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Testing the Theory of Good Thinking and Deciding in Organizational Setting: Many Benefits of Leader's Actively Open-Minded Thinking

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The aim of this work was to test the theory of good thinking and deciding in organizational context by examining the relationships between leaders' Actively Open-Minded Thinking (AOT) and different employee level outcomes. Across two studies in which we surveyed managers and their subordinates, we have shown that manager's AOT positively correlated with subordinate-rated decision-making quality and intellectual humility of their superiors, as well as with subordinates' ratings of their teams' psychological safety and their own job satisfaction and feeling of organizational support. We conclude that AOT is the disposition that predisposes some managers to patterns of thinking and behavior that are observable and highly valued by their subordinates, resulting in a range of beneficial outcomes for employees, and that it might be worthwhile to investigate how we can teach managers to think in more actively open-minded way.

Key words: actively open-minded thinking, decision-making, intellectual humility, psychological safety, leadership

Introduction

Decision-making is one of the core things a manager does and one of the core skills he or she must possess. Most of the competency-based models of managerial work put decision-making at the forefront of managerial duties (e.g., Bartram, 2005; Dierdorff & Rubin, 2006; Tett et al., 2000). For example, Bartram (2005) lists deciding and making judgments among the great eight managerial competencies and Tett et al. (2000) conclude that decision-making is the common core of all twelve models of leadership competencies that they reviewed.

Yet, research indicates that managers are bad at decision-making. For example, Nutt (2002), who studied 400 decisions made by top managers over twenty years, came to a

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startling conclusion that decisions made by top managers fail half of the time, although this by itself does not necessarily mean that the decision-making process was bad. Lovallo and Sibony (2010) describe the McKinsey survey of 2,207 executives of which only 28 percent said that the quality of strategic decisions in their companies was generally good, 60 percent thought that bad decisions were about as frequent as the good ones, and the remaining 12 percent thought good decisions were altogether infrequent.

In addition to establishing that managers are not particularly good decision-makers, studies have tried to uncover the reasons behind the good vs. bad decisions. First, it seems that when making decisions managers often rush to conclusions without searching for and considering wide enough array of possibilities or evidence, leading to mistakes such as premature commitment to an idea (Nutt, 2002), relying on a limited set of assumptions (Ketchen & Craighead, 2022), or anchoring to the first piece of information and failing to adjust one's position subsequently (Ketchen & Craighead, 2022; Sibony, 2020). A second problem seems to be selective search and interpretation of evidence. Managers, like other people, have a tendency to search for and overweigh evidence that is in line with their current, favorite position or idea, while simultaneously avoiding and downplaying evidence that counters it. This can lead to several serious mistakes in decision-making such as: a) an escalation of commitment to the current idea even when evidence against it appears (Ketchen & Craighead, 2022; Sibony, 2020); b) constructing a coherent story from a selection of facts fueled by the tendency to attend only to information that confirms the current idea/position and ignore or discount information that contradicts it (i.e., confirmation bias; Kahneman et al., 2011; Ketchen & Craighead, 2022; Sibony, 2020); c) the groupthink trap, since this tendency to shield oneself from counterevidence can also lead to surrounding oneself with likeminded people or those who are afraid to speak against the bosses' idea (Sibony, 2020). Finally, the third problem is the overconfidence in one's own conclusions and decisions (Ketchen & Craighead, 2022; Sibony, 2020). If a person only attends to information that confirms his/her initial position, without ever questioning it, this will lead to accumulation of one-sided arguments and to bolstered confidence in one's conclusions.

Actively Open-Minded Thinking as an Antidote to the Managerial Mistakes

Given that it can be argued that these three problems underpin majority of managerial decision failures, it is remarkable that the concept of Actively Open-Minded Thinking (AOT; Baron, 2000; 2019; Baron et al., 2015) is still practically non-existent in the managerial literature. According to Baron (2000), who developed this theory, AOT describes what good thinking should look like, and it consists of three things:

a) a search for information that is sufficient and thorough in proportion to the importance of the question,

b) active search for and fair treatment of possibilities other than the one decision-maker initially favors,

c) confidence that is appropriate for the amount and quality (direction) of thinking being done.

From this definition of AOT, it is immediately clear that this kind of thinking is the direct antidote to the three mistakes in managers' thinking that underpin the majority of bad strategic decisions. This is not surprising, as the AOT was developed precisely to be a "prescriptive" theory of rationality, i.e., to prescribe how people should think and make judgments in order to counteract the

most prevalent and serious cognitive biases that trump quality decision-making. Our goal within this study is, thus, to test this theory in an organizational setting, i.e., to test the benefits of managers' AOT for employee level outcomes.

Empirically Documented Benefits of Actively Open-Minded Thinking

Outside the organizational context, there is plenty of evidence for the beneficial effects of AOT on beliefs, judgments, and decision-making. For starters, evidence suggests that AOT correlates negatively with a wide range of the usual cognitive biases identified in human decision-making, such as confirmation bias, sunk cost effect, outcome bias, belief bias, and others (Erceg et al., 2022; Stanovich & West, 1997; Stanovich et al., 2016; Toplak et al., 2014). Additionally, people higher on AOT are less prone to holding epistemically suspect beliefs such as conspiracy, superstitious or paranormal beliefs (Erceg et al., 2022; Pennycook et al., 2020; Svedholm & Lindeman, 2013; Svedholm-Häkkinen & Lindeman, 2018), are more accurate at a variety of judgments, such as distinguishing between good and bad arguments (Stanovich & West, 1997), are better at forecasting world events (Mellers et al., 2015) or distinguishing between real and fake news (Bronstein et al., 2019).

Possible Beneficial Effects of Actively Open-Minded Thinking within Organizational Environment

We also believe that managers who are high on AOT bring about additional beneficial outcomes relevant for the workplaces. It is reasonable to expect that managers who are open to and actively search for opposing information and evidence want to hear what others think and have to say and include them in the decision-making process. In organizational literature, such characteristic is labeled as manager's humility and refers to manifested willingness to view oneself accurately, a displayed appreciation of others' strengths and contributions, and teachability (Owens et al., 2013). This managerial characteristic has been shown to be highly beneficial at the individual (e.g., enhanced trust in the leader, work engagement and job satisfaction, enhanced follower creativity), team (e.g., increased team performance, enhanced information sharing) and organizational level (e.g., lower turnover, higher firm performance; Davis et al., 2016; Ou et al., 2018; Owens et al., 2013; Swain & Murray, 2020). Additionally, it seems that humble leaders tend to create a climate of psychological safety (Swain, 2018; Wang et al., 2018), which refers to the shared belief held by members of a team that the team is safe for interpersonal risk taking, i.e., that no one will be reprimanded or ridiculed for stating their opinion, questioning and disagreeing with others or noticing mistakes (Edmondson, 1999; 2018). Psychological safety has significant benefits for organizations and employees, which again include increase in employee job performance, engagement and creativity, enhanced team learning behavior and performance, reduction in errors, increase in organizational commitment, and perceived organizational support (see Newman et al., 2017 and Edmondson & Lei, 2014 for review, and Frazier et al., 2017 for meta-analysis).

The Present Study

Therefore, the aim of this study is to examine the role of manager's AOT in positive employee level outcomes. Specifically, across two studies we were interested to see how managers' AOT was related to the subordinates' perceptions of the decision-making quality and intellectual humility of their managers,

as well as to the subordinates' work attitudes such as job satisfaction and perceived organizational support. We planned for two studies, as we were also interested to see how stable our eventual effects are, i.e., whether or not they will replicate on two independent samples, using different measures of the target constructs. In Study 2, in addition to the aforementioned variables, we also captured psychological safety as an important and positive team outcome that could be positively influenced by manager's AOT. We advanced the hypotheses that managers' AOT will be positively correlated with all the employee level outcome variables. Specifically, managers' AOT will be positively correlated with:

H1: subordinate perceptions of their superiors' decision-making quality,

H2: subordinate perceptions of their superiors' intellectual humility,

H3: subordinate ratings of their own job satisfaction,

H4: subordinate ratings of perceived organizational support, and

H5: subordinate ratings of psychological safety in their teams.

In addition to this, we wanted to see whether AOT helps explain these important outcomes above the effects of the Big Five personality factors as one of the most important individual difference characteristics explaining both leadership and work outcomes (Judge et al., 2009; Schmitt, 2014). To investigate the incremental validity of AOT above the Big Five factors, we combined the two samples to increase the statistical power.

The main reason we wanted to conduct this incremental validity analysis relates to the practical validity of AOT for the purpose of selection for managerial positions. Big Five personality traits are routinely used in such selection processes so it makes sense to check whether practitioners can gain additional predictive power by also measuring AOT in such situations (although from the conceptual perspective this might mean parsing out the valid variance in AOT). However, incremental validity analyses are problematic in several ways, mainly due to the imperfect reliabilities of the measures. One of the possible solutions is to conduct regression analysis using structural equation modelling (SEM) on latent variables that are free from measurement error (Westfall & Yarkoni, 2016), which is what we did.

Study 1

Methodology

Procedure

We instructed psychology students, in exchange for extra course credits, to recruit for the study participants who were employed as managers and had at least three subordinates. The participants were informed that they will participate in a study on managerial competencies/leadership skills and were motivated to take part in the study with feedback about their leadership potential and a gift card valuable about $7. In addition to the variables that we describe in this study, we collected additional data so that the completion of the survey took about one hour. Upon completing their own survey, managers were asked to forward the link to another survey for their subordinates, along with a code that they generated and that we used to match the responses to their subordinates. The subordinates' survey was substantially shorter than the managers' and lasted about 10 minutes.

Participants

Both managers and their subordinates participated in our study. Overall, 124 managers participated in our study (49% males and 51% females) with a mean age of *M* =

45.16 (*SD* = 10.47) and mean years of experience in managerial role of *M* = 12.68 (*SD* = 9.04). On average, managers had *M* = 47.84 subordinates (Min = 3, Max = 1400). Education wise, our managers mostly had a college degree (65%), but there were also some with only a high school degree (27%) as well as those with a PhD (8%). They were mostly employed in the private sector (83%), but some also worked in a state-owned company (13%) or a public institution (4%). Finally, most of our managers work in small companies with less than 50 employees (40%), followed by big companies with more than 500 employees (36%) and then middle-size companies with 50 to 500 employees (24%). Not all of the managers were rated by their subordinates – we managed to obtain subordinate ratings for 95 managers, meaning that for 95 managers we were able to connect their responses with those of their subordinates. The majority of those 95 managers were rated by two subordinates (81%), some were rated by three subordinates (6%), some by four (2%), and some only had one subordinate rating (11%). In total, 190 subordinates participated in this study. For the majority of managers, who received more than one peer-rating, we averaged those ratings prior to conducting the analyses. All the subsequent analyses were always done on the largest possible sample, meaning that the descriptive statistics for the managers' self-ratings were done on a larger sample (*N* = 124) than the descriptive statistics for the subordinate-ratings and the correlations between the self- and subordinate-ratings (*N* = 95).

Instruments

Managers

Actively Open-Minded Thinking (AOT) was measured with a 10-item questionnaire (recommended at the time by the Society for Judgment and Decision-Making; https://sjdm.org/) where participants rated their level of agreement with the statements (e.g., "People should take into consideration evidence that goes against conclusions they favor" or "Changing your mind is a sign of weakness" [reverse-coded]) on a 5-point scale (1 = completely disagree, 5 = completely agree), and the final score was calculated by averaging these ratings[1].

Cognitive ability was measured with a 12 items version of the International Cognitive Ability Resource (ICAR; for details see icar-project.com and Condon & Revelle, 2014). ICAR is a cognitive ability assessment tool consisting of four different types of tasks: letters and numbers series, matrix reasoning items, verbal reasoning items and three-dimensional rotation items (not used in our study). The validation of this measure is reported in Condon and Revelle (2014).

The Mini International Personality Item Pool questionnaire (Mini IPIP) (Donnellan et al., 2006) is a 20-item personality measure, measuring the Big 5 traits each with four items. Participants were instructed to rate the accuracy of the description (e.g., "Am the life of the party.", "Sympathize with others' feelings.", "Get chores done right away.", "Have frequent mood swings.", "Have a vivid imagination.") on a 7-point scale (1 = completely incorrect 7 = completely correct).

Subordinates

The Manager's Decision-Making Quality Scale (Wood, 2012) consists of eight items assessing subordinates' perceptions of their managers' decision-making quality and success. Subordinates were instructed to rate their agreement

[1] If not written otherwise, for each of the variables in the study, we calculated the final score by averaging ratings or correct responses.

with the statements describing their manager (e.g., "The decisions my superior makes follow reason and logic" or "The decisions my superior makes end up working out well") on a five-point scale (1 = completely disagree, 5 = completely agree).

The manager's intellectual humility was measured using the Expressed Humility Scale (Owens et al., 2013) consisting of nine items (e.g., "This person actively seeks feedback even if it is critical", or "This person acknowledges when others have more knowledge and skills than him/herself"). The participants rated the degree to which each of the item describes their manager on a five-point scale (1 = completely disagree, 5 = completely agree).

The subordinates' job satisfaction was measured by a single item (a 5-point scale, ranging from 1 = very unsatisfied to 5 = very satisfied) assessing their satisfaction with their job overall.

Perceived organizational support (Eisenberger et al., 1986) was measured with eight statements (e.g., "This organization really cares about my well-being", or "The organization does not value my extra effort") for which participants indicated their level of agreement on a seven-point scale (1 = completely disagree, 7 = completely agree).

Results

Prior to conducting the main analyses, we calculated the descriptive statistics of our focal variables. This is presented in the Table 1.

On average, it seems that managers mostly agreed with statements describing AOT as a good standard of thinking and reasoning. Another noticeable result are high ratings on decision-making quality and intellectual humility – it seems that majority of subordinates see their superiors as intellectually humble, good decision makers. In general, employees/sub-

Table 1 *Descriptive statistics of Study 1 focal variables*

Variable	*Mean*	*SD*	Min	Max	Theoretical range	ω_t
Managers						
AOT	3.75	0.44	2.10	4.80	1 – 5	.76
ICAR	7.70	3.24	0	12	0 – 12	.87
Openness	4.77	1.24	1.75	7.00	1 – 7	.81
Conscientiousness	5.24	1.20	1.75	7.00	1 – 7	.86
Extraversion	4.95	1.22	1.50	7.00	1 – 7	.84
Agreeableness	5.52	0.92	1.75	7.00	1 – 7	.75
Neuroticism	3.30	1.07	1.25	6.00	1 – 7	.87
Subordinates						
DMQ	4.21	0.58	1.63	5.00	1 – 5	.95
IH	4.26	0.73	1.22	5.00	1 – 5	.98
JS	4.07	0.59	2.50	5.00	1 – 5	/
POS	4.71	1.00	2.63	7.00	1 – 7	.87

Note. ωt = Omega total reliability; AOT = Actively Open-Minded Thinking; ICAR = International Cognitive Ability Resource; DMQ = Manager's Decision-Making Quality; IH = Manager's Intellectual Humility; JS = Job Satisfaction; POS = Perceived Organizational Support.

ordinates also seem to be very satisfied with their jobs and feeling somewhat supported by their organization. To investigate the relationships between subordinate-rated outcomes and AOT, we calculated the bivariate correlations among our variables and present them in Table 2. We have conducted one-tailed tests to obtain the degrees of significance as our main hypothesis was directional (i.e., we predicted that AOT would be positively correlated with the outcomes).

Table 2 shows that manager's AOT is positively related to the subordinate's ratings of their Decision-Making Quality and Intellectual Humility. This means that managers who agree with AOT as a standard of good thinking are perceived by their subordinates to be better decision makers and more intellectually humble, suggesting that adherence to beliefs about good standards of thinking is reflected in the managers' observable behaviors. Perceived Manager's Decision-Making Quality and Intellectual Humility were, in response, positively related with subordinates' Perceived Organizational Support. However, manager's AOT was not bivariately related to either of the subordinates' work attitudes, Job Satisfaction or Perceived Organizational Support. In addition to this, manager's AOT was positively related to his/her Cognitive Ability, Openness, and Agreeableness.

Besides being related with manager's AOT, perceived Manager's Decision-Making Quality was also positively related with his/her Cognitive Ability and Agreeableness. In addition to AOT, only Cognitive Ability and two of the five personality factors, Openness and Agreeableness, showed some meaningful correlations with the measured outcomes. Other personality factors were basically unrelated to any of the outcomes. In order to replicate and extend our results, we conducted Study 2, where we used some measures that were similar to the ones in this study, but also some additional measures (as explained below).

Table 2 *Bivariate correlations among Study 1 variables (raw correlations are shown above the diagonal and disattenuated correlations are shown below the diagonal)*

	AOT	ICAR	Open.	Cons.	Extra.	Agree.	Neuro.	DMQ	IH	JS	POS
Managers											
AOT	1	.24**	.19*	-.01	-.07	.25**	-.09	.25**	.28**	.15	.12
ICAR	.29	1	-.04	-.12	-.13	.02	-.14	.21*	.13	.10	.08
Open.	.24	-.05	1	.03	.21*	.31**	-.18*	.05	.11	-.20*	-.17
Cons.	-.01	-.14	.04	1	.05	.10	-.21**	.09	.05	-.09	.02
Extra.	-.09	-.15	.25	.06	1	.38**	-.28**	-.01	-.04	-.03	.09
Agree.	.33	.02	.40	.12	.48	1	-.09	.22*	.18*	.20*	.27**
Neuro.	-.11	-.16	-.21	-.24	-.33	-.11	1	.00	.01	-.04	-.12
Subordinates											
DMQ	.29	.22	.06	.10	-.01	.26	.00	1	.72**	.17*	.42**
IH	.32	.14	.11	.05	-.04	.21	.01	.75	1	.18*	.44**
JS	.18	.11	-.22	-.10	-.03	.23	-.04	.17	.18	1	.56**
POS	.15	.08	-.20	.02	.11	.33	-.14	.46	.48	.60	1

Note. AOT = Actively Open-Minded Thinking; ICAR = International Cognitive Ability Resource; Open. = Openness; Cons. = Conscientiousness; Extra. = Extraversion; Agree. = Agreeableness; Neuro. = Neuroticism; DMQ = Manager's Decision-Making Quality; IH = Manager's Intellectual Humility; JS = Job Satisfaction; POS = Perceived Organizational Support.

** $p < .01$, * $p < .05$ one-sided

Study 2

Methodology

Procedure

In Study 2, we collected data in two ways. We approached several companies and asked them to collaborate with us on a study about leadership competencies. Companies that agreed to participate invited their managers to participate in a 3-hour workshop, the first part of which included testing and the second part a lecture on "state-of-the-art" knowledge on leadership skills. The second way was identical to Study 1 – we instructed several psychology students to recruit managers who had at least three subordinates to participate in the study.

All managers were motivated to participate in the study with the promise of personalized feedback and a gift card voucher (around $13). The managers completed a battery of tests and questionnaires, not all of which are mentioned in this study. It took them on average around an hour and half to complete this battery. Managers were asked to provide us with email addresses of five of their subordinates who were then sent the link to a much shorter questionnaire (10 to 15 minutes long) in which they were asked to rate their manager, as well as their own work attitudes (e.g., job satisfaction and perceived organizational support) and their team psychological safety. Subordinates completed several more questionnaires that we do not list here.

Participants

A total of 126 managers and 335 of their subordinates participated in this study. There were 78 (62%) male and 48 (38%) female managers with mean age *M* = 42.08 (*SD* = 7.53), mean years of work experience *M* = 18.15 (*SD* = 7.36) and mean number of subordinates *M* = 25.44 (Min = 3, Max = 386). Again, most of them had a college degree (66%), but there were also some with only a high school degree (22%) as well as those with a PhD (12%). Almost all of our managers worked in the private sector (94%), with a minority coming from the public sector or NGOs. Regarding the company size, the majority of managers worked in companies with 50 to 500 employees (42%), followed by large companies with more than 500 employees (38%) and smaller companies with less than 50 employees (20%).

Out of 126 managers participating in the study, we managed to obtain at least one rating for 108 of them. 19% of managers were rated by five, 21% by four, 22% by three, 23% by two and 15% by only one subordinate. This time, a total of 335 subordinates participated in the study. As in Study 1, we averaged all of the subordinates' ratings for each of the managers before conducting further analyses.

Instruments

In Study 2, we tried to constructively replicate Study 1 findings (Lykken, 1968). Thus, some of the measures we used were the same as in Study 1, but we also captured some additional constructs and for some constructs we deliberately used different measures. There is no single criterion for successful replication. At minimum, one can look at three things: whether the effects are in the same direction, whether both effects are statistically significant and whether the original effects fall within 95% CI of the replication effects (e.g., Open Science collaboration, 2015). We will use these three criteria to evaluate whether our Study 2 managed to replicate Study 1 results. Here, we describe instruments that were new or different in comparison to Study 1.

Managers

AOT – this time we measured AOT with currently recommended 11-item scale available at https://sjdm.org/dmidi/Actively_Open-Minded_Thinking_Beliefs.html. The scoring was similar as before – calculating average of the participants' ratings on a 5-point scale (1 = completely disagree, 5 = completely agree).

Cognitive Reflection Test (CRT) – as a measure of cognitive ability, this time we used the Cognitive Reflection Test (CRT; Frederick, 2005). For this study, we developed three items, which were similar to the original three in structure but differed in content, since we wanted to make them more work related and face-valid (e.g., "You are a manager in an auto equipment factory. If 5 machines make 5 car parts in 5 minutes, how many minutes would it take for 100 machines to make 100 car parts?"; intuitive response = 100, correct response = 5).

IPIP 50 – this time we also decided to measure personality traits with more items than before to get a more reliable measure. To achieve that we used a Croatian translation of the IPIP50 (Mlačić & Šakić, 2008), which captures each of the five factors with ten items. Participants rated their levels of agreement with the statements on a 5-point scale (1 = completely incorrect, 5 = completely correct).

Subordinates

Manager's AOT perceptions – this time, in addition to measuring managers' AOT, we also decided to measure their subordinates' perceptions about whether their superiors tend to think in an AOT way. We did this specifically to see if managers' AOT and behavior is observable by their subordinates. The subordinates rated two statements about their superiors that we developed and that reflected the core of AOT ("My superior looks for arguments and information that could be contrary to his/her existing views and initial decisions" and "My superior changes his/her opinion if the circumstances change, that is, if there are good arguments for the change") using a seven-point scale (1 = completely disagree, 7 = completely agree).

Manager's Decision-Making Quality – this time we opted for a similar, but a bit different scale used by Wood and Highhouse (2014). Instead of eight, this scale consists of five statements on which, again, subordinates rated their managers using a 5-point scale (1 = completely disagree, 5 = completely agree).

Psychological safety – we measured psychological safety with a 7-items scale developed by Edmondson (1999). Participants rated the statements ("If you make a mistake on this team, it is often held against you" and "Members of this team are able to bring up problems and tough issues") on a 7-point scale ranging from 1 = completely incorrect to 7 = completely correct.

The variables of manager's Intellectual Humility, Job Satisfaction and Perceived Organizational Support were measured with identical items as those in Study 1.

Results

Again, before moving to the main analyses, we have calculated the descriptive statistics of our variables. This is shown in Table 3.

In general, Study 2 managers mostly agreed with the AOT principles, and their subordinates rated them, on average, as intellectually humble, good decision-makers. Subordinates were also relatively satisfied with their jobs, perceived their team climate to be quite safe and did not plan to leave the organization in the foreseeable time. To examine the relationships between AOT and other relevant variables and outcomes, we have computed

Table 3 *Descriptive statistics of Study 2 focal variables*

Variable	*Mean*	*SD*	Min	Max	Theoretical range	ωt
Managers						
AOT	3.92	0.42	2.83	4.73	1 – 5	.71
CRT	0.60	0.36	0	1	0 – 1	.70
Openness	3.87	0.46	2.70	4.90	1 – 5	.81
Conscientiousness	4.08	0.58	2.10	5	1 – 5	.89
Extraversion	3.75	0.63	2.10	5	1 – 5	.89
Agreeableness	4.10	0.45	2.70	5	1 – 5	.83
Neuroticism	2.17	0.62	1	4	1 – 5	.90
Subordinates						
AOT p.	5.52	0.83	2.50	7	1 – 7	/
DMQ	4.26	0.46	2.95	5	1 – 5	.91
IH	4.35	0.52	2.44	5	1 – 5	.96
JS	4.09	0.46	2.80	5	1 – 5	/
POS	5.31	0.88	2.92	7	1 – 7	.96
PS	5.83	0.65	3.90	6.86	1 – 7	.86

Note. ωt = Omega total reliability; AOT = Actively Open-Minded Thinking; CRT = Cognitive Reflection Test; AOT p. = Manager's AOT perceptions; DMQ = Manager's Decision-Making Quality; IH = Manager's Intellectual Humility; JS = Job Satisfaction; POS = Perceived Organizational Support; PS = Psychological Safety.

bivariate correlations between our variables. Again, to obtain the degrees of significance we have conducted one-tailed tests. We are reporting these correlations in Table 4.

Table 4 shows that managers with higher AOT were perceived as being better decision makers, more intellectually humble and their team climate was perceived as being more psychologically safe compared to managers with lower AOT. Additionally, managers' agreement with AOT standards obviously reflected in their observable behavior judging from the relatively high positive correlation between managers' AOT and subordinates' AOT perceptions. Subordinates' perceived organizational support again failed to significantly correlate with the managers' AOT, while the correlation between subordinates' job satisfaction and AOT was positive and significant this time.

Unlike AOT, which was consistently related with most of the outcomes in the expected direction and to the expected degree, Cognitive Abilities (CRT) and the Big Five factors exhibited only sporadic correlations with these outcomes. Specifically, CRT was significantly correlated only with Psychological Safety, indicating that managers with higher cognitive abilities tend to have teams that are more psychologically safe, which is generally consistent with the relationship between intelligence and leadership outcomes (Judge et al., 2004). Of the five personality traits, only Agreeableness and Openness managed to correlate sig-

Table 4 *Correlations among Study 2 variables (raw correlations are shown above the diagonal and disattenuated correlations are shown below the diagonal)*

	AOT	CRT	Open	Consc	Extra	Agree	Neuro	AOT p.	DMQ	IH	JS	POS	PS
Managers													
AOT	1	.18*	.21**	-.19*	.08	.13	-.05	.36**	.18*	.22*	.18*	.09	.21*
CRT	.24	1	.21*	.01	.02	.05	.02	.09	.11	.12	.09	-.03	.31**
Open	.28	.27	1	.19*	.38**	.19*	-.23**	.04	.04	-.01	.17*	.08	.02
Consc	-.24	.01	.22	1	.06	.20*	-.35**	.02	-.03	-.10	-.08	-.08	-.09
Extra	.10	.03	.45	.07	1	.38**	-.33**	.02	.00	-.03	-.02	.05	.09
Agree	.17	.07	.23	.23	.44	1	-.21*	.17*	.13	.21*	.04	.17*	.23**
Neuro	-.06	.03	-.27	-.39	-.37	-.24	1	-.05	-.05	.06	-.02	.08	-.07
Subordinates													
AOT p.	.43	.11	.04	.02	.02	.19	-.05	1	.42**	.61**	.34**	.41**	.41**
DMQ	.22	.14	.05	-.03	.00	.15	-.06	.44	1	.73**	.42**	.53**	.51**
IH	.27	.15	-.01	-.11	-.03	.23	.06	.62	.78	1	.43**	.51**	.47**
JS	.21	.11	.19	-.08	-.02	.04	-.02	.34	.44	.44	1	.61**	.33**
POS	.10	-.04	.09	-.09	.05	.19	.09	.41	.57	.53	.62	1	.43**
PS	.27	.39	.02	-.10	.10	.27	-.08	.44	.58	.52	.34	.47	1

Note. AOT = Actively Open-Minded Thinking; CRT = Cognitive Reflection Test; Open = Openness; Consc = Conscientiousness; Extra = Extraversion; Agree = Agreeableness; Neuro = Neuroticism; AOT p. = Perceptions of manager's AOT; DMQ = Manager's Decision-Making Quality; IH = Manager's Intellectual Humility; JS = Job Satisfaction; POS = Perceived Organizational Support; PS = Psychological Safety.
** $p < .01$, * $p < .05$ one-sided

nificantly with any of the outcomes – Agreeableness with AOT perceptions, Intellectual Humility, Perceived Organizational Support and Psychological Safety, and Openness with Job Satisfaction.

Analysis of AOT's Incremental Validity on a Combined Sample

After combining the two samples for the variables that were present in both studies (details of this procedure are in the Online Supplement), we were left with four outcomes: subordinates' ratings of managers' Decision-Making Quality and Intellectual Humility, perceptions of subordinates' Job Satisfaction and Perceived Organizational Support. The combined sample had between $N = 214$ and $N = 250$ cases, depending on the variable.

As we mentioned earlier, we conducted a SEM regression, regressing the outcomes on AOT and Big Five factors. We were interested in whether the beta ponder of AOT will remain statistically significant (one-sided tests due to directionality of hypotheses) after accounting for the effects of the Big Five factors. The results showed that the coefficient for AOT remained significant for each outcome variable except the subordinate rated Decision-Making Quality, although the incremental variance explained by AOT was rather modest (0.018 for Decision-Making Quality, 0.042 for Intellectual Humility, 0.022 for Job Satisfaction and 0.027 for Perceived Organizational Support; detailed results are presented in the Online Supplement).

Discussion

The guiding rationale behind our two studies was that one of the most important tasks that managers need to do is make decisions that have implications for their teams and companies. Often, these are high stake decisions which would benefit from specific decision-making skills that are often absent,

given the literature on management decision-making failures (e.g., Nutt, 2002). In the decision-making field of study and literature, the concept of AOT has a long theoretical and empirical history. Yet, to our surprise, the concept of AOT as a central construct and one of the most important decision-making individual difference variables, is completely missing from the management research. With our studies, we are hoping to fill this gap and respond to several calls to bridge the gap between decision making and industrial/organizational (I/O) research traditions that were so far largely distant and disparate (cf., Dalal et al., 2010; Highouse et al., 2014).

With a fair degree of consistency across our two studies, managers' AOT was positively related with subordinates' ratings of their managers' Quality of Decision-Making and Intellectual Humility, as well as with perceived team Psychological Safety, Perceived Organizational Support, and overall Job Satisfaction. Formally, looking at the three criteria for successful replication that we specified, Study 2 effects were always in the same direction as Study 1, and their 95% CI always included Study 1 effects. Regarding the statistical significance criterion, both effects of interest that were significant in Study 1 were also significant in Study 2 (AOT relationship with Decision-Making Quality and Intellectual Humility ratings). Thus, we conclude that, overall, Study 2 successfully replicated and extended the results of Study 1, confirming that AOT is also relevant in the organizational context and that managers' AOT is related to a range of important outcomes. Significantly, for most of the outcomes, managers' AOT was still important even after controlling for the effects of personality traits. Granted, these effects were not large, but this is not surprising given the different sources of ratings and far from perfect indicators of the target constructs, but also the fact that the outcome variables are affected by various and different aspects that are often even outside managers' control (e.g., employees' personality).

Still, it is also worth noting that the AOT is not a classical self-report measure as participants do not rate how often they personally think or behave in a specific way, but only to what degree they agree that specific way of thinking and behaving represents a standard of good thinking and behaving. The rationale here is that people who believe a certain type of behavior is generally good and desired will more often behave in this way, but this gap between believing that something is a good behavior and actually behaving in that way could also diminish the correlations between the AOT and other variables. To obtain the effects of AOT that we and previous other studies have obtained testifies, in our view, to the validity of the AOT measure and to the importance of the construct for various outcomes in different domains. In short, we believe that our studies provide evidence for the importance of AOT in the organizational settings and good arguments for paying more attention to this concept in future studies.

One surprising and a bit disappointing finding from our point of view was the relatively low correlation between self-rated managers' AOT and their Decision-Making Quality as rated by their subordinates. Indeed, this was the only outcome for which AOT did not exhibit statistically significant incremental validity above the effects of personality traits on our combined sample. However, in Study 2 we also measured whether subordinates were able to perceive their managers' AOT and obtained moderate correlations between the managers' AOT and subordinates' perceptions of their AOT. This means that managers' AOT was observable by other people in their surroundings. It also implies that the process, rather than the outcome, of making a decision might be a better criterion for

assessing the quality of decision-making, as the process is under direct individual control while the outcome can be affected by many other things, outside one's control, including pure luck.

Besides positioning AOT as one of the crucial individual differences underpinning good decision-making, attesting to its benefits at a company level, our studies have shown that managers' AOT could have additional benefits at the individual and team levels. First, high AOT managers were consistently perceived as more intellectually humble meaning that their subordinates noticed that these managers value their opinions and advice, show appreciation for their contributions, and notice and praise their strengths. As noted in the introduction, studies have shown that this has many benefits for individuals, teams, and organizations – higher work engagement and job satisfaction, enhanced creativity, increased team performance, lower turnover, higher firm performance, etc. (Davis et al., 2016; Ou et al., 2018; Owens et al., 2013; Swain & Murray, 2020). In addition, AOT managers tended to have teams that were more psychologically safe, which also has its own benefits such as heightened job performance, engagement and creativity, enhanced team learning, and reduction in errors (Newman et al., 2017; Edmondson & Lei, 2014; Frazier et al., 2017). In sum, it seems that acknowledging one's own limitations, paying attention to others' thoughts and arguments, soliciting and valuing their inputs and advice, and changing your mind accordingly have many benefits at every level of the organizational structure, and AOT is a thinking disposition that predisposes individuals to think and behave in this way more. Thus, the benefits of managers' AOT permeate an organization through different channels and mechanisms not limited solely to enhanced quality of decision making.

Practical Implications

One practical implication of our results is that it could be possible to educate managers to make better and more beneficial decisions for their organizations and its employees by teaching them what is AOT and how to think in actively open-minded way. Although there are individual differences in propensity towards AOT, as AOT represents the standards of good thinking, it is in principle teachable. Some of the previous studies showed some promise in this regard. For example, Perkins (2019) showed that it is possible to teach students to develop their arguments better, specifically by including the other-side perspective, which is something that does not come naturally to people. Gurcay-Morris (2016) showed that a short, one hour long, AOT online module managed to increase the other-side thinking and somewhat decrease overconfidence in one's own judgments. Thus, increasing managers' AOT holds a promise as an avenue not only to enhanced quality of decision-making at the high levels of organization, but also to increased psychological safety of the teams and engagement and satisfaction of employees, with all of the benefits these outcomes bring. This is definitely worth pursuing in future scientific endeavors.

Limitations

The first limitation relates to AOT and outcome measures. The current AOT measure that assesses one's beliefs about proper standards of thinking is, in a way, a proxy for one's "true" tendency towards AOT. Although such a measure has its advantages, it is also possible that there exists a gap between what someone believes and what someone does, possibly lowering the correlations between AOT and the outcomes. Other approaches to measuring AOT in organizational contexts

could be investigated in the future (for example, the AOT situational judgment test which is currently being developed by our research group; Vrhovnik, 2022).

The other limitation relates to the incremental validity of AOT over and above cognitive ability. In our analyses we have not included a measure of cognitive ability in our incremental validity analysis. The reason for this is simply that we used different ability measures across the studies and therefore could not merge them in a combined sample, and doing incremental analysis on separate samples would not make much sense due to the low sample size. In other words, statistical strength of such analyses would be too low to warrant reliable conclusions, and SEM regression especially requires high sample size (Westfall & Yarkoni, 2016). However, as both ability measures (ICAR and CRT) exhibited smaller correlations with the outcomes than AOT, we suspect that the AOT would still be able to explain incremental variance had the ability measures been included in the analysis.

Conclusion

In conclusion, we have conducted two studies in which we demonstrated benefits of managers' AOT at many organizational levels. Specifically, we have shown that the higher the manager's AOT, the better their decision-making capabilities and the higher their intellectual humility as judged by their subordinates. Furthermore, managers with higher AOT tended to have teams that were more psychologically safe and employees that were more satisfied with their jobs and that felt more supported by their organization. We argue that the AOT is the disposition that predisposes some managers to patterns of thinking and behavior that are observable and highly valued by their subordinates, resulting in a range of beneficial outcomes. Thus, one promising way forward is to develop and test educational interventions aimed to teach AOT to highly positioned organizational leaders with a bid to enhance the quality of decision making in the organization, but also to improve their employees' work-related attitudes, thus affecting different organizational outcomes in a positive way.

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