Intuition versus deliberation: the role of information processing in judgment and decision making
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Citation for published version (APA):
Dijkstra, K. A. (2012). Intuition versus deliberation: the role of information processing in judgment and decision making

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Chapter 1

General Introduction
People are confronted with judgments and decisions on a daily basis. These decisions concern mundane issues such as what to have for dinner, what toothbrush to buy and how to get to work, but also more important issues such as whom to marry or whether to buy a particular apartment or not. Many judgments and decisions are made in a professional context. Consider for example judgments made by judges, doctors, CEO’s, and firemen. Some of these decisions are based on habits, some are based on extensive deliberation and consultation and others are made more intuitively.

Traditionally it is thought that the best judgments and decisions are made after extensive deliberation. Normative models of decision-making argue that decisions under risk should be made by first assessing the various possible outcomes, followed by an estimation of the utility and the probability of each of these outcomes. Multiplying the utility of each outcome with the probability that the outcome occurs is the next step. Finally the decision-maker is expected to opt for the decision with the highest (subjective) expected utility (SEU; Edwards, 1954; 1961; Savage, 1954; von Neumann & Morgenstern, 1944). In the same way the best choice would be made by identifying attributes for different options and evaluating the relative importance for each attribute. Next, evaluations for attributes are summed up for each option. The decision-maker is expected to select the option with the highest multi attribute utility (MAU; see for reviews Huber, 1974; MacCrimmon 1973).

However, in reality people do not always possess all relevant information or they lack cognitive capacity and time to execute such analyses (Simon, 1955). Even in the case we have all the needed information, time, and cognitive capacity, we are not that good at applying normative decision rules (Brehmer, 1971; Brehmer & Qvarnstrom, 1976; Hammond & Summers, 1972; Swets, Dawes & Monahan, 2000). Instead, people often rely on mental short-cuts, so called heuristics. That is: They base their judgment or decision on a very limited, but highly informative, number of cues. In this way people are often able to make adequate decisions utilizing a limited amount of cognitive resources (see for an overview Gigerenzer & Gaismayer, 2011). On the other hand, there is growing evidence that people can unconsciously integrate large amounts of information (Glöckner & Betsch, 2008b), and integrate them to come to summary evaluations or feelings (Betsch, Plessner, Schwieren, & Güting, 2001; Dijksterhuis & Nordgren, 2006; Plessner, Betsch, Schallies, & Schwieren, 2008; see also Betsch & Glöckner, 2010). Intuitions based on these experiences can be remarkable accurate, as demonstrated in the lab (e.g., Albrechtsen, Meissner, &
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Susa, 2009; Dijksterhuis & Nordgren, 2006; Halberstadt & Green, 2008; Wilson & Schooler, 1991) as well as in field studies (e.g., Klein, 1993).

The goal of the current dissertation is to improve our understanding of intuition in judgment and decision-making. What are the effects of relying on intuitions in comparison to deliberation? What is the underlying process? How does this relate to expertise? In the current chapter I present a brief overview of relevant theory and empirical evidence relevant to the focal theme of this dissertation. Furthermore, I introduce the main concepts and main independent and dependent variables utilized in this dissertation.

Conceptualizing Decision Modes

Intuition is studied in both philosophy and psychology. Not surprisingly, there are different definitions, and these go back as far as Kant and Jung. Philosophers see intuition as a priori knowledge or experiential belief characterized by its immediacy. Beyond this, the nature of intuition is debated. Roughly speaking, there are two main views. The first view asserts that intuitions are a priori. They are intellectual seemings that something is the case or true. For example, whether the mathematical statement $2x 5 = 10$ is true. The second view argues that intuitions are a species of beliefs, and are based on experience (see Bealer, 1998; Parsons, 2000). These intuitions, as a consequence, can differ between individuals, in contrast to the first view.

Psychologists also differ in their definitions of intuition. Abernathy and Hamm (1995) identified as many as twenty different definitions. Generally these definitions are more in line with the second philosophical view on intuition, and agree that intuition is some kind of information acquired without conscious and deliberative reasoning. In this dissertation I opt for a rather general definition presented by Betsch (2008): “Intuition is a process of thinking. The input to this process is mostly provided by knowledge stored in long-term memory that has been primarily acquired via associative learning. The input is processed automatically and without conscious awareness. The output of the process is a feeling that can serve as a basis for judgments and decisions.” (p. 4) Deliberation in contrast, is described as a strategy in which “Information is integrated in a serial manner, processing is cognitively demanding and rather slow, and individuals using these strategies are aware of most of the underlying processes and can even verbalize them.” (p. 6)
Research in social and cognitive psychology often distinguishes between two types of cognitive mechanisms to explain “higher” cognitive phenomenon such as reasoning, thinking and decision-making (e.g., see for a review Evans, 2008). These dual process models have in common that they distinguish between a mode of processing that is more intuitive and a more deliberate mode of processing. The former is fast, automatic, requires low effort, possesses high capacity, and is characterized by parallel processing of information (e.g., Hammond, Hamm, Grassia, & Pearson, 1987; Hogarth, 2001; Seligman & Kahana, 2009). The more deliberate mode of processing is slow, effortful, sequential, and possess low capacity (e.g., Evans, 2010; Horstmann, Ahlgrimm, & Glöckner, 2009; Sloman, 2002). Recently, scholars proposed to differentiate processes within both categories of dual processing models (Glöckner & Witteman, 2010; Hogarth, 2010). According to Glöckner and Witteman (2010), intuition is not a homogenous concept, but a label for different cognitive mechanisms. Although I acknowledge that several (perhaps simultaneous or interacting) mechanisms can be active in intuition, I do not distinguish between intuitive mechanisms in this dissertation. In this dissertation I study the effect of relying on intuition as a judgment and decision strategy, and contrast this decision mode to more deliberate reasoning and decision-making. In the following section I briefly introduce different kinds of ‘intuition’; i.e., I will briefly outline the differences between intuition and judgment and decision strategies that are often confused with intuition.

Heuristics (as mentioned in the preceding paragraph) are often confused with intuition (Gigerenzer, 1991; 2007; Kahneman, 2003), but do not fit the above definition of intuition. Decisions based on heuristics tend to ignore rather than integrate multiple pieces of information (Betsch, Plessner, Schwieren, & Gütig, 2001), neither are they based on a “feeling”. Several studies confirm that analytic thinking is characterized by more heuristic search processes (Cokely & Kelly, 2009), and that deliberated judgments more often rely on heuristics than judgments made intuitively (Haberstroh, 2008; Haberstroh & Betsch, 2002; Halberstadt & Levine, 1999). For instance, people who deliberate are more prone to (consciously or unconsciously) utilize the anchoring (Plessner & Czenna, 2008) and the recognition heuristic (Hilbig, Scholl, & Pohl, 2010), than people who rely on intuition.

Fast judgments and decisions based on habits can also be confused with intuition. Habits are, similar to intuitions, acquired via associative learning and without conscious awareness (Wood & Neal, 2007). However, deciding on the basis of a habit is not a process
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of thinking. A habit is triggered by perception of the context with which the habitual response is associated, and is triggered without a mediating goal (Wood & Neal, 2007). Intuition on the other hand, is goal dependent (e.g., Betsch, 2008).

Unconscious-thought theory (UTT; e.g., Dijksterhuis & Nordgren, 2006) is also associated with intuition. Unconscious-thought theory claims that people can make superior decisions after a period of distraction in which they unconsciously address the judgment task. UTT would fit Betsch’s (2008) definition; UTT is a process of thinking, occurs without conscious awareness, and the output is a feeling that can serve as a basis for judgments and decisions. The focus of UTT is on integration of information, and not on the role of experience and implicit learning processes. However, UTT is a recently developed framework and some of its assumptions and claims are controversial (Acker, 2008; González-Vallejo, Lassiter, Bellezza, & Lindberg, 2008; González-Vallejo & Phillips, 2010; Smith & Collins, 2009). Although UTT could very well be a process that is related to intuition, it is clear that the precise mechanisms and possible moderating variables yet have to be uncovered. Therefore I focus solely on the contrast between deliberation and intuition in the current dissertation.

Deliberation

In the current section I describe the most important characteristics and effects of deliberation. In a classical experiment demonstrating the effects of deliberation, Wilson and Schooler (1991) asked participants to rate how much they liked different strawberry jams that varied in overall quality. Half of the participants were asked to list their reasons for liking or disliking the jams after tasting. In this way they allegedly could better organize their thoughts before rating the jams. The remaining participants were not given a specific instruction. Results showed that participants who deliberated before making their judgment gave judgments that differed more from expert opinions than participants who relied on their intuition. This phenomenon has been replicated in several domains. Examples are quality judgments of college courses (Tordesillas & Chaiken, 1999; Wilson & Schooler, 1991), Olympic dives (Halberstadt & Green, 2008), predicting basketball games (Halberstadt & Levine, 1999), detecting deception (Albrechtsen, Meissner, & Susa, 2009), and judging the quality of paintings, apartments, and jelly beans (Nordgren & Dijksterhuis, 2009).
The work of Wilson and his colleagues (Wilson & Dunn, 1986; Wilson, Dunn, Bybee, Hyman, & Rotondo, 1984; Wilson, Dunn, Kraft, & Lisle, 1989; Wilson, Hodges, & LaFleur, 1995; Wilson, Kraft, & Dunn, 1989; Wilson, Lisle, Schooler, Hodges, Klaaren, & LaFleur, 1993; Wilson & Schooler, 1991) has been very influential in shaping how we think about deliberating or analyzing reasons before making judgments or decisions. They explain the effects of deliberating as a disruption, and relate this to research showing how automatic behaviors are disrupted when people analyze and decompose them (Baumeister, 1984; Kimble & Perlmuter, 1970; Langer & Imber, 1979). Baumeister (1984) demonstrated this phenomenon in the context of games (Pac Man and a roll-up game), and his findings can be applied to other domains where behavior relies on learned and automatic responses (e.g., driving a car, hitting a ball in baseball, or playing a musical instrument). In a similar way can judgments be disrupted when people reflect about the underlying reasons (Wilson, Dunn, et al., 1989). People are often unaware of why exactly they feel the way they do. When people verbalize their thoughts and analyze their reasons, they focus on reasons that are accessible in memory, plausible, and reportable (Wilson et al., 1995; Yamada, 2009), possibly ignoring aspects that are more difficult to verbalize.

Wilson et al. (1995) asked participants to rate how much they liked a specific individual and to what extent they thought the individual was suitable as a social worker. Positive or negative information about the individual was made more accessible by presenting this information twice. Judgments of participants who analyzed their reasons were more in line with the relatively accessible information, compared to participants in the control condition. Unfortunately, accessible, plausible, and reportable reasons are not always the main determinants of people’s judgments and preferences, and they do not necessarily determine the quality of these judgments (Nisbett & Wilson, 1977).

Along similar lines, Tordesillas and Chaiken (1999) argued that introspection disrupts systematic processing by directing attention in such a way that people are less able to focus on information most relevant to the task at hand. Participants in their study were presented with a description of six psychology courses and were asked to indicate their intention to participate in each of these courses. Afterwards, participants rated how much they were influenced by each separate attribute in the description of each course, how much weight each attribute should be given, and their confidence in their choice. In addition, recall of the attributes was assessed and participants listed their thoughts. Participants in the
control condition listed more thoughts overall and these were also more closely related to important as opposed to unimportant attributes, compared to participants who were asked to deliberate and analyze their reasons.

### Intuition

As noted before, relying on intuition can lead to surprisingly good judgments, choices and decisions. Fireman can for example make accurate judgments and decisions by relying on intuition, especially in uncertain situations where a lot of information has to be processed and under time pressure (Klein, 1993). People can also recognize complex grammatical patterns without being able to explain why (e.g., Reber, 1967; Vokey & Brooks, 1992; Wippich, Mecklenbraüker, & Krisch, 2004), or are able to predict outcomes for sport competitions, at least better than after deliberation (Halberstadt & Green, 2008; Halberstadt & Levine, 1999).

Klein (1993; 2003) concluded that expert decision makers are able to draw on repertoires of patterns obtained by experience. This leads them to (unconsciously) recognize patterns that guide judgments and that help them to predict or anticipate outcomes (Recognition-Primed Decision Strategies). Decision makers are unaware of this process and are unaware of the reasons for their judgment, at least at the moment when the decision is made. Others argue that these effects can be explained by the fact that people can process and integrate multiple pieces of information without noticeable cognitive effort and can make complex probabilistic inferences (Glöckner & Betsch, 2008b; Betsch & Glöckner, 2010).

There are also scholars who claim that people can rely on affective reactions or gut feelings that guide their decisions. According to Finucane, Alhakami, Slovic, and Johnson (2000; see also Slovic, Finucane, Peters, & MacGregor, 2002) representations of objects and events in peoples’ mind are tagged in varying degrees with affect. When making judgments or decisions, people consult an *effect pool* which contains all positive and negative tags associated with representations of objects and events. Using this overall, readily available affective impression would be far easier and more efficient than weighing pros and cons or retrieving relevant examples from memory.

Similarly, Damasio (1994) argued that people developed a so-called *somatic marker* through learning (Bechara & Damasio, 2005; Damasio 1994). These somatic
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markers would increase accuracy and efficiency of the decision-making process by guiding the decision maker. People for instance generate anticipatory skin conductance responses (SCRs) whenever they ponder a risky choice, even before explicitly knowing that it was a risky choice (Bechara, Damasio, Tranel, & Damasio, 1997; Wagar & Dixon, 2006). Wagar and Dixon (2006) demonstrated this effect in a gambling game (Iowa Gambling Task). Participants drew cards from four decks; some cards would generate a gain and some would generate a loss. Two decks were generally profitable while the remaining two decks would result in an overall loss. GSRs of participants were significantly higher when they were about to select from a bad deck, relative to a good deck. These changes took place before participants knew what the optimal strategy was. Furthermore, this difference in GSR correlated with preference for the good deck.

Besides affective reactions, processing fluency has also been linked to intuition (Fu, Dienes, & Fu, 2010; Topolinski & Strack, 2009b; Wippich, 1994). Processing fluency can be defined in terms of the experienced ease with which information is processed. People can intuitively recognize objects in fragmented pictures (Wippich, 1994), newly learned grammaticality in letter strings (Kinder, Shanks, Cock, & Tunney, 2003), and whether a number of words share a common associate (Topolinski & Strack, 2009a; 2009c). Research showed that performance on these tasks is related to processing fluency.

Interestingly, most of these mechanisms can be related to individual experiences. For instance, there is ample evidence showing that the valence of the majority of our affective reactions is learned rather than innate (Rozin & Millman, 1987). Further evidence is provided by research on evaluative conditioning (De Houwer, Baeyens, Vansteenwegen, & Eelen, 2000; Razran, 1954; Staats & Staats, 1957; for an overview see De Houwer, Thomas, & Bayens, 2001). Ease of processing can be enhanced by repeated exposure to the stimulus (Bornstein & D'Agostino, 1994; Jacoby, Kelley, & Dywan, 1989), or by the activation of associated concepts (Topolinski, Likowski, Weyers, & Strack, 2009; Topolinski & Strack, 2009a). Research showed that affective reactions and processing fluency contributes additively and independently to performance on more or less intuitive tasks such as coherence judgments and artificial grammar tasks (Topolinski & Strack, 2009b). To sum up, intuition appears to be characterized by processing and integrating multiple pieces of information without noticeable cognitive effort, and is associated with mechanisms that are based on individual experiences.
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Processing style

The way we attend to and process information affects what information we process and how shallow or deep we process that information. But it also affects how we make judgments and decisions. Additional insight into the effect of intuition versus deliberation on judgment can therefore be gained by understanding how and in what way judgment mode affects processing style, and vice versa.

Processing style refers to the way people attend to information. People can either attend to the Gestalt of a stimulus or pay more attention to its details. A collection of trees for example can be seen as a forest, but people can also direct their attention to the individual trees (Gasper & Clore, 2002; Navon, 1977; Schooler, 2002). In a classic study Navon (1977) tested his global precedence hypothesis. He hypothesized that people by default look at the Gestalt of the stimulus rather than the details, and presented his participants with large letters made of smaller letters. Participants were asked to identify as quickly and accurately as possible if a target letter was presented as either the large or the small letter. He showed that people are generally faster in deciding whether the target letter is the large letter than the small letter.

Derryberry and Tucker (1994; see also Förster, 2009b; Förster, Friedman, Özelsel, & Denzler, 2006) suggested that these attentional mechanisms regulate both perceptual and conceptual processes. The attentional mechanism used to select conceptual nodes within the semantic network is correlated with the attentional selection mechanism utilized on a perceptual level. Friedman, Fishbach, Förster, and Werth (2003) showed that participants were more creative in generating unusual exemplars of a category after the induction of a global processing style, compared to participants who paid attention to the details. They argued that priming visual perception of the Gestalt of stimuli activates abstract concepts in memory and enhances creativity. Moreover, Förster and Dannenberg (2010a) argued that a global processing style is related to the understanding of ambiguous, complex, and abstract stimuli. In a global processing style we make sense of a stimulus by integrating it into superordinate, inclusive knowledge structures. In contrast, a local processing style is related to searching for details. Generally, a global processing style supports creativity and
metaphor understanding, while a local processing style supports analytical thinking and concrete construals.

As a case in point, Macrae and Lewis (2002) showed that people are less able to recognize complex stimuli when in a local processing style; participants in whom a local focus was induced were less able to recognize human faces. Interestingly, the same effect occurred when people gave a verbal description of human faces. Macrae and Lewis (2002) concluded that verbalizing induces a local processing style. A local processing style shifts attention to individual elements of information (featural information) in contrast to their spatial relations (configural information). Reliance on featural information makes it harder to recognize faces (Dodson, Johnson, & Schooler, 1997; Westerman & Larsen, 1997). Likewise, analyzing reasons or verbalizing thoughts before making a judgment could induce a local processing style, and this could also make it harder to judge complex stimuli.

Recent research on the brain situated these two processing styles in different locations, namely, global processing in the right hemisphere and local processing in the left hemisphere (Derryberry & Tucker, 1994; Förster & Friedman, 2010; see also Förster & Dannenberg, 2010b). Interestingly, mechanisms associated with intuition (see previous section) are also related to the right hemisphere (e.g., Bowden & Jung-Beeman, 2003; Jung-Beeman, et al., 2004; Volz & Von Cramon, 2006), suggesting that global processing style and intuitive processes might be related.

### Quality of Decisions

As mentioned, one of the aims of this dissertation is to study the effects of intuition versus deliberation, and to study in what way intuition contributes to better judgments and decisions, as demonstrated by other scholars (e.g., Halberstadt & Levine, 1999; Wilson & Schooler, 1991). But what are adequate and poor decisions? To answer this question we turn to the issue of how to assess quality of decisions.

One option would be to compare the number of positive and negative attributes associated with each option. The option with the most positive in relation to negative attributes would be the best option. For example, when buying an apartment or car, the best choice would be the one with the most favorable and least unfavorable attributes. Obviously, people have different opinions about what constitute favorable or unfavorable attributes. Some give more weight to the number of bedrooms and the presence of a double
bathroom; others find the presence of a garden essential. Quality of choice in this example is subjective and no inferences can be made about the absolute quality of the decision; i.e. there is not likely to be an alternative that is seen as the dominant alternative by all interested in buying a new house. Alternatively, one might assess deviations from normative models in which participants evaluate each attribute (MAU; see beginning of this chapter). But, whether an attribute is favorable or unfavorable might also depend on other attributes: A penthouse with a rooftop terrace and view of the skyline might seem nice, but your opinion might change dramatically when there is only one small elevator in the building.

Quality of judgments or decisions can alternatively be assessed by the eventual outcome of the selected alternative. Whether it was smart to buy a particular stock or to bet on your soccer team can be assessed by objective outcomes; stock went up or down, the soccer team won or lost. These are the exceptions rather than the rule. Basically, human decision-making is subjective; the probabilities assigned to certain outcomes as well as the evaluation of these outcomes are subjective. Similarly; the weights assigned to different attributes in MAU-theory also tend to differ between individuals. In sum there is not a single best decision that applies to all of us. For that reason research tends to rely on other indicators of the quality of decisions, such as consistency over time, and the transitivity of preferences (if you prefer a₁ to a₂ and a₂ to a₃, you should also prefer a₁ to a₃)

Alternatively, one can assess whether the process that lead to the decision was correct. Were the rights steps taken and was the decision based on the appropriate information (e.g., requisite decision modeling; Phillips, 1984)? But what if the decision process is based on a less easy to track process, like intuition? In such cases one could focus on subjective aspects such as satisfaction about the decision and more objective characteristics such as consistency over time. Despite the fact that important conclusions can be drawn from these variables, it is not possible to draw conclusion about the objective quality of the decision.

Another way to assess the quality of a judgment or decision is to compare it to expert opinion; as was done in the classical experiment demonstrating the effect of judgment mode by Wilson and Schooler (1991). Similarly, in the current dissertation I assessed quality of judgments, among others, by comparing individual scores to expert judgments. In my experiments I assessed quality judgments of art. It is often argued that
beauty lies in the eyes of the beholders and that there is no accounting for taste. The field of psychological aesthetics studies the experience of beauty and tries to understand what makes a painting or a sculpture beautiful or ugly. Studies have identified a number of criteria that affect the experience of beauty (see for an overview Jacobson, 2006). Given that beauty does not entirely lie in the eyes of the beholder and that there is some objective criteria of high quality art, we used expert opinion as reference point.

Using quality judgments of art enabled me to test the effect of intuition in different types of domains (auditory, visual, and written stimulus material). Another argument to choose art, is its close resemblance to domains in which effects of intuitions versus deliberation are demonstrated before; such as quality of jams (Wilson & Schooler, 1991), judging Olympic dives (Halberstadt & Green, 2008) and judging paintings (Nordgren & Dijksterhuis, 2009). All these domains have in common that it is (for most people) quite difficult to articulate their preferences. It might be that people rely on intuition especially in these domains.

**Current dissertation**

As mentioned above, judgment and decision-making occur within a wide variety of domains. These different domains often have characteristics that may affect judgment and decision processes. My dissertation builds upon the work of Wilson and colleagues (e.g., Wilson et al., 1995; Wilson et al., 1993; Wilson & Schooler, 1991) on intuitive versus deliberative judgment. As a consequence I rely, in part, upon the type of tasks used in that line of research. In the final chapter I will address the generalizability of the findings obtained in the various studies presented in this dissertation. The focus of the following empirical chapters is on information processing mode as an underlying mechanism of intuition. Another focus will be to explain how and when people come to different judgments when relying on intuition rather than relying on reasons.

In the first empirical chapter (Chapter 2) I address a possible underlying process of intuition, namely global versus local processing style. I argue that deliberation induces a local processing style which narrows conceptual attention and can have detrimental effects on judgment and decision-making. Intuition, in contrast, is related to a focus on the Gestalt and integration of information, and can have beneficial effects on judgment and decision-making. Next (Chapter 3) I return to the relation between processing style and the way we
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make decisions. I investigate whether the relation between decision mode and processing style is bidirectional, and test whether processing styles induces a preference for and reliance on intuitive versus deliberative decision strategies. In addition, I test whether decision mode and processing style can exhibit decisional fit. That is: whether people experience value when the decision-strategy they are using fits their processing style, and that this is not the case when there is a lack of fit between decision-mode and processing style. In Chapter 4 I focus on the characteristics of intuitive as opposed to more deliberate decisions. I test whether judgments and decisions made in a global, in contrast to a local processing style, are affected by processing fluency and affective reactions. In Chapter 5 I focus on the moderating effects of expertise on the effect of judgment mode on judgment. I propose that the beneficial effects of intuition relative to deliberation depend on the decision makers' experience and knowledge. I argue that especially individuals whose knowledge is ‘outperformed’ by their experience (intermediate experts) profit from relying on intuition. Finally, in the General Discussion, I will summarize and integrate the empirical findings and discuss limitations and practical implications. 1

1 Because Chapters 2-5 were written as separate research articles, they can be read independently. Readers will notice some overlap between the theoretical introductions and method sections.