rijksuniversiteit groningen

A Mixed-Methods Study on Decision-Makers' Use of a Decision-Rule

Eleni Mavropoulou

Master Thesis - Talent Development and Creativity

[*s3135195*]
[*April*] [*2022*]
Department of Psychology
University of Groningen
Examiner/Daily supervisor:
……Dr. Susan Niessen……

Abstract

Using a decision-rule to predict academic or job performance has attracted scientists and practitioners' interest. Following a decision-rule's result or not, is based either on the holistic approach (decisions are made with the use of intuition and personal judgment) or the mechanical approach (decisions are made with the use of a decision-rule's result). Research evidence has demonstrated that using a decision-rule's result provides more accurate predictions than individuals' predictions and should be preferred. However, individuals tend to avoid using results of decision-rules, which is known as algorithm aversion. A cognitive process, namely intuitive thinking style, might be related to algorithm's aversion persistence. Research on people's intuitive thinking style has displayed a preference for intuitive-based hiring. A compromising solution, between research suggestion and practitioners preferred way of selection, is to provide the option of deviation from the decision-rule's result. However, this has the consequence of less accurate predictions. In this mixed-method study ($N = 22$), using a correlational analysis we studied whether people with high scores on intuitive thinking style would be more likely to deviate from the decision-rule's result (Hypothesis 1) and to make less accurate predictions, due to that deviation (Hypothesis 2). We found statistical support for Hypothesis 1, but not for Hypothesis 2. Using thematic analysis, we examined why people deviate from the decision-rule's result. We were only able to identify individuals' thinking patterns related to the use of the decision-rule. Implications and future directions are also discussed.

Keywords: decision-making, intuitive thinking style, algorithm aversion, performance prediction

A Mixed-Methods Study on Decision-Makers' Use of a Decision-Rule.

Making accurate predictions about a person's performance can be a hard and complex procedure. Based on the decision-making literature, individuals can follow two main approaches to make predictions; the holistic approach and the mechanical approach (Dawes et al., 1989). The holistic approach is based on people's intuition and personal judgment, whereas the mechanical approach is based on the use of standardized procedures such as statistics and decision-rules or algorithms (Grove et al., 2000). Research evidence claims that the use of the mechanical approach provides more accurate predictions than those of the holistic approach (Kuncel et al., 2013). An example based on the mechanical approach is the use of standardized methods during hiring processes (see e.g., Kuncel & Hazlett, 2010). However, people tend to avoid using results of decision-rules, which is known as algorithm aversion (Dietvorst et al., 2015). There are several reasons of algorithm aversion persistence, one of them is based on individuals' cognitive processes and namely, the intuitive thinking style (Chen et al., 2008). Lodato et al., (2011) suggested that Humane Resource Management (HRM) professionals who appeared to mostly rely on their intuitive thinking style, also preferred to use intuitive-based hiring processes. In other words, they might avoid completely the option to use decision-rule's result or they might use it as a type of advice (see e.g., Önkal et al., 2009). In both cases, the decision-rule's result would be overruled.

We understand that there is a gap between what research suggests and what happens in practice. Dietvorst et al., (2018) suggested the option of allowing people to deviate from the decision-rule's result to some extent and provide their own prediction. In this way, people are more willing to use a decision-rule instead of only having the option to follow its outcome. This solution is two-fold; on the one hand, people take into account the decision-rule, on the other hand, they make less accurate predictions.

In this mixed-methods study, we aim to investigate the relationship of a cognitive process with rule deviation and prediction accuracy. In addition, we aim to understand people's reasoning of their tendency to deviate from the decision-rule. Hence, we formulated the following research questions: What is the relationship between intuitive thinking style and decision-rule use? Why do decision makers deviate from the result of the decision-rule?

Decision-making approaches in terms of prediction accuracy

A brief explanation of the decision-making approaches will help our understanding of the way people use decision-rule's result. To make predictions individuals usually rely on two approaches (see e.g., Dawes et al., 1989); the mechanical approach and the holistic approach. We explain both the approaches in terms of their accuracy in predicting academic performance and organizational performance.

Decision making process based on the mechanical approach uses statistics, actuaries and mathematical formulae or decision-rules for performance prediction (Grove et al., 2000). An example in an organizational context is the use of standardized assessment tools such as structured interviews or cognitive ability tests in personnel selection (see e.g., Highhouse & Kostek, 2010; Kuncel & Hazlett, 2010; McDaniel, et al., 1994; Nolan et al., 2016; Schmidt & Hunter, 1998). Likewise in an academic context, the use of a decision-rule predicts students' academic performance (Dietvorst et al., 2018). The decision-rule contains relevant information to the fields of studies and every component has a specific assigned weight.

The holistic approach is based on the usage of intuition and personal judgment as selection methods, which rely on experts' judgment and knowledge (see e.g., Ahlburg, 1992; Brooks et al., 2009; Diab et al., 2011; Dipboye, 1997; Lievens et al., 2005; Rynes et al., 2002; van der Zee et al., 2002; Yu & Kuncel, 2020). A general definition of intuition would help in the better understanding of the holistic approach. According to research, people process in-

formation either by using a conscious and deliberative system or an unconscious and intuitive processing system (Hassin et al., 2005). The latter one provides us with what we call intuition; having the feeling of understanding something without knowing how and why you understand it.

Salas et al., (2010) have suggested that individuals' intuition might lead to accurate predictions. However, the accuracy of the predictions depends on multiple components such as the decision-maker (e.g., their level of expertise and processing style), the nature of the task (e.g., structure of the task and feedback) and the environment (e.g., time pressure). In fact, meanwhile, research evidence has also displayed that individuals' reliance on the holistic approach and mainly on their intuition, even when they are experts, leads them to less accurate predictions (Kuncel et, 2013). This comes in accordance with the previous literature, which claims the deficiency of the holistic approach in performance prediction (see e.g., Grove & Meehl, 1996; Grove et al., 2000).

According to research, the major advantage of the mechanical approach is its consistency in predictions (Grove et al., 2000). A characteristic example of this consistency in predictions is the Brunswik Lens Model, which analyzes people's thinking procedures (Brunswik, 1955, 1956). This model consists of three primary components: a person's response or judgment, the environmental cues and the outcome. People grasp a variety of information in the environment (cues), and weigh parts of this information in their minds in order to make their predictions. The parts of information that are connected depend on the person's assigned importance to them. "Thus, the model makes a distinction between "man" (the judge's prediction for each individual target) and the "model of man" (the estimated average values from regressing the judge's prediction on a set of cues)." (p. 1061, Kuncel et al., 2013). Previous research has indicated that the "model of a man" provides better predictions

than a human. As it is suggested in the literature, people are successful in gathering information, but they are not that efficient when they have to associate all this information and make a precise human performance prediction (Kuncel et al., 2013). Nevertheless, people's preference or tendency to use the holistic approach in predicting work or academic performance remains (Highhouse, 2008; Lodato et al., 2011).

Algorithm Aversion

For many years organizations have displayed their preference to use selection methods based on the holistic approach (Ahlburg, 1992; Brooks et al., 2009; Diab et al., 2009; Dipboye, 1997; Lievens et al., 2005; Rynes et al., 2002; van der Zee et al., 2002). Dietvorst et al., (2015) studied people's tendency regarding the use of a decision-rule. They conducted an experiment where participants could either use the decision-rule outcome, without acknowledging the decision-rule's accuracy or making the prediction by using their own judgment. At the same time, they were aware that the rule does not have perfect accuracy in its prediction. The researchers found that people used the decision-rule more when they had no knowledge about its accuracy, whereas when they were aware of its imperfection, they preferred to use their own judgment. They kept resisting even when they realized that most of the time the decision-rule provides more accurate results than a person. The tendency of people to not use a decision-rule that has a possibility of error, was named by the previous authors as algorithm aversion.

Reasons of algorithm aversion

People's insistency to not use the decision-rule makes us wonder why this is happening. There are several reasons for people's insistency such as the threat of technological unemployment, doubts regarding the effect of the decision-rule and individuals' cognitive processes such as intuitive thinking style.

The threat of technological unemployment is related to HRM professionals' belief that using a decision-rule makes them to have less control in personnel selection, which undermines their expertise (Meehl, 1986; Nolan et al., 2016; 2020). Another reason is the HRM professionals' belief regarding the effectiveness of a decision-rule in employee selection (Nolan et al., 2016). According to Terpstra (1996) and Diab et al., (2011), for years HRM professionals hold the belief that the holistic approach is a better predictor for future job performance as well as a more practical and inclusive method than the use of a mechanical approach. Additionally, organizations' preferences and policies regarding the use of mechanical approaches, might hinder HRM professionals to use them, even though they are aware of their scientific evidence (Klimoski & Jones, 2008).

In the current paper, we focused more on the last reason, which is people's cognitive processes and specifically individuals' intuitive thinking style. According to Lodato et al., (2011), intuitive thinking style is strongly correlated with HRM professionals' preference to use intuition-based hiring. In other words, if people typically use their gut-feeling for decisions outside of their work, they also use it during their work tasks. A detailed explanation of what intuitive thinking is and how it works it will help our understanding. In Cognitive-Experiential Self-Theory (CEST; Epstein, 1990, 1991, 1993, 1994) a distinction is displayed between intuitive thinking style and rational thinking style. An intuitive thinking style is based on emotions and intuition, whereas rational thinking style is based more on people's logic and analytical thinking (Epstein et al., 1996). Based on CEST, individuals use both thinking styles to some extent and the outcome of their usage is people's behavior and conscious thought. There are times, where the two thinking styles cooperate in a harmonic way, while other times emotions and thoughts contradict one another and one of the thinking styles dominates (Denes-Raj & Epstein, 1994). Literature has demonstrated that each thinking style's domi-

nance depends on different factors such as the person's preference to use one system more than the other or their emotional engagement (Anderson, 1982; Epstein et al., 1996).

Sinclair and Agerström (2020) investigated the relationship between people's intuitive thinking style and prediction accuracy and they found that people who mostly used their intuition, based their decisions more on candidates' motivation letters than on their SAT scores. In addition to that, they found that people who based their decisions on more standardized measures such as SAT scores made more accurate predictions than people who relied on holistic measures.

Overcoming algorithm aversion

People may insist on algorithm aversion, however research has also investigated how people behave when a decision-rule's result is provided to them. For instance, Önkal et al., (2009) found that in prediction tasks in which people could use an expert's advice, people were more receptive to an expert's advice than to a decision-rule's one. They also explained that the preference for human judgment advice might be embedded in human nature and might be related to individuals' psychological needs (Huffmon, 2006). In addition to that, they also believed that it is difficult to convince people to use a decision-rule's result. Likewise, Castelo et al., (2019), studied how the perception of the task and the decision-rule affect people's reliance on the decision-rule. They conducted a series of studies in which they found that in a subjective task, people would accept the use of a decision-rule when it displays emotions and seems like a human. Castelo et al., (2019) concluded that even though several difficulties appear when people are asked to use a decision-rule, there are ways to convince people of its use.

Dietvorst, et al., (2018) provided a possible solution to people's resistance of using a decision-rule. They suggested that if people have the ability to correct the imperfect decision-

rule, then it is more likely to accept its use. However, correcting a decision-rule has the consequence of a less accurate prediction (see e.g., Carbone et al., 1983; Goodwin & Fildes, 1999; Hogarth & Makridakis, 1981; Lim & O'Connor, 1995; Willemain, 1991; Dietvorst et al., 2018). Noteworthy to mention is that it might be better to have these less accurate predictions, but have people convinced to use a decision-rule. Also, if only a small deviation from the original outcome of a decision-rule is permitted, then people's decisions will be more accurate (Dietvorst et al., 2018). In this way, decision-rules are used more often and people also feel they contribute to the decision-making process. Having this knowledge, we aim to contribute to the current literature by trying to understand how people's tendency to deviate from a decision-rule can be minimized.

Based on the studies by Dietvorst et al., (2018) and Lodato et al., (2011), in the current study we aim to investigate whether people's high scores on intuitive thinking style are also related to more deviation of a decision-rule, when they use a decision-rule and they have the possibility to overrule its results. Dietvorst et al., (2018) studied under which conditions people would use the result of an imperfect decision-rule. In a series of studies, they provided different options to the participants; one of them was to deviate from the decision-rule's result. In the current study, we also created a decision-rule that predicts university students' mean grades and we provided the participants with the option to use the decision-rule's outcome or to deviate from it as they wish. In the study by Lodato et al., (2011), they found that HRM professionals' high scores on intuitive thinking style were correlated with preference for intuitive-based hiring. In addition, as they suggested it would be essential to identify why people prefer intentionally to use an intuitive method even when they are aware of its inconsistencies. Hence, in this study we measure people's intuitive thinking style in order to examine its relationship with the use of a decision-rule and we aim to examine at a deeper level the

reasons for their strong resistance to using its outcome. Thus, we try to understand their reasoning by asking them to vocalize their thoughts while completing a prediction task. Therefore, we formulated the following hypotheses[1]:

Hypothesis 1. People with higher scores on intuitive thinking will be more likely to deviate from the result of a decision-rule.

Hypothesis 2. People with higher scores on intuitive thinking will make less accurate predictions, because they deviate from the decision-rule more.

Method

Participants

Fifty-four people participated in the study via Qualtrics survey program between 25 February and 1 May 2020. Only the answers of 22 participants (13 females and 9 males) were used in the analysis because of not answering the validation question correctly or did not complete the study until the end. Participants' nationality was 50% German, 36.4% Greek and the rest were German/Canadian, Greek/American and Turkish. Due to the COVID-19, two subsamples were used and merged into one sample. First year international psychology students of the University of Groningen ($n_1 = 12$), who received SONA credits for their participation, and people from the general population ($n_2 = 10$) from different occupations and fields of studies participated in the study (seven working people and three students). Conducting an a priori power analysis we estimated a required sample size of 21 participants based on a moderate effect size (0.50) used on the study by Lodato et al., (2011), the alpha level (0.05) and the desired power (0.80).

---

[1] Initially, we formulated one more hypothesis: People with higher scores on intuitive thinking style will report lower preference for using a decision-rule to make decisions. However, due to a mistake in the design of the survey we were not able to test this hypothesis.

Procedure

The study was approved by the Ethical Committee Psychology (ECP), of the faculty of Social Sciences of University of Groningen, The Netherlands. In the beginning, an informed consent was presented to the participants, if they did not agree with, they did not participate in the study. The data was also filtered based on a validation question and on missing values. The validation question was asking which information was available to the participants while they were making their predictions. Five options were presented and participants should choose the three correct ones. If participants did not respond correctly on the validation question, they were excluded from the study. Twenty-one of the participants did not respond correctly to the validation question and 11 of the participants did not complete the study until the end.

For the first subsample, participants were asked to visit the lab and participate in a prediction task, in which they asked to predict the GPA (mean grade) of the first year of ten psychology students based on three criteria; the score on introduction to psychology test, the score on math test and a motivation letter. The result of a decision-rule (a predicted GPA grade) was also provided to the participants and they were informed that the decision-rule included the same components as the ones they had in order to make the prediction. Specifically, we used a decision-rule with data provided by the university administration and participants knew that the introduction to psychology grade has the highest weight and the motivation letter the lowest. Also, they were informed that if they followed the decision-rule's prediction, they would provide more accurate results. Based on this information they were asked to make their predictions. An example task, asking to make one prediction, was also provided in order to become familiar with the process. While they were making the predictions, they were asked to think aloud in order to record their thinking process. In the end, they were

asked to complete a questionnaire that measures their intuitive thinking style (REI; Pacini & Epstein, 1999). Participants were also asked if they would like to receive a summary at the end of the study.

Due to the COVID-19, the study had to be adjusted. The qualitative part, specifically the think aloud part, of the study had to be removed because the study was not feasible to take place at the lab. Therefore, a second subsample was created and participants were invited to participate in the study by email. For this reason, we were able to recruit participants from different fields of studies and employments. In the email, they received a link in which they could complete the same study, however the think aloud part was excluded in the online version.

Measures

Intuitive thinking style. The independent variable was a person's preference to intuitive thinking style, which was expected to be related to the person's decision making strategy and accuracy. In order to study whether a person scores higher on the intuitive thinking style, participants were asked to complete the intuitive thinking style scale from the Rational-Experiential Inventory (REI) (Pacini & Epstein, 1999), which has displayed a reliability of $\alpha = 0.87$ in previous studies (see e.g., Lodato, 2008). The questionnaire had 20 items (e.g., "I trust my initial feelings about people.") (for the complete questionnaire see Appendix A) and participants asked to indicate the extent to which they agree or disagree with the statements on a 5-point Likert scale (rated 1 = *completely false* to 5 = *completely true,* $\alpha = 0.85$).

Rule deviation. The first dependent variable was the extent to which people deviated from the decision-rule's prediction. This was measured by comparing the result provided by the decision-rule with participants' predictions. Rule deviation is operationalized as the mean absolute deviation between participants' predicted first-year GPA (P) and the decision-rule

prediction (*D*) of the ten predictions. The following formula was used: *Rule deviation* $= \frac{\sum_{i=1}^{10} \left| P_i - D_i \right|}{10}$.

Prediction Accuracy. The second dependent variable was the accuracy of people's predictions. This was measured by comparing participants' GPA predictions to the applicants' actual GPAs. The closer their prediction was to the actual GPA, the more accurate it was. Prediction accuracy is operationalized as the mean absolute deviation between participants' predicted first-year GPA (*P*) and the applicant's observed first-year GPA (*O*) of ten predictions. The following formula was used: *Prediction accuracy* $= \frac{\sum_{i=1}^{10} \left| P_i - O_i \right|}{10}$.

The applicants' actual GPAs, in a scale from 1 to 10, were provided from the university administration (1 = *lowest grade* to 10 = *highest grade).* The decision-rule's GPAs predictions (1 = *lowest grade* to 10 = *highest grade)* were calculated by conducting a regression analysis on applicants' grades on introduction to psychology, math and their motivation letters.

Thinking aloud and Thematic Analysis

In this study, the used interview process was the thinking aloud. The twelve students from the University of Groningen that participated in the think aloud part were asked to verbalize their thoughts while responding to the aforementioned task. The use of this method allows participants to only verbalize their thoughts without adding any interpretation and it manages all the vocalizations as data, which makes it an objective method (van Someren et al., 1994). For instance, in our study, participants were asked to think aloud while they were thinking how to predict the mean grade of 10 different psychology students based on the

aforementioned information. This method enabled us to investigate participants' thinking processes on deviating from the decision-rule's result. While they were thinking aloud, they were encouraged to avoid analyzing their thoughts. The aim of this interview process was to understand participants' thinking processes and not to explain their reasoning (van Someren et al., 1994).

In order for all the participants to experience the study in the same way, the researcher read a short text before the start of the prediction task: " You can start the task. Please read the instructions carefully and if you have any questions, you can ask me. In general, I won't talk, I will only talk in order to remind you to think aloud." As we already mentioned, before starting to make the 10 predictions, participants completed one example item in order to become familiar with the prediction task and the process of vocalizing their thoughts.

The recordings of the participants were transcribed and analyzed with Thematic Analysis, which is " a method for identifying, analyzing and reporting patterns within data" (p. 79, Braun & Clarke, 2006). The following six steps were used in the analysis. 1) A thorough knowledge of the dataset was needed, which occurred by transforming the audio recordings in to transcripts (Braun & Clarke, 2006). 2) The researcher read the transcripts and made groups of similar information, which are the codes. The codes were created based on the "data-driven" approach (Tuckett, 2005). The focus of this approach is on what the data provides without taking into account a theory. 3) The research question (why people prefer to deviate from the decision's rule outcome) guided the creation of the themes, which are more general concepts that include the codes. The themes were created based on how frequently the codes were observed and their importance for the study. 4) The initial themes were reviewed before being defined. For instance, in the beginning only two themes were created and in the review process the two themes were restructured. 5) The themes were finalized and

6) the writing of the final report started in which the researcher explained the themes in detail and described her findings. The analysis was conducted in the Atlas.Ti program.

Results

Quantitative analysis

The two subsamples were merged to one sample and a correlational analysis was conducted. In the analysis, the correlation between people's intuitive thinking style and rule deviation (mean absolute percentage error) was examined as well as the correlation between people's intuitive thinking style and the accuracy of predictions (mean absolute percentage error). Descriptive statistics were also calculated (see Table 1).

Table 1.

Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximun	N
Intuitive thinking style	3.44	0.47	2.30	4.20	22
MAPE rule deviation	0.09	0.03	0.03	0.16	22
MAPE prediction ccuracy	0.22	0.16	0.07	0.64	22

The correlational analysis indicated a significant, moderate and positive correlation between people's intuitive thinking style and rule deviation, r = . 426, p = .024 (one-tailed), which as it was predicted in Hypothesis 1. The correlational analysis also indicated a non-significant, weak, negative correlation between people's intuitive thinking style and predictions' accuracy, r = - .124, p = .291 (one-tailed). The direction of the correlation was according to Hypothesis 2, however it was statistically non-significant.

We hypothesized that people with higher scores on intuitive thinking style would deviate more from the decision-rule's result. Based on their correlation, we claim that there is a positive and moderate to strong correlation between the variables, which provides statistical support for Hypothesis 1. We also hypothesized that people with higher scores on intuitive thinking style would have displayed less accurate predictions since they would deviate from the result of the decision rule more. For this hypothesis, we did not find a significant correlation, however the direction of the correlation was as expected, negative. In addition, we found that only a very small percentage of people followed the decision-rule's result and most of the time they decided to deviate from its outcome. However, the deviation from the decision-rule's result was very small. Participants followed the decision-rule's result only 0.02 %, however they slightly deviated from the decision-rule ($M_{rule\text{-}deviation} = 0.09$, $SD_{rule\text{-}deviation} = 0.07$).

Qualitative analysis

The aim of the qualitative analysis, with the use of thematic analysis, was to understand why decision makers deviate from the result of a decision-rule. After transcribing the vocalizations and familiarizing ourselves with the data, we started with the analysis.

Based on the research question and the provided task, we expected that participants would mention the grades of the introduction to psychology test and the math test, information from the motivation letter and the decision-rule's prediction. We observed that people constantly were mentioning most of the information, however the decision-rule's prediction was not always mentioned. Apart from our expectations, we observed that participants were giving explanations about their predictions in which they mentioned which of the provided information they used and which were their thoughts while making their predictions. Initially, we created many codes (15 codes) and in the reviewing process we realized an overlap

among some codes. For this reason, some of the codes were merged and we created six group codes (use of the motivation letter, predicting a grade, explanation, decision-rule use, grades and secondary components). Based on these codes and the research question, we created two main themes, which we also reviewed; "Thinking patterns based on the available information" and "Thinking patterns based on participants' explanations". As we will explain in detail, in the first theme we observed the way participants used the provided information and in the second theme we observed participants' explanations about the use of this information and their expectations.

Thinking patterns based on provided information

Having in mind the information provided to the participants, we tried to understand whether and to what extent they used the decision-rule's result and the way they combined the provided information. First, we observed whether the participants referred to the decision-rule's result in their transcripts. Four of the participants mentioned the decision-rule's result nearly for every candidate; five of the participants mentioned the decision-rule's results for some candidates; two of the participants did not mention the decision-rule's result at all; and for one of the participants the quality of the recording did not provide us with a detailed transcript, thus we also did not know whether he/she used the decision-rule's result. Thus, for the latter three participants we did not have enough information of the use of the decision-rule's result. Examining participants' predictions, provided us with a deeper understanding of the use of the decision-rule's result. Nine out of the twelve participants used the decision-rule's result at least to some extent, in some of their predictions (see Tables in the Appendix B). In addition to that, for all 120 predictions, we observed that only three times, specifically two of the participants actually followed the decision-rule's result, whereas 55 times they referred to the decision-rule's prediction, but they did not necessarily follow it (see Table 2). This pref-

erence to deviate from the decision-rule's result provided us with the insight that participants were not convinced of the decision-rule's accuracy and they wanted to evaluate each of the decision-rule's components.

Understanding that participants did not follow the decision-rule's result, we thought that this tendency to deviate might be related to the way participants used the provided information. Specifically, either/both mentioned the candidates' grades in the tests (72 times) (e.g., Participant 5 "So introduction to psychology 4.0, grade in maths 3.6.") or/and took them in to account in their predictions (78 times) (e.g., Participant 6 "psychology is already a clear goal. Yeah maths is already a good sign…"). Participants knew that a candidate's motivation letter was the least important component for the prediction of the mean grade. However, a noteworthy result was how often they referred to the candidates' motivation letters, either by analyzing the motivation letters (113 times) (e.g., Participant 8 "I really like this person's motivation letter, I think this person sounds very interesting.") or by inferring characteristics of the participants (31 times) (e.g., Participant 7 "I mean this person is super super motivated so it has been studying a lot."). In the analysis of the motivation letters, participants mentioned language issues or grammar mistakes (20 times) (e.g., Participant 4 "I don't like the letter too much I don't know what it is with the the grammar.") and they were kind of annoyed or irritated by them. There was only one instance that a participant explicitly mentioned that the typing mistakes influenced his/her prediction (e.g., Participant 12 "because of the typos I would not pass him or she, him or her."). Thus, we see that this might be a minor component, but it possibly affects participants' predictions to some extent. In the same vein, we observed that participants tried to infer to the candidates gender (13 times), which is not clear to what extent they were influenced by it (e.g., Participant 4 " is it him? I don't know…

Alright let's say it's her this time."). Also, the candidates' gender was not revealed in the provided information.

Reading the transcripts, we identified four different ways of participants' prediction processes. Their prediction processes had either three or four steps, which we explain next. In the first prediction process (five participants used this process), 1) they mentioned or evaluated the tests' grades, 2) they read and analyzed the motivation letter, 3) they took into account the decision-rule's result and 4) they provided their prediction. In the second one, participants did not mention the decision-rule's result at all (five participants used this process). Thus, 1) they mentioned or evaluated the tests' grades, 2) they read and analyzed the motivation letters and 3) they provided their prediction. In the third prediction process (three participants used this process), 1) they analyzed the motivation letter, 2) they mentioned or evaluated the tests' grades and 3) they provided their prediction. In the last prediction process (one participant used this process), 1) they mentioned their predictions, 2) they mentioned or evaluated the tests' grades and 3) they analyzed the motivation letters. It is important to mention that these prediction processes were not used in an absolute manner and each participant might have used more than one prediction process in each of the predictions.

Based on the above observations, we understand participants' need to make sense and evaluate each of the decision-rule's components. We were able to observe the way they combined information and whether they followed the decision-rule's result. However, they did not provide us with concrete reasons of why they did not want to follow the decision-rule. It seems more to us that they were constantly influenced by what it was provided and they were intrigued by the motivation letters' information. Even though in the explanation of the task, it was mentioned that the decision-rule leads to more accurate predictions than those of a person.

Thinking patterns based on participants' explanations

Aiming to understand why people prefer to deviate from the decision-rule, we observed participants' thinking processes on explaining their predictions. As we mentioned before, participants knew that the decision-rule's prediction is usually more accurate than their own prediction. However, they did not follow the decision-rule's prediction consistently and made their own predictions. Specifically, they provided explanations based on the candidates' grades (e.g., Participant 5 "it says the grades are a bit low, so I'm gonna say…around 6") and the motivation letters (e.g., Participant 3 "because they seem very ambitionated and like they are willing to work for it"). They also used the decision-rule's predictions in their explanations (e.g., Participant 7 "So I think I am actually gonna go with umm the mean prediction with 6.1 and predict 6.5 because people tend to get better"), however by mentioning whether they would provide a higher or a lower grade than the decision-rule's result (e.g., Participant 3 "So I think I am actually gonna go with umm the mean prediction with 6.1 and predict 6.5 because people tend to get better.") or whether they were influenced by the decision-rule's result (e.g., Participant 2 "this is of course influencing my decision…ummmm… cause now I am thinking like that the formula and not… like or….did the essay pull down the grade that much?"). Thus, again we observe participants' reliance on the provided information, however this time there is a different action; they are mainly focused on explaining their thinking process.

Additionally, participants tried to explain their thoughts and expectations about the candidates performance (e.g., Participant 2 "I still think that this person…ummm…would suit the university here") and in some cases the use of intuition was clear (e.g., Participant 8 "I don't…get the feeling they're really ambitious or this is the right study to study… maybe it would be better in philosophy from what I can tell umm…"). They also made comparisons

between the different candidates (12 times). It was not clear if they used a specific candidate as an "anchor", however they seemed to be influenced by the order they saw each candidate (e.g., Participant 2 "but then again this might have been different if I…could compare them all…at once"). However, in any of these prediction processes they did not explicitly state why they preferred to adjust the decision-rule's result. They only provided us with some indications.

Based on participants' explanations, we can argue that the provided information triggered participants to either referring to them constantly or to evaluate them. In addition, we observed that their attention was also triggered by other minor components such as grammar mistakes or candidates' gender. The fact that they talked about such topics, it inclines us to believe that participants might have followed some cognitive biases implicitly. However, they did not provide us with enough insights on why they decided to not follow the decision-rule's result. We were only able to identify possible relations.

Table 2.

Overview of thematic analysis

Themes	Code groups	Codes	Amount of times the code used
Thinking patterns based on provided information	Decision-rule use	Following the decision-rule's prediction	3 times
		Referring to the decision-rule's prediction	55 times
	Motivation letter	Analyzing the motivation letter	113 times
		Infer to participants' characteristics	32 times

Themes	Code groups	Codes	Amount of times the code used
	Secondary components	Language issues	20 times
		Mentioning Gender	13 times
	Prediction	Predicting a grade	108 times
	Tests' grades	Mentioning grades	72 times
		Taking into accounts the grades	78 times
Thinking patterns based on participants' explanations	Explanation	Based on the grades	48 times
		Based on the decision-rule	13 times
		Based on the motivation letter	38 times
		Use of intuition	14 times
		Making comparisons between the candidates	12 times

Discussion

In the present study, in the quantitative analysis we examined the relationship of people's intuitive thinking style and decision-rule use. In the qualitative analysis, we studied why people tend to deviate from the decision-rule's result.

For Hypothesis 1, we found a positive and moderate relationship between high scores on intuitive thinking style and people's tendency to deviate from the decision-rule's result. As we already mentioned, two studies were central in our hypothesis generation. Our study makes a unique contribution to current literature by making a connection between people's intuitive thinking style and their tendency to modify the decision-rule's result. According to

Dietvorst et al., (2018), people use the result of an imperfect decision-rule, when they have the option to deviate from its outcome. In addition, they mentioned that the essential differentiation on the decision-rule use is based on people's knowledge regarding the decision-rule's accuracy. Specifically, when they knew there was an error possibility in the decision-rule's outcome, the probability to trust their own prediction was higher (Dietvorst et al., 2018). In other words, people have a tendency to deviate from the decision-rule's outcome, when its accuracy is not absolute. This provides partial support for our hypothesis since we studied a particular cognitive process of individuals, namely intuitive thinking style, which extends the results of Dietvorst et al., (2018). Simultaneously, the positive correlation between people's intuitive thinking style and decision-rule's deviation comes in accordance with Lodato et al., (2011). They found that individuals who display high scores on intuitive thinking style, they also display a preference for personnel selection based on intuition. Considering this finding and combining it with the research evidence regarding people's preference to deviate from a decision-rule's result (Dietvorst et al., 2018), we formulated our hypothesis for which we found support.

For Hypothesis 2, we found a statistically non-significant, negative and weak correlation for the relationship between people's high scores on intuitive thinking style and predictions' accuracy. Thus, we cannot make strong arguments regarding the relationship between individuals' intuitive thinking style and the accuracy of their predictions. However, it is important to mention that we found the expected negative direction in this relationship. This finding comes in accordance with previous research studying intuitive thinking style and inaccuracy of predictions (Sinclair & Agerström, 2020). Specifically, they found a relationship between people's reliance on intuition and candidates' evaluation based on their motivation

letters. Additionally, people who relied more on standardized measures such as the SAT scores, made more accurate predictions.

In the quantitative analysis, we tried to address why people prefer to deviate from the result of a decision-rule. In the first theme, we discussed how participants used the provided information. Most of the participants referred to the decision-rule, however the deviation of its outcome and the preference for their own prediction were consistent. In addition, participants tried to explain their thinking processes regarding the use of the decision-rule's outcome; they mentioned whether they would follow the decision-rule's outcome, or they would provide a prediction higher or lower of its outcome. In the study by Dietvorst et al., (2018), people could deviate from the decision-rule only by a specific amount, however in the present study there was no limit on the deviation from the decision-rule. Combining both the quantitative and qualitative analysis, we observed that participants deviated from the decision-rule, however they took into account the decision-rule's result and the predictions they made were close to the decision-rule.

In addition, participants displayed the tendency to evaluate all the provided information and to not blindly follow the decision-rule's outcome. Participants paid too much attention to the motivation letters. This attention was displayed in multiple ways; they analyzed the motivation letters' content, they inferred to a participant's characteristic, or they would even pay attention to minor components such as language mistakes and candidate's gender. This was an interesting outcome since in the beginning of the prediction task, they were informed that usually the decision-rule's predictions are more accurate than those of a person. In fact, participants acknowledged that the motivation letter was the least important component in terms of prediction accuracy. Hence, people's tendency to extensively talk about the motivation letters is linked to the phenomenon of the dilution effect. The presence of least

relevant information distracts people's attention. Consequently, they do not evaluate the most accurate and important information (e.g., Nisbett et al., 1981). According to Ruscio (2000), good decision-making is based on disregarding information and following simple rules. Hence, cognitive processes such as complex thinking might not lead to accurate predictions. Thus, it seems that the presence of the motivation letters attracted participants' focus, which is similar to previous research evidence suggesting that interviews distract people (Dana et al., 2013). Practitioners' reliance on applicants' CVs led them to make predictions about applicants' competencies (Burns et al., 2014; Cole et al., 2009). As we discussed in the thematic analysis, participants were inferring to candidates' motivation and future performance.

Addressing participants' prediction processes based on their explanations provided us with noteworthy results. Participants acknowledged the fact that the decision-rule's prediction is usually more accurate than their own predictions. However, they decided to make their own predictions instead of following the decision-rule's prediction. A type of contradiction is evident; knowing how you can provide the most accurate prediction and still deciding to follow a different prediction process. This observation is linked to Cognitive Dissonance Theory (Cooper, 2007; Festinger, 1957; Festinger & Allen, 1964; Festinger & Carlsmith, 2007; Harmon-Jones & Harmon-Jones, 2008), which states that a contradiction such as the aforementioned creates cognitive dissonance and makes people concerned about the correctness of their responses. In order to minimize their concerns, they try to find a convincing explanation for their decision. This is similar to participants' explanations regarding their expectations and thoughts about the candidates' future performance.

We observed that participants made comparisons between the different applicants, even though it was not part of the task. The fact that they made such thoughts, provides us with the insight that participants might be affected by the order they saw each applicant.

However, we cannot make a strong claim about it, since they did not mention if they used a particular candidate as an anchor. Based on that, when individuals make doubtful decisions, they use a reference (an anchor) in order to minimize the vagueness (Fiske & Taylor, 2017).

In addition to that, we observed participants' thoughts and expectations about the candidates and in some cases the clear use of intuition. This provides us with a stronger indication of why people might prefer to deviate from the decision-rule's result. We realized that in all of our explanations to be connected with cognitive biases. This comes in accordance with literature suggesting that people who mostly rely on the intuitive thinking style, they will be more sensitive to cognitive biases due to the use of intuition (Epstein, 1994; Epstein et al., 1996; Gibbard, 1990). A characteristic example of cognitive bias is the dilution effect as we already explained.

Theoretical Implications

As we already discussed, we contributed to the existing literature by combining and extending the results of Dietvorst et al., (2018) and Lodato et al., (2011). The former ones have investigated how people could be more receptive to the use of decision-rules, whereas the latter ones have studied the relationship of HRM professionals' reliance on intuitive thinking and hiring processes based on intuition. We investigated and found statistical support for the relationship between individuals' tendency to intuitive thinking style and their tendency to deviate from the decision-rule's result. In addition, our focus on intuitive thinking style adds in the literature of cognitive processes. In particular, previous research has focused more on the relationship between intuitive thinking style and people's performance or experience; or its relationship with contextual components such as time availability (Phillips et al., 2015). In fact, previous research has focused specifically on the relationship between experts' intuitive thinking process and prediction accuracy (see e.g., Yu & Kuncel, 2020). In the cur-

rent study, we did not examine particularly experts; we focused on the relationship between individuals' intuitive thinking style and prediction accuracy. For this relationship we found the expected negative direction, but no statistical support. However, previous research has found support between people's intuitive thinking style and prediction accuracy (Sinclair & Agerström, 2020). For this reason, we highlight the need for more research on this particular relationship.

Based on our qualitative findings, we hope that we provided insight regarding people's thinking processes in terms of the use of a decision-rule. The relationship of our results with dilution effect and cognitive dissonance theory display the cognitive biases the presence of cognitive biases. In addition, examining why people deviate from a decision-rule's result remains an important topic to study.

Practical Implications

Our study displayed some important practical implications as well. It would be beneficial for practitioners to become aware of their thinking style tendency and take that into account, when they have to predict a person's performance. As we mentioned before, individuals manage different information with two thinking processes: the rational thinking style and the intuitive thinking style. These two systems work together and sometimes one of them dominates (Epstein et al., 1992, Denes-Raj & Epstein, 1994). This depends on the person and his/her preferences, the situation and the emotional involvement (Epstein et al., 1996). Based on our correlational analysis, people who tend to rely on their intuitive thinking style, it might be more probable to deviate from a decision-rule's prediction. Thus, people becoming aware of their tendency to rely on the intuitive thinking style mostly, might encourage them to control their tendency to deviate from the decision-rule's outcome as well.

Furthermore, practitioners could receive training programs regarding the use of decision-rules in performance prediction with a two-fold goal. On the one hand, asking them to use a decision-rule and allowing them to deviate from its outcome, if they wish to. However**,** by providing a specific range of deviation as it was suggested by Dietvorst et al., (2018). In the current study, we did not use a specific range of deviation, however since we did not find significant statistical evidence regarding the accuracy of people's predictions, we cannot make strong claims. In addition, it might be beneficial to experience the positive outcomes of using a decision-rule. Meaning that they could actually observe the increased accuracy of their predictions, when they mostly rely on the decision-rule's prediction. On the other hand, when practitioners acknowledge the decision-rule's components and are able to use or evaluate this information, it is important to be aware of the dilution effect. In this way, they might be able to avoid paying attention and be influenced by less essential information in terms of prediction accuracy. Moreover, the awareness of the dilution effect might provide additional value on persuading people to use a decision-rule's outcome.

Strengths, Limitations and Future Directions.

The findings of the present study add in the current literature regarding the use of a decision-rile in predicting academic and job performance. Specifically, previous studies examining algorithm aversion strongly suggested people's tendency to use a decision-rule, when they have the freedom to deviate from its result (Dietvorst et al., 2018). In this study, we provided to the participants the option to decide if they would like to deviate from the decision-rule's result. In addition, we specified people's tendency to deviate from the decision-rule by studying a particular cognitive process, namely intuitive thinking style. We found that it was more probable for people with high scores on intuitive thinking style to deviate from the decision-rule's prediction. This finding is linked with the scientific evidence that people

with high intuitive thinking style display higher preference for intuitive-based hiring (Lodato et al., 2011). In other words, people's tendency for the intuitive thinking style might make them doubt decision-rules' predictions. Furthermore, we might have found a statistically non-significant relationship between individuals' intuitive thinking style and their prediction accuracy, however we found the expected negative direction of this relationship. This adds to the existing findings, which displayed a negative and weak correlation between people's intuitive thinking style and prediction accuracy (Sinclair & Agerström, 2020). For this reason, we encourage future research to focus more on this relationship.

An essential component of this study was the examination of the relationships among intuitive thinking style, rule deviation and prediction accuracy. Future studies could have a similar design, however with a larger sample size. In this way, people's rule deviation might be a mediator in the relationship between intuitive thinking style and prediction accuracy. In the current study, no scientific value would be added if we would conduct a regression analysis due to our small sample size. A unique component of our study is the combination of quantitative and qualitative analyses. With quantitative analysis, we had the chance to examine the correlations between intuitive thinking style and people's willingness to deviate from a decision-rule's result as well as the accuracy of their predictions. In addition, the qualitative analysis gave us the chance to discover details on people's thinking processes that we would not be able to approach with a quantitative analysis. One of the most important findings of the qualitative analysis was participants' thinking processes about their predictions.

However, there are some points that we should take into account. First of all, all the participants were asked in the beginning of the study to complete a validation question. The aim of this question was to be assured that the participants had understood the task and were fully concentrated while completing the study. This question was properly used when the

study was completed by the students in the university. However, when the study became available in an online form and people from different fields of studies and occupations could complete it, it seemed that participants either misunderstood the question or they were not that concentrated, since they could complete the study at any time they wanted. A consequence of that, we conducted a quantitative analysis on a smaller sample size. Future research can conduct a similar experiment to that one with a larger sample size and investigate a mediation relationship. Specifically, researchers could study whether people with high intuitive thinking style make less accurate predictions due to their tendency to deviate from the decision-rule more. In addition, the qualitative analysis was conducted with responses only from first year psychology students from the University of Groningen. Future research could expand the sample in order to have better generalizability and external validity. For example, practitioners in organizations who are involved in the process of personnel selection.

A related point to the small sample size is the issue of power. Before conducting the study, we calculated the power that we would need in order to avoid type II error. Based on the study by Lodato et al., (2011), we used a moderate effect size of 0.50. In the current study, we needed a sample of at least 21 participants and we achieved to collect 22 participants. Therefore, we believe that our study had enough power, however due to our non-statistically significant results it is important to consider that we might not be able to detect a small effect.

Furthermore, the qualitative analysis might have more constructive conclusions, if more transcripts were available and/or a different type of interview has been used. Due to the Coronavirus, we were able to collect only 12 transcripts instead of 30 that we were aiming for. This has the consequence of having less data to analyze. In addition, the think aloud method that we used as an interview process has the disadvantage that participants did not

have any guidance on what to mention, which led us to not having a concrete answer to the research question but only possible relations. However, if we used a structured interview, participants would not have explained their thinking process intrinsically but they might have been influenced by the questions. Another option would be to provide more example tasks to the participants. In the current study, they had only one example task in order to have an overview of what was expected of them. The technique of thinking aloud is a process that the participants are not familiar with and they might need some more time in order to feel comfortable and share more of their thoughts. In addition, in the literature researchers are advised to have experience on collecting qualitative data while using it (van Someren et al., 1994). However, in the present study it was used for the purpose of a master thesis project.

An important point regarding qualitative analysis is regarding sense making, which is people's tendency to create a concrete story of all the provided information, even from arbitrary information (Gilovich, 1991). We hope that in our analysis we did not encounter that fallacy.

A final point to mention is that due to a default in Qualtrics (the data collection website), we were not able to see in which order the participants saw the ten different candidates. This had the consequence of not being able to understand if they decided to deviate from the decision-rule based on what they described in their transcripts. If this would have taken place, we might have had more details about the use of the decision-rule and the link between the quantitative and the qualitative analysis would be stronger.

Future research could also conduct a similar type of stud but with groups. For instance, participants could be asked to make similar predictions as in this study, however they would be asked to make prediction with their group. According to Kugler et al., (2012) people in groups appear to be more analytical and care for their own interest. Thus, it would be

interesting to investigate whether a particular cognitive process, such as thinking styles, has a stronger effect on prediction accuracy in groups.

Conclusion

To conclude, people took into account the decision-rule, however they decided to deviate from its result. As in previous studies (Dietvorst et al., 2018), in the current study we observed people's resistance to fully trust the decision-rule based on the positive correlation we found between people's intuitive thinking style and individuals' tendency to deviate from the decision-rule's outcome. We suggest a relation between people's cognitive process with this resistance to fully trust the decision-rule. However, we do recognize people's concern to evaluate all the available information and based on that evaluation to make their prediction. Thus, it seems that there is an intention for change toward more standardized approaches. However, as it is suggested in the literature of organizational change, there are several steps that have to take place in order for change to be implemented (Kotter, 1995). Similarly, convincing people in organizations to use and trust decision-rules' outcomes needs time.

References

Ahlburg, D.A. (1992). Predicting the job performance of managers: What do the experts know? *International Journal of Forecasting*, *7*(4), 467–472. https://doi.org?10.1016/0169-2070(92)90030-D

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369-406. https://doi.org/10.1037//0033-295X.89.4.369

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. http://dx.doi.org/10.1191/1478088706qp063oa

Brooks, M.E., Guidroz, A.M., & Chakrabarti, M. (2009). Distinction bias in applicant reactions to using diversity information in selection. *International Journal of Selection and Assessment*, *17*(4), 377–390. https://doi.org/10.1111/j.1468-2389.2009.00480.x

Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review, 62*(3), 193–217. https://doi.org/10.1037/h0047470

Brunswik, E. (1956). *Perception and the representative design of psychological experiments* (2nd ed.). University of California Press.

Burns, G. N., Christiansen, N. D., Morris, M. B., Periard, D. A. & Coaster, J. A. (2014). Effects of applicant personality on resume evaluations. *Journal of Business and Psychology, 29*(4), 573–591. 591. https://doi.org/10.1007/s10869-014-9349-6

Castelo, N., Bos, M. W., & Lehmann, D. R. (2019). Task-dependent algorithm aversion. *Journal of Marketing Research*, *56*(5), 809–825. https://doi.org/10.1177/0022243719851788

Carbone, R., Andersen, A., Corriveau, Y., & Corson, P. P. (1983). Comparing for different time series methods the value of technical expertise individualized analysis, and

judgmental adjustment. *Management Science, 29*(5), 559–566. https://doi.org/10.1287/mnsc.29.5.559

Chen, Y.-C., Tsai, W.-C., & Hu, C. (2008). The influences of interviewer-related and situational factors on interviewer reactions to high structured job interviews. *International Journal of Human Resource Management*, *19*(6), 1056–1071. https://doi.org/10.1080/09585190802051345

Cole, M. S., Feild, H. S., Giles, W. F., & Harris, S. G. (2009). Recruiters' inferences of applicant personality based on resume screening: Do paper people have a personality? *Journal of Business and Psychology*, *24*(1), 5–18. https://doi.org/10.1007/s10869-008-9086-9

Cooper, J. (2007). *Cognitive dissonance : fifty years of a classic theory*. Sage. https://dx-doi.org/10.4135/9781446214282

Dana, J., Dawes, R., & Peterson, N. (2013). Belief in the unstructured interview: The persistence of an illusion. *Judgment and Decision Making*, *8*(5), 512–520.

Dawes, Faust, D., & Meehl, P. E. (1989). Clinical versus actuarial judgment. *Science (American Association for the Advancement of Science)*, *243*(4899), 1668–1674. https://doi.org/10.1126/science.2648573

Denes-Raj, V., & Epstein, S. (1994). Conflict between experiential and rational processing: When people behave against their better judgment. *Journal of Personality and Social Psychology, 66*(5)*,* 819-829. https://doi.org/10.1037/0022-3514.66.5.819

Diab, D. L., Pui, S.-Y., Yankelevich, M., & Highhouse, S. (2011). Lay perceptions of selection decision aids in us and non-us samples. *International Journal of Selection and Assessment*, *19*(2), 209–216. https://doi.org/10.1111/j.1468-2389.2011.00548.x

Dipboye, R.L. (1997). Structured selection interview: why do they work? Why are they underutilized?, In N. Anderson & P. Herriot (Eds.), *International Handbook of Selection and Assessment* (pp. 455-73). Wiley.

Dietvorst, B. J., Simmons, J. P., & Massey, C. (2015). Algorithm aversion: People erroneously avoid algorithms after seeing them err. *Journal of Experimental Psychology: General, 144*(1)*,* 114–126. https://doi.org/10.1037/xge0000033

Dietvorst, B.J., Simmons, J. P., & Massey, C. (2018). Overcoming algorithm aversion: People will use imperfect algorithms if they can (even slightly) modify them. *Management Science, 64*(3)*,* 1155-1170. https://doi.org/10.1287/mnsc.2016.2643

Epstein, S. (1990). Cognitive-experiential self-theory. In L. Pervin (Ed.), *Handbook of personality theory and research* (pp. 165-192). Guilford Press.

Epstein, S. (1991). Cognitive-experiential self-theory: An integrative theory of personality. In R. Curtis (Ed.), *The relational self: Convergences in psychoanalysis and social psychology* (pp. 111-137). Guilford Press.

Epstein, S., Lipson, A., Holstein, C., & Huh, E. (1992). Irrational reactions to negative outcomes: Evidence for two conceptual systems. *Journal of Personality and Social Psychology*, *62*(2), 328–339. https://doi.org/10.1037//0022-3514.62.2.328

Epstein, S. (1993). Implications of cognitive-experiential self-theory for personality and developmental psychology. In D. Funder, R. Parke, C. Tomlinson-Keasey, & K. Widaman (Eds.), *Studying lives through time: Personality and development* (pp. 399-438). American Psychological Association. https://doi.org/10.1037/10127-033

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist, 49*(8)*,* 709-724. https://doi.org/10.1037//0003-066X.49.8.709

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, *71*(2), 390-405. https://doi.org/10.1037/0022-3514.71.2.390

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford University Press.

Festinger, L., & Allen, V. (1964). *Conflict, decision and dissonance.* Stanford University Press.

Festinger, L., & Carlsmith, J. M. (2007). Does cognitive dissonance explain why behavior can change attitudes? In J. A. Nier (Ed). *Taking sides: Clashing views in social psychology* (2nd ed., pp. 74-91). McGraw-Hill.

Fiske, S. T., & Taylor, S. E. (2017). *Social cognition: from brains to culture.* Sage.

Gibbard, A. (1990). *Wise choices, apt feelings: A theory of normative judgment*. Harvard University Press.

Goodwin, P., & Fildes, R. (1999). Judgmental forecasts of time series affected by special events: Does providing a statistical forecast improve accuracy? *Journal of Behavioral Decision Making, 12*(1), 37–53. https://doi.org/10.1002(SICI)1099-0771(199903)12:1<37::AID-BDM319>3.0.CO;2-8.

Grove, W., & Meehl, P. (1996). Comparative efficiency of informal (subjective, impressionistic) and formal (mechanical, algorithmic) prediction procedures: The clinical-statistical controversy. *Psychology, Public Policy, and Law*, *2*(2), 293-323. https://doi.org/10.1037/1076-8971.2.2.293

Grove, W. M., Zald, D. H., Lebow, B. S., Snitz, B. E., & Nelson, C. (2000). Clinical versus mechanical prediction: A meta-analysis. *Psychological Assessment*, *12*(1), 19–30. https://doi.org/10.1037/1040-3590.12.1.19

Harmon-Jones, E., & Harmon-Jones, C. (2008). Cognitive dissonance theory: An update with a focus on the action-based model. In J. Shaw & W. Gardner (Eds). *Handbook of motivation* (pp. 71-83). Guilford Press.

Hassin, R. R., Uleman, J. S., & Bargh, J. A. (2005). *The new unconscious*. Oxford University Press.

Highhouse, S. (2008). Stubborn reliance on intuition and subjectivity in employee selection. *Industrial and Organizational Psychology*, *1*(3), 333–342. https://doi.org/10.1111/j.1754-9434.2008.00058.x

Highhouse, S., & Kostek, J. A. (2013). Holistic assessment for selection and placement. In APA handbook of testing and assessment in psychology, Vol. 1: *Test theory and testing and assessment in industrial and organizational psychology* (pp. 565–577). American Psychological Association. https://doi.org/10.1037/14047-031

Hogarth, R. M., & Makridakis, S. (1981). Forecasting and planning: An evaluation. *Management Science. 27*(2)*,* 115–138. https://doi.org/10.1287/mnsc.27.2.115

Huffmon, S. H. (2006). Expert political judgment: how good is it? how can we know? *The Journal of Politics*, *68*(2), 467–469. https://doi.org/10.1111/j.1468-2508.2006.00420_4.x

Klimoski, R., & Jones, R. G. (2008). Intuiting the selection context. *Industrial and Organizational Psychology*, *1*(3), 352–354. https://doi.org/10.1111/j.1754-9434.2008.00061.x

Kotter, J. P. (1995). Leading change: Why transformation efforts fail. *Harvard Business Review*, *73*(2), 59–67.

Kuncel, N. R., Klieger, D. M., Connelly, B. S., & Ones, D. S. (2013). Mechanical versus clinical data combination in selection and admissions decisions: A meta-analysis. *The Journal of Applied Psychology*, *98*(6), 1060–72. https://doi.org/10.1037/a0034156

Kugler, T., Kausel, E. E., & Kocher, M. G. (2012). Are groups more rational than individuals? A review of interactive decision making in groups. *Wiley Interdisciplinary Reviews. Cognitive Science*, *3*(4), 471–482. https://doi.org/10.1002/wcs.1184

Lievens, F., Highhouse, S., & DeCorte, W. (2005). The importance of traits and abilities in supervisors' hirability decisions as a function of method of assessment. *Journal of Occupational and Organizational Psychology*, *78*(3), 453–470. https://doi.org/10.1348/096317905X26093

Lim, J. S., & O'Connor, M. (1995). Judgemental adjustment of initial forecasts: Its effectiveness and biases. *Journal of Behavioral Decision Making, 8*(3)*,* 149–168. https://doi.org/10.1002/bdm.3960080302

Lodato, M. A. (2008). *Going with your gut: An investigation of why managers prefer intuitive employee selection.* Bowling Green State University / OhioLINK.

Lodato, M. A., Highhouse, S., & Brooks, M. E. (2011). Predicting professional preferences for intuition-based hiring. *Journal of Managerial Psychology*, *26*(5), 352–365. https://doi.org/10.1108/02683941111138985

McDaniel, M. A., Whetzel, D. L., Schmidt, F. L., & Maurer, S. D. (1994). The validity of employment interviews: A comprehensive review and meta-analysis. *Journal of Applied Psychology*, *79*(4), 599–616. https://doi.org/10.1037/0021-9010.79.4.599

Meehl, P. E. (1986). Causes and effects of my disturbing little book. *Journal of Personality Assessment*, *50*(3), 370–375. https://doi.org/10.1207/s15327752jpa5003_6

Nisbett, R., Zukier, H., & Lemley, R. (1981). The dilution effect: Nondiagnostic information weakens the implications of diagnostic information. *Cognitive Psychology, 13*(2), 248–277. https://doi.org/10.1016/0010-0285(81)90010-4

Nolan, K., Carter, N., & Dalal, D. (2016). Threat of Technological Unemployment: Are hiring managers discounted for using standardized employee selection practices? *Personnel Assessment and Decisions*, *2*(1). https://doi.org/10.25035/pad.2016.004

Nolan, K., Dalal, D., & Carter, N. (2020). Threat of Technological Unemployment, use intentions, and the promotion of structured interviews in personnel selection. *Personnel Assessment and Decisions*, *6*(2). https://doi.org/10.25035/pad.2020.02.006

Önkal, D., Goodwin, P., Thomson, M., Gönül, S., & Pollock, A. (2009). The relative influence of advice from human experts and statistical methods on forecast adjustments. *Journal of Behavioral Decision Making*, *22*(4), 390–409. https://doi.org/10.1002/bdm.637

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, *76*(6), 972-987. https://doi.org/10.1037/0022-3514.76.6.972

Ruscio, J. (2000). The role of complex thought in clinical prediction: Social accountability and the need for cognition. *Journal of Consulting and Clinical Psychology*, *68*(1), 145–154. https://doi.org/10.1037/0022-006X.68.1.145

Rynes, S.L., Colbert, A.E., & Brown, K.G. (2002). HR professionals' beliefs about effective human resource practices: correspondence between research and practice. *Human Resource Management*, *41*(2), 149–174. https://doi.org/10.1002/hrm.10029

Salas, E., Rosen, M., & DiazGranados, D. (2010). Expertise-based intuition and decision making in organizations. *Journal of Management*, *36*(4), 941–973. https://doi.org/10.1177/0149206309350084

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, *124*(2), 262–274. https://doi.org/10.1037/0033-2909.124.2.262

Sinclair, S., & Agerström J. (2020). Does expertise and thinking mode matter for accuracy in judgments of job applicants' cognitive ability? *Scandinavian Journal of Psychology*, *61*(4), 484–493. https://doi.org/10.1111/sjop.12638

Terpstra, D. E., & Rozell, E. J. (1997). Why some potentially effective staffing practices are seldom used. *Public Personnel Management*, *26*(4), 483–495. https://doi.org/10.1177/009102609702600405

Tuckett, A.G. (2005). Applying thematic analysis theory to practice: A researcher's experience. *Contemporary Nurse*, *19*(1-2), 75–87. https://doi.org/10.5172/conu.19.1-2.75

van der Zee, K.I., Bakker, A.B., & Bakker, P. (2002).Why are structured interviews so rarely used in personnel selection? *The Journal of Applied Psychology*, *87*(1), 176–84. https://doi.org/10.1037/0021-9010.87.1.176

van Someren, Barnard, Y. ., & Sandberg, J. A. (1994). *The think aloud method: A practical approach to modelling cognitive processes*. Academic Press.

Willemain, T. R. (1991). The effect of graphical adjustment on forecast accuracy. *International Journal of Forecasting, 7*(2), 151–154. https://doi.org/10.1016/0169-2070(91)90049-2

Yeomans, M., Shah, A., Mullainathan, S., & Kleinberg, J. (2019). Making sense of recommendations. *Journal of Behavioral Decision Making*, *32*(4), 403–414. https://doi.org/10.1002/bdm.2118

Yu, M., & Kuncel, N. (2020). Pushing the limits for judgmental consistency: Comparing random weighting schemes with expert judgments. *Personnel Assessment and Decisions*, *6*(2). https://doi.org/10.25035/pad.2020.02.002

Appendix A

Experiniality Scale from Rational-Experiential Inventory (REI)

1. I like to rely on my intuitive impressions.

2. I don't have a very good sense of intuition. (-)

3. Using my gut feelings usually works well for me in figuring out problems in my life.

4. I believe in trusting my hunches.

5. Intuition can be a very useful way to solve problems.

6. I often go by my instincts when deciding on a course of action.

7. I trust my initial feelings about people.

8. When it comes to trusting people, I can usually rely on my gut feelings.

9. If I were to rely on my gut feelings, I would often make mistakes. (-)

10. I don't like situations in which I have to rely on intuition. (-)

11. I think there are times when one should rely on one's intuition.

12. I think it is foolish to make important decisions based on feelings. (-)

13. I don't think it is a good idea to rely on one's intuition for important decisions. (-)

14. I generally don't depend on my feelings to help me make decisions. (-)

15. I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.

16. I would not want to depend on anyone who described himself or herself as intuitive. (-)

17. My snap judgments are probably not as good as most people's. (-)

18. I tend to use my heart as a guide for my actions.

19. I can usually feel when a person is right or wrong, even if I can't explain how I know

20. I suspect my hunches are inaccurate as often as they are accurate. (-)

Note: The minus sign (-) indicates that item is reverse scored.

Appendix B[2]

Transcript 2			
Introduction grade	**Math grade**	**Decision-rule**	**Participant's prediction**
9.3	Ok	8.5	8.7
4.7	Not bad	5.6	4
Not good	Not good	Higher than	6.5
9	8	7.6	8.8
Good	Good	6.7	6.5
Very good	Very good	-	4
Not good	Not good	6	5.5
Okay	Okay	6.5	-
6.9	4.8	6.5	7
-	-	7	8

Transcript 3			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
Good	Good	Around 6	7
Not good	Very good	-	Go with the prediction
Very good	Very good	-	7.5
Moderate	Moderate	6.1	6.5
-	Not great	-	6
-	-	-	7.5
High	Pass	-	8
Pretty good	Pretty good	-	-
Not good	Not good	5.8	6
Below pass	Below pass	5.5	6

[2] Transcript 1 has no table because there were only a few information in the transcript and we were not able to create a table.

Transcript 4			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
9.7	4.9	7.7	8 or 9
9	7	7.6	8.5
5.5	5.1	-	5.5
7.9	7.5	-	7.5
9	8	-	8.5
Fail	Fail	-	5.5
7.6	7.5	-	7.5
Good	Ever better	-	6
-	-	-	7-8
5.2	3.6	-	5.5

Transcript 5			
Introduction grade	**Math grade**	**Decision rule**	**Participants' prediction**
4	3.6	-	6.5
5.2	4.4	Takes into account but not a specific grade	5.6
7.6	7	-	7.5
5.9	4.4	-	5.8
No good	Not good	-	6
-	Low	-	Not good
5	Less 3	-	Low
Close to 9	7	-	7.5
9.3	5.5	7.6	6.4
7.6	4.6	-	5.9

Transcript 6			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
Really high	4.6	7.2	8
5.9	3.8	6	5.5
6.9	4.6	6.5	7
7.9	4	6.9	7
6.5	3.6	-	5.5
10	6.5	7.9	8
7.2	7.5	6.9	7.5
10	9	8.1	8
5.3	4.2	5.9	5
7.6	5.5	6.9	7

Transcript 7			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
10	6.5	7.8	8.5
8.3	4.2	-	7.5
low	7.5	6.1	6.3
7.6	4.6	Take into account but not a specific grade	6.7
6.9	5.1	6.6	A bit above 6
5.5	3.4	Higher than..	6.5
8.3	5.3	Take into account but not a specific grade	7.3
6.9	4.9	6.5	6.3
7.9	3.1	-	5.8
5.5	4.9	Take into account but not a specific grade	5.4

Transcript 8			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
8	8.5	-	-
Kind of good	Not good	-	7.3
Not pass	Really bad	-	6.5
Really good	Not good	-	8
Not good	Not pass	-	6
Okay	Not good	-	7
Average	Problem	-	6.5
Good	-	-	7.5
Good	Good	-	7.9
Not good	Not good	-	6.4

Transcript 9			
Introduction grade	**Math grade**	**Decision-rule**	**Participants prediction**
-	-	-	4.5-5
-	-	-	7
Not pass	3.1	-	5.5
-	Not high	-	6.8
Low	Low	-	5.5
-	-	-	5.2
High	High	-	8.7
8.6	4	-	8
7.9	5.1	-	7.5
8.3	Low	-	8

Transcript 10			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
6	Bad	-	6.5

Transcript 10			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
No good	No good	-	3.7
6.5	Very good	-	8
Very good	Very good	-	8
Good	Good	7.3	6.7
6	Low	-	6.5
6-7	6-7	-	6.5
No good	No good	5.8	4
6.9	-	6.5	7.3
8.6	5.5	-	6

Transcript 11			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
6.5	Really good	Take into account but not a specific grade	6.9
8.3	Not good	7.1	7.5
Pass	Okay	6.4	6
No good	No good	5.9	5.9
Good/pass	Good/pass	6.2	5.6
Good	Not good	6.9	7.5
-	-	6.4	6.8
Bad	bad	5.7	6
Not good	Pass	5.5	5.5
Pass	Pass/no good	6.7	7

Transcript 12			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
Not as good	Not as good	-	4

Transcript 12			
Introduction grade	**Math grade**	**Decision-rule**	**Participants' prediction**
Not as good	Not as good	-	Not passing
Really good	Really good	Take into account but not a specific grade	8
7.2	Lower than 5.5	-	5
Too low	Too low	-	5
9.7	4.9	-	8
7.9	3.8	-	5
6.5	Really good	6.7	8
Good enough	3.8	-	6
4.2	Enough	(Maybe 5.5)	5.5