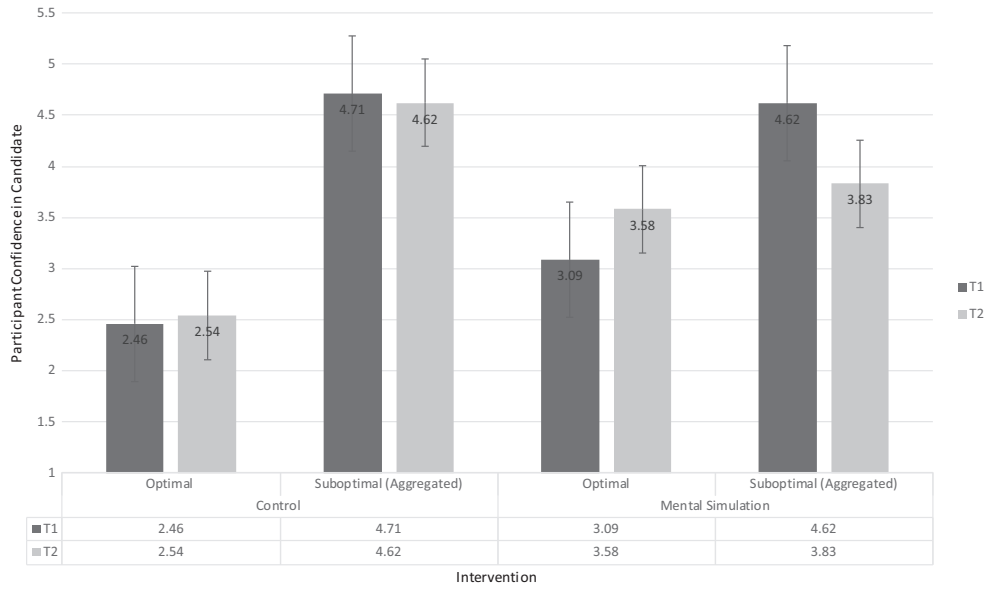

Figure 1. Mean group confidence in Optimal/Suboptimal Candidates (aggregated) by intervention and time (Study 2).

information processing in groups and how this impacts overall group decision-making, proving a 'fruitful ground for research' (Kerr & Tindale, 2004, p. 636). The presence of unique (hidden) information in Hidden Profile decision groups creates an immediate information asymmetry between those who hold the information and those who do not, but who could make different – even better – decisions if they had access to that information (Connelly, Certo, Ireland, & Reutzel, 2011). Accessing, sharing and applying that information is the key challenge.

The present research makes a unique contribution to the literature on group decision-making in Hidden Profile tasks by undertaking a mixed method analysis, incorporating a Thematic Analysis. In our first study, binary logistic regression revealed that solving the Hidden Profile at T1 led to a *decrease* in the odds of solving the Hidden Profile at T2. However, increasing the proportion of time discussing the Optimal Candidate during/after the mental simulation led to an *increase* in the odds of solving the Hidden Profile at T2. Coupled with this, results from our analysis confirmed that the mental simulation triggered an increase in the proportion of time discussing the Optimal Candidate.

The Thematic Analysis from Study 1 also provided evidence for: (1) the existence of the Individual Preference Effect, with individual group members heavily influenced by their own individual pre-discussion decisions and shown to be sharing information in support of these; and (2) the existence of Communication Apprehension amongst group members and its adverse effect, evidenced by their reticence in sharing and recognizing unique information. Our interpretative analysis of the group members' narrative exchanges brought these themes to life, demonstrating clearly how these factors impacted on the group discussion. The narratives suggested that the mental simulation intervention attenuated the adverse effects of the Individual Preference Effect and Communication Apprehension, creating a more cooperative framework, allowing group members to be honest about their recognition of unique information and also in putting forth a strong rationale for their chosen candidate. This is an important result, since the mere effect of receiving information prior to joining the group discussion can lead to preliminary preference formation, even when not expressly requested. For example, Reimer, Reimer, and Hinsz (2010) found that naïve groups, where group members learned about the decision task and alternatives for the first time as a group, were more likely to solve the Hidden Profile than 'predecided groups' where individual members entered the discussion having formed and stated an individual preference. Analysis of the group discussions found that members of predecided groups focused more on group members' preferences, whilst naïve groups exchanged more unshared information.

Study 2 built on these results in an experimental design, testing the mental simulation against a control condition. Groups undergoing mental simulation demonstrated: (1) improved group decision outcomes; (2) increases in group members' confidence in the Optimal Candidate; and (3) reductions in group members' confidence in the Suboptimal Candidates.

What might underlie the mental simulation's success suggested by these findings? The Premortem, on which the mental simulation is based, was developed as a tool to enable teams to critique their own plans prior to implementation (Veinott, Klein, & Wiggins, 2010). In this respect, the mental simulation therefore invokes elements of both critical thinking and dissent. Both elements, as noted previously, have shown some success in improving group decision outcomes in Hidden Profile tasks (Greitemeyer et al., 2006; Postmes et al., 2001).

Postmes et al. (2001) also found that groups with a critical thinking norm valued unshared and shared information more equally. In Study 2, there was no significant difference between

groups in recognizing that they held unique/different information. However, groups in the mental simulation condition showed a significant increase in confidence in the Optimal Candidate and a significant reduction in confidence in the Suboptimal Candidate, as well as better decision quality. This suggests more value was ascribed to unique information in those groups. Postmes et al. found that the more groups valued unshared versus shared information, the better their decisions. Our results mirror these findings. A recognition of the value of an item of information suggests greater integration of that information. This is also consistent with the importance of integration highlighted in the findings of Xiao et al. (2013). It is not sufficient to simply identify a piece of unique information. What individuals actually do with this piece of information is a critical aspect of the decision-making process, which is what leads to our focus on group member behaviour.

The exploratory qualitative analysis in the present study bears out that the intent of the group members is critical and that this can be affected by levels of information asymmetry. Bergh, Ketchen, Orlandi, Heugens, and Boyd (2019) highlighted the important role information asymmetry plays as *a boundary condition* in research. Here, the concept of information asymmetry takes on the role of a moderator within a theoretical model and the interest level becomes how the focal actors, (i.e., the group members making the group decision) may change their behaviours depending on changes in the level of information asymmetry. Bergh et al. (2019) highlighted that the desired state in situations of information asymmetry is 'reduce-reduce' (p. 19), a scenario defined as both parties on both sides of a transaction *collaborating*, with the aim of *reducing* levels of information asymmetry about each other. Achieving the aim requires the parties involved to actively share information, to reduce the information mismatch. The alternative scenarios are in sharp contrast: (1) 'reduce-increase' – one party seeks to reduce information asymmetry whilst the other maintains it; and (2) 'increase-increase' – both parties seek to increase the level of each other's information asymmetry. Bergh et al. noted that how these scenarios play out largely depends on the goals of the parties and the situation they find themselves in. For example, 'reduce-increase' may emerge in scenarios where the same parties have differing goals, depending on the particular issue: shareholder boards and CEOs may, on the one hand, both want to reduce information asymmetry, whilst having conflicting or competing agendas at other times. The 'increase-increase' scenario is more likely to emerge when the parties seek to retain competitive advantage by maintaining the information mismatch. In Bergh et al.'s words 'when the intent is to reduce information asymmetry on both sides of a relationship, positive resolutions. . .become more likely.' (p. 19).

The *reduce-reduce* approach is highly applicable to Hidden Profile group decision-making scenarios: if all group members are able to collaborate successfully to reduce the information asymmetries inherent in Hidden Profiles, then optimal decision-making should emerge. However, this requires cooperation amongst the group members. Toma and Butera (2009) primed groups to either compete or cooperate in a Hidden Profile task. Group members in groups primed to compete were more likely to withhold unshared information, that is, they were *more* likely to maintain the information asymmetry within the group, than those members of groups primed to cooperate. There was no such difference in how the group members managed shared information between groups primed to compete or cooperate. In addition, group members in competitive groups were more reluctant to disconfirm their initial preferences and decision quality was poorer in these groups. Toma and Butera's findings underscored the fact that it is the aims and actions of the individual group members that hold the key to achieving optimal decision-making in groups and this is borne out in our qualitative analysis. The mental simulation provided a framework where group members could work together to achieve *reduce-reduce*.

Limitations and future directions

To manage the demands of the qualitative thematic analysis, we focused on a small sample (17 face-to-face groups of four), comprised of first-year undergraduate psychology students. Consequently, their experience with tasks such as this, particularly involving hiring decisions, is limited. Additionally, this exercise took place early in the new university semester, when students were forming new friendships and relationships, so at a point in time when state Communication Apprehension and fear of peer evaluation may have been particularly acute. These factors may also have contributed to a lack of confidence in both group member interactions and shared decision-making.

Alongside this, the strength of the 'failure frame' underpinning the mental simulation is also worthy of future examination. As noted, the Premortem, on which the mental simulation is based, was developed as a tool to enable teams to critique their own plans prior to implementation (Veinott et al., 2010). Too strong a failure frame could result in correct decisions being overturned. This could be tested using a Manifest Profile task, where we would expect most participants to select the correct candidate, then examining how or if their decisions are impacted by the mental simulation. Experience levels and confidence amongst decision-makers could also play a part in this.

The qualitative analysis provides some support for the positive impact of the mental simulation in: (1) enabling group members to uncover and integrate unique (vs. shared) information and apply it to the group decision; and (2) reducing the bias towards preference-consistent information. Future studies could evaluate the impact of the mental simulation more directly on these key measures, including repetition, through detailed coding of the content of the group discussions before and after the intervention, (as per Schulz-Hardt et al., 2006).

In summary, across both studies, the mental simulation demonstrated a positive effect on group information exchange and decision quality. In Study 2, it also reduced groups' confidence in the Suboptimal Candidate, whilst increasing confidence in the Optimal Candidate. Lastly, we believe the additional interpretative license afforded by the qualitative approach adds valuable insights into group information exchange and processing in Hidden Profile decision tasks by focusing on the actions and motivations of the individual group members.

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Conflicts of interest

All authors declare no conflict of interest.

Author contributions

Dawn H Nicholson, BA, BSc, PhD (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Writing – original draft; Writing – review & editing) Tim Hopthrow (Supervision; Writing – review & editing) Georgina Randsley de Moura (Supervision) Giovanni A. Travaglino (Supervision; Writing – review & editing).

Data availability statement

The data (including the group discussion transcripts) that support the findings of this study are available from the corresponding author upon reasonable request.

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