Introduction

In legal settings it is important to accurately determine the veracity of statements provided by suspects, witnesses, and alleged victims. Therefore, for more than 40 years various researchers have systematically studied deception and its detection (Vrij, 2008). However, researchers have not focused on people who lie about their intentions regarding the future. This is quite remarkable considering the frequency and importance of situations calling for an assessment of whether a person is lying or telling the truth about the future (e.g., their stated reasons for crossing a border).

There are numerous ways to examine how a person who tells the truth about the future may differ from a person who lies about the future (for a recent review, see Granhag & Mac Giolla, 2013). When we think about specific future events, we typically evoke mental images (i.e., we experience the future in our mind's eye; D'Argembeau, 2012; Szpunar & McDermott, 2008). The process that underlies the formation of mental images, which is central to this thesis, is called *episodic future thinking* (EFT) (Szpunar, 2010). Specifically, the focus of this thesis is on how people describe their mental image of the future in an investigative interview. The challenge for people trying to determine whether a suspect is lying (henceforth referred to as *lie catchers*) is to distinguish truthful statements from deceptive statements.

Definition of deception

According to Vrij (2008, p. 15), *deception* is defined as "a successful or unsuccessful deliberate attempt, without forewarning, to create in another a belief which the communicator considers to be untrue". This definition stresses two features that are relevant in legal settings. The first feature is that deception is an act involving at least two persons which, by definition, excludes self-deception. The second feature refers to the intentionality, or the idea that false information must be deliberately communicated to another person. Thus, accidentally communicating false information (e.g., misremembering) should not be considered as deception.

There are different types of lies: for example, *outright lies*, *exaggerations*, and *subtle lies* (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). In telling outright lies, the liar communicates information he or she knows is false. In making exaggerations, the liar over- or understates facts. In telling subtle lies, the liar communicates information that may contain some truth but is nevertheless intended to mislead lie catchers. For example, when a liar does not volunteer relevant information, he or she is telling a subtle lie (concealment). Outright lies seem the most common of the three types (DePaulo et al., 1996; Vrij, 2008).

Deception for future actions

In an investigative interview, a person can either describe a genuine intention or a false intention. A genuine intention is referred to as a *true intention*. A true intention can be either legal (i.e., a non-criminal intention) or illegal (i.e., a criminal intention). If a person with a criminal intention is questioned about future actions, he or she will probably try to conceal the future plans. Instead, this person may tell a credible cover story (e.g., the pretense of a non-criminal intention). A cover story is referred to as a *false intention*. According to Vrij's (2008) definition of deception, a cover story is a lie because it is a deliberate attempt to communicate untruth to the interviewer. Therefore, in this thesis, a person who describes a true intention in an interview is referred to as a *truth teller*. A person who describes a false intention in an interview is referred to as a *liar*.

Aims

Broadly speaking, the general research question of this thesis is how mental images can help to differentiate between true and false intentions. The first aim is to identify the *trademarks* (of the mental images) that are rather characteristic of true intentions and that are lacking or are less distinct in false intentions. In other words, the focus of the thesis is not mind-reading (i.e., the content of a liar's true intention) nor the liar's motivation for lying. Hence, the thesis aims only at discovering ways to differentiate between true and false statements and does not aim at informing beyond that.

The second aim is to examine how a number of factors might moderate the usefulness of the identified trademarks (i.e., the effects of time, repeated questioning, and familiarity). Here, the aim is not to propose a full-fledged interview technique that allows lie catchers to reliably detect deception. Research in this area is still in its infancy. However, it may be fair to claim that the thesis represents the first steps toward what might eventually result in a promising contribution to already existing interview protocols.

Empirical foundation

This thesis is based in two fields of research: Research on how people commit and pre-experience a future action, and research on how liars and truth tellers perform in an investigative interview. That is, one eye is directed to the future and one eye is directed to the past.

With an eye to the future

Thinking of the future can take various forms. The one relevant for this thesis is future thinking with commitment to carry out a future action. This form of future thinking is often accompanied by the formation of mental images. In the following section I discuss the scientific literature with respect to how people commit and pre-experience a future action.

Committing to a future action

Definition of the term intention. The first aim is to identify the trademarks in the mental images that are characteristic of true intentions (and lacking or less distinct in false intentions). For this purpose, it is necessary to describe the characteristics of a true intention and to distinguish them from related concepts such as *goals* (Tubbs & Ekeberg, 1991). In this thesis, an intention is defined as an individual's mental state preceding a corresponding action. In particular, there are three central characteristics that define an intention. First, intentions are directed at the intender's *own action*. Second, a strong *commitment* tends to underlie intentions. Third, intentions often require a certain amount of *reasoning* (Malle & Knobe, 2001). Before describing these characteristics further, it should be explained that an intention is not the same as desire or intentionality. That is, *desire* can be directed at something other than one's own actions (e.g., another's action, an object, or an outcome), does not necessarily come with a strong commitment, and does not require reasoning. One can, for example, desire chocolate but take no action to satisfy that desire. In the same vein, *intentionality* is not the same as intention because it refers to the quality of action (i.e., purposeful actions contrasted with accidental actions).

Implementation intention. Typically, people have numerous competing wishes and desires but cannot realize them all. Therefore, they have to choose among, or commit to, some of these desires. However, the fact that not all intentions are implemented suggests that commitment may be insufficient to guarantee goal attainment (Orbell & Sheeran, 2000; Webb & Sheeran, 2006). Gollwitzer (1999) proposes that the mere formulation of a desired endpoint (e.g., "I intend to do X") may benefit from making specific plans (e.g., "If situation Y is

encountered, then I will initiate behavior X!"). The desired endpoint (i.e., the *what*) is called the *goal intention*, and the specific planning behavior (i.e., the *when*, *where*, and *how* to implement a specific action) is termed *implementation intentions* (Gollwitzer, 1999). It is noteworthy that the concept of goal intention fits neatly with the proposition that strong commitment is a fundamental characteristic of intentions (Malle & Knobe, 2001). Furthermore, the concept of implementation intentions is closely related to reasoning, which Malle and Knobe consider another key characteristic of intentions. In sum, different scholars agree that there is a link between intentions and reasoning.

There is strong evidence that another prominent capability of the human mind, the ability to remember past events, is involved in future thinking. This capability involves various memory systems and allows us to pre-experience and to plan the future through the creation of vivid mental images (D'Argembeau, 2012). It should be noted that the scientific literature uses different terms to refer to this mental capability. In this thesis, I use the most frequently used term 'episodic future thinking' to stress the *experience-near* nature of imagining future events (see Szpunar & Tulving, 2011, for an overview of these terms).

Pre-experiencing a future action

Future thinking, which is a frequent phenomenon of daily life, is essential for various aspects of human cognition and behavior (Berntsen & Jacobsen, 2008; D'Argembeau, Renaud, & Van der Linden, 2011). Future thinking allows for behavioral flexibility and effective goal planning (Atance & O'Neill, 2001; Schacter, Addis, & Buckner, 2008; Suddendorf & Corballis, 2007). Such flexibility and goal planning are essential in sound decision-making (Bechara & Damasio, 2005; Boyer, 2008); in addition, they are an integral part of people's sense of the self (Conway, 2005; Wheeler, Stuss, & Tulving, 1997). Below, our capability for *mental time travel*, the ability to travel back in time and to travel forward in time is discussed.

Mental time travel. Research shows that our ability to imagine the future relies on memory, and on episodic memory in particular (for reviews see, e.g., Schacter et al., 2008; Szpunar, 2010). In brief, research generally distinguishes between *semantic memory* (i.e., the recall of general factual knowledge) and *episodic memory* (i.e., the memory of personally experienced events). For example, a person might "know" that Paris is the capital of France (semantic memory) but may never have been there personally (episodic memory). A hallmark of episodic memory is *autonoetic consciousness*, which is the ability to be consciously aware that beyond the present moment, the self continues to exist (Tulving, 1985, 2005; Wheeler et al., 1997). Autonoetic consciousness allows us to mentally project ourselves back and forth in time (to experience the past and the future). This ability is called mental time travel (Tulving, 1985). The capability for mental time travel underlines the importance of the role of the *self* in mental simulations. Similarly, Malle and Knobe (2001) propose that intentions are directed at the intender's own actions. In other words, an intention refers to the act of the self. Another relevant finding is that the self plays a central role in *autobiographical memories* (AM). Moreover, there is strong evidence for the claim that the majority of specific AM are

accompanied by visual imagery (Conway, 2005, 2009; Conway & Pleydell-Pearce, 2000; May, Andrade, Panabokke, & Kavanagh, 2004). Hence, the self seems to be an important link between our ability to form an intention, remember the past, and pre-experience the future using visual imagery. This relationship becomes even clearer when we look more closely at AM.

Memory. AM consist of memories of an individual's life, ranging from specific representations (which refer to episodic memory) to abstract representations (which refer to semantic memory). This mental faculty recognizes that memory may be unique to an individual or may generalize more widely within social groups, societies, and cultures. Research suggests that AM are not just "stored" but instead are transitory patterns of activation over an underlying autobiographical knowledge database. That is, memory is hierarchically organized such that more abstract knowledge at a higher level are accessed before more specific knowledge at a lower level: (a) *lifetime periods* (i.e., personal semantic knowledge about important others, common locations, and goals), (b) *general events* (i.e., summary representations of repeated events or events extended in time), and (c) *episodic details* (episodic memories, which represent moments of a specific past experience; Conway, 2009).

For example, in thinking about Christmas*,* I will first access very general information about important others (family faces) or familiar places (my parents' house). This is personal semantic knowledge. Then I will access memories of repeated events, such as opening Christmas gifts with my family. This is general event knowledge. Finally, I will access episodic details such as the image of my sister opening her gift last year. When the pattern of activation reaches this last stage of the hierarchy, autonoetic consciousness may result and provide us with the sense of mental time travel. This specific memory is a stable pattern of activation over all three knowledge structures and, thus, typically contains knowledge at different levels of specificity (i.e., from abstract to specific representations) (Conway & Pleydell-Pearce, 2000). The exact nature of AM is still under debate (e.g., Berntsen & Rubin, 2012).

Recent research suggests that AM may also play a crucial role in future thinking. A recent study found that people first access higher levels of knowledge before they access lower levels of knowledge when trying to imagine a specific future event (D'Argembeau & Mathy, 2011). Importantly, linking a future event to a personal goal facilitates access to episodic details during visualization. In sum, these findings suggest that personal semantic knowledge, and in particular knowledge about personal goals, play important roles in future thinking.

Episodic future thinking. This capacity is defined as "a projection of the self into the future to pre-experience an event" (Atance & O'Neill, 2001, p. 533). Converging evidence from neuropsychology, psychopathology, cognitive psychology, developmental research, and functional neuroimaging strongly suggests that our ability to imagine future events with detailed and vivid mental images relates closely to our ability to remember past events (for a review, see Schacter et al., 2012). Before examining this relationship more closely, I will explain how EFT differs from other mental representations of the future.

One feature is the *novelty* of the event. In other words, the event that an individual wants to carry out in the future must not be a recurrence of the past. This is the case when, for example, an individual has formed a script-like knowledge of a routine activity. For example, in thinking about a repeated routine, such as a weekly choir rehearsal, an individual might rely on his or her script-like knowledge of numerous past events instead of relying on genuine EFT.

Furthermore, it is important to differentiate EFT from other forms of non-directed imagery such as fantasizing. Thus, one must distinguish between (a) mental images evoked by EFT and (b) other acts of imagination. Szpunar (2010) suggests that the relevance (plausibility) of an event to one's own life is an important prerequisite for EFT. Consider the following three hypothetical scenarios: (1) imagine an elephant, (2) imagine encountering a stray elephant on the way to work tomorrow, and (3) imagine seeing an elephant on a planned trip to the zoo that you intend to take next week (Szpunar, 2010). The first scenario refers to a more *general* capacity for mental imagery (e.g., Kosslyn, 1994) that is likely to be the basis for the ability to engage in the mental construction of more complex personal scenarios such as EFT. In contrast, the second scenario (a bizarre event) represents a *specific*, personal future episode. However, this event is of a rather implausible nature, and therefore is unlikely to evoke EFT. In comparison, the final scenario (the planned trip to the zoo) evokes a *specific,* upcoming personal event that one might reasonably imagine or plan for (e.g., 'What time of day should I go?' or 'What animals will I have time to see?'). In sum, although the latter two mental images refer to specific scenarios in one's own future, they differ in terms of relevance to one's own life. Therefore, only the final scenario is likely to evoke EFT (Szpunar, 2010).

In sum, EFT involves imagining a specific, novel, and self-relevant future situation. This idea relates to the concepts discussed above: As episodic memory, EFT contains episodic details (Schacter et al., 2012). EFT, as an intention, relates to the self (e.g., Malle & Knobe, 2001; Szpunar, 2010). Furthermore, since the future event is novel, it is likely that a certain amount of reasoning and planning is required. This relationship is empirically supported (D'Argembeau et al., 2011).

Research has identified different factors that influence EFT. For example, recent studies have shown that *temporal distance* affects how people experience their simulations of the future (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; deVito, Gamboz, & Brandimonte, 2012; Szpunar & McDermott, 2008). In addition, people typically generate EFT around short-term concerns (e.g., "What will I be doing this weekend?" or "When am I going to find time to study for this test?" (D'Argembeau & Van der Linden, 2004; Spreng & Levine, 2006). When comparing EFT, simulations of events in the *near* future are consistently rated more vividly than events in the *distant* future (e.g., D'Argembeau & Van der Linden, 2004). This pattern, which is also found for past events, is typically interpreted in terms of the *temporal construal theory* (Trope & Liberman, 2003). This theory states that "the greater the temporal distance from a future event, the more likely is the event to be represented abstractly in terms of a few general features that convey the perceived essence of the events rather than

in terms of concrete and more incidental details of the event" (Trope & Liberman, 2003, p. 405). This finding suggests that *time* affects mental images of the future.

Another factor that seems to affect how we simulate future events is *familiarity*. The contents of the simulations described above are usually characterized by familiar, contextual information. That is, when thinking about events in the near future, participants tend to imagine themselves in familiar contexts where they interact with familiar people (D'Argembeau & Van der Linden, 2004; Gamboz et al., 2010; Hassabis & Maguire, 2007). Comparing the vividness of events shows that representations of unfamiliar contexts typically contain fewer sensorial details, occur in a less clear context, and have a weaker subjective experience than representations of familiar contexts (Szpunar & McDermott, 2008). Hence, the contents of simulations of the future are usually characterized by familiar, contextual information. These simulations are discussed below.

Mental images. A common method used to examine the contents of mental images of the future is the word-cuing technique. In studies that use this method, participants are usually prompted by a word cue (e.g., vacation) and are then asked to generate hypothetical scenarios in response to the cue (e.g., seeing yourself eating dinner in Barcelona next summer with your husband). Such studies have revealed some interesting findings about the nature of mental images.

First, a mental image contains e*pisodic details*. The definition of this term, as used in this thesis, comes from D'Argembeau and Mathy (2011, p. 259) who refer to an episodic detail as "the constitutive elements of an episodic memory or future thought that provide event specificity and trigger the feeling of experiencing the event". However, the exact properties of episodic details are rather complex and under-explored. For example, if you close your eyes and think about your plans for next weekend, you may pre-experience this future action in vivid images. More precisely, in your mind's eye, you may "see" a totally different place than the current one; you may move around in that place, pick up objects, interact with people, and even experience certain emotions (D'Argembeau & Van der Linden, 2004, 2006).

As this example illustrates, the episodic details are associated with components of experiencing (i.e., sensory–perceptual–conceptual–affective details; Conway, 2009). These details may mainly consist of components extracted from a single past event that can be clearly located in space and time. However, sometimes these visual images may represent details that are experience-near and generic at the same time. For example, thinking of a familiar person you met this morning for coffee involves both the mental representation of a specific past event (i.e., how you sat outside your favorite coffeehouse in the sun) and generic components (i.e., a familiar person who is the representation of numerous past events). Some scholars may disagree with this definition because they view the term 'episodic' as more specific in nature compared to D'Argembeau and Mathy's (2011) understanding. In this thesis, the term episodic detail is used in a rather general sense to refer to any experience-near detail (as opposed to *experience-far*). As D'Argembeau and Mathy (2011) point out, this definition is based on the possibility that some generic details may also contribute to the episodic flavor of an event representation.

Second, a mental image can vary with respect to its *clarity* and its *vividness.* Arnold, McDermott, and Szpunar (2011) use the term *clarity* to refer to an individual dimension of the mental image, and *vividness* as an umbrella term for the overall specificity of the mental image. Consistent with this usage, the studies discussed in this thesis examine mental images in a number of separate dimensions (e.g., clarity of the location) or as one combined trademark (i.e., the experienced vividness of the mental image).

Mental images and true and false intentions

Although it is rather difficult to draw firm conclusions about how and to what extent the concepts (of goals, intentions, planning, memory, and EFT) are relevant to future thinking, one conclusion can be drawn: Mental images are likely to accompany intentions. Although mental images can be visualized in situations that are unrelated to intentions (e.g., fantasizing or remembering past events), they may often be experienced when thinking about the future (Szpunar, 2010). This thesis does not address which underlying process causes this simulation. Instead, the intent is to examine whether mental images (as phenomena of future thinking) are helpful in differentiating between true and false intentions.

With an eye to the past

One can argue that deception about future actions is a special case for lie catchers. For example, the ground truth is not as certain for lies about future events than as it is for lies about past events (Granhag, 2010). In brief, past events are potentially knowable whereas future events are not. As a consequence, lie catchers have more difficulty in verifying an individual's intentions (e.g., there is no crime scene evidence). A further complication may be that intentions can change. Thus, a commitment made earlier may no longer be relevant later. Generally speaking, only slightly more than half of all people successfully translate intentions into actions (Orbell & Sheeran, 1998; Sheeran, 2002). This finding may apply equally well to those with criminal intentions as to those with non-criminal intentions. Although people may have criminal intentions when questioned about these intentions, they may later decide to not act on them.

As the aim is to examine true and false intentions, it is reasonable to assume we can learn from deception research on past events. This research may have certain features in common with the research on deception research focusing on future events. Below a number of findings from deception research on past actions will be discussed.

The unanticipated question approach

One approach to deception detection that is particularly relevant for this thesis is the *unanticipated question* approach. This approach is based on empirical findings on suspects' *counter-interrogation strategies* (e.g., Hartwig, Granhag, & Strömwall, 2007). In brief, the

unanticipated question approach suggests that liars – in order to construct a convincing cover story – (1) tend to anticipate the questions they might be confronted with and (2) tend to prepare ready-made answers to these anticipated questions (Clemens, Granhag, & Strömwall, 2013). Unanticipated questions have been found to be more cognitively demanding to answer than anticipated questions (Vrij et al., 2009). This finding holds for both liars and truth tellers, but for different reasons. Truth tellers may find unanticipated questions difficult because such questions require a more thorough memory search. However, for liars, unanticipated questions may be even more difficult because such questions require spontaneously invented answers. In addition, liars must reply with plausible answers that do not contradict facts the interviewer already knows or may learn (Vrij et al., 2009).

In brief, unanticipated questions may cause increased cognitive load for liars than for truth tellers. A reasonable assumption is that liars and truth tellers will produce similar answers to anticipated questions (i.e., the liars will benefit from their preparation) but different answers to unanticipated questions (i.e., the liars will suffer because they cannot rely on their memory). The unanticipated questions approach suggests that asking questions that an individual is unlikely to have anticipated, and thus prepared for, will increase the differences between liars' and truth tellers' statements (Sooniste, Granhag, Knieps, & Vrij, 2013a).

The repeat vs. reconstruct hypothesis

In real-life settings, lie catchers often rely on repeated interviews in making their assessments on the truthfulness or untruthfulness of statements. In this way, the lie catcher can compare the various statements in different dimensions, such as their *consistency*. As consistency strongly affects judgments on credibility (Greuel, 1992; Leippe, Manion, & Romanczyk, 1992), researchers have studied the topic of 'consistency over time'. It has been found that lie catchers in real-life settings hold several misconceptions, such as inconsistency implies deception and consistency implies truth (i.e., *consistency heuristic*; Granhag & Strömwall, 2000).

In contrast to this belief, Granhag, Strömwall, and Jonsson (2003) found deceptive consecutive statements to be more consistent than truthful consecutive statements. Based on these and other empirical findings, the *repeat vs. reconstruct* hypothesis, which is based on two central premises, has been advanced. First, truth tellers – when asked about a critical point in time – basically rely on their memory in order to recollect what happened. Since research has shown that one of the most salient characteristics of memory is its *reconstructive* nature (Bartlett, 1932), it can be expected that truth tellers who repeatedly try to retrieve a previously experienced event will gain (commission), lose (omission), and/or change information over time (Baddeley, 1990). Second, liars cannot rely on their memory when speaking about a (critical) point in time (if they did, they might incriminate themselves). Therefore, liars need to fabricate and rehearse a convincing cover story so that they can repeat the same details if questioned again. That is, liars try to remember what they have said in previous interrogations, whereas truth tellers try to remember what they actually have

experienced. More specifically, the claim is that the 'rehearsal strategy' used by liars promotes consistency, whereas the more recollective nature of the truth tellers' memory might result in inconsistencies (Granhag & Strömwall, 2002; Granhag, Strömwall, & Jonsson, 2003).

The relationship between consistency and veracity as proposed by the *repeat vs. reconstruct* hypothesis has only been found for anticipated questions (e.g., Granhag et al., 2003). If liars can anticipate a question and prepare a ready-made answer, they are equally consistent as, or more consistent than, truth tellers. However, when asked unanticipated questions, liars have been found to be less consistent than truth tellers (Leins, Fisher, Vrij, Leal, & Mann, 2011). In essence, there are two ways to ask an unanticipated question: (1) by using an unanticipated *response format* (e.g., asking for a pictorial report instead of a verbal report) or (2) by asking an unanticipated question (e.g., asking about the planning phase instead of the actual event). Leins et al. (2011) found that liars produce less consistent statements than truth tellers when questioned in an unanticipated way.

On true and false intentions

Theoretical framework

In the examination of true and false intentions, researchers should be aware of some aspects that are specific to this emerging research domain. As there are, as yet, no established paradigms on how to properly examine true and false intentions, it is necessary to provide some information on the specific constraints that characterize the examination of deception detection related to future actions. Some aspects may be similar to deception research with respect to past actions whereas others are not.

Explicit constraints

The general procedure used in the four studies consists of three phases. In brief, half of the participants (liars) plan a mock criminal act (e.g., placing a memory stick containing illegal material at a shopping mall). The other half of the participants (truth tellers) plan a non-criminal act (e.g., purchasing gifts at the same mall). After the planning phase and before having the chance to implement their planned actions, all participants are asked to imagine being stopped by the security police to answer some questions about their intentions. Truth tellers are instructed to tell the truth whereas liars are instructed to use their cover story which masks their criminal intention. During the interview-phase, an interviewer who is blind to the participants' experimental conditions interviews all participants based on the same structured interview protocol. Immediately after the interview, the participants are asked to complete a Post-Interview Questionnaire (PIQ). The liars are explicitly instructed to cease role-playing

and to answer this questionnaire truthfully. Each of these phases comes with explicit constraints which are discussed below.

Planning phase. To be able to plan their future actions, all participants are provided with the information about the *location* (where), the *time frame* (when), and the *goal* (what) of their intention. Thus, the framework of the specific intention is well-defined. Although the researchers provide the framework, the participants may choose the specific *actions* (how) they will use to achieve their intention. Although this experimental set-up may reduce the ecological validity, it allows us to be certain of the *ground truth* (i.e., the actual facts of a situation used to determine, with certainty, whether information is accurate; see Vrij, 2008).

Interview phase. The interview with a suspect is a crucial aspect in the investigative process. In fact, the primary goal of the investigative process is to gather information about the crime in question (Memon, Vrij, & Bull, 2003). In other words, this process may elicit essential information about possible differences between true and false intentions. In particular, this thesis focuses on the differences that may occur when suspects describe a mental image evoked when planning their future actions. To examine these differences, three critical questions are posed in the investigative interview. The first question (i.e., "Did you have a mental image?") requires a straightforward yes/no response. If this question is answered affirmatively, the interviewee is asked to describe this mental image ("Please describe your mental image with as many details as possible."). The third question, which is a prompt ("Is there anything more you want to add to your description?"), aims at acquiring additional information. Importantly, the participants are not asked to imagine the future event in the interview (online-response). Rather, they are asked to *remember* the mental image they may have experienced in the planning phase (offline-response).

Questionnaire phase. All participants are asked to cease role-playing and to rate how vividly they experienced their mental images. Although this method of obtaining information may not be suitable for the investigative process, it allows us to learn more about the underlying processes involved in the forming of true and false intentions. The purpose of this phase is to examine how liars have experienced imagining their false intention and to compare this with how truth tellers have experienced imagining their true intention. The ratings pertain to the *clarity* and *content* of the mental image and to how the *planning* of the future actions was experienced.

Core assumption

The core assumption of this thesis is that the trademarks accompanying future thinking, such as provided by a specific mental image of the future, are more distinct for true intentions than for false intentions. This assumption is based on findings that suggest a strong relationship exists between mental images and intentions (Goschke & Kuhl, 1993; Pham & Taylor, 1999). Further support comes from the observation that self-relevant future events (such as true intentions) tend to create stronger feelings of experience and to contain more episodic details than self-irrelevant future events (such as false intentions) (DeVito et al., 2012). It follows that

people holding true intentions experience processes (or trademarks) of future thinking. In contrast, these trademarks should be experienced less distinctly, if at all, by people with false intentions. Obviously, a lie catcher who is aware of these trademarks will be better equipped to differentiate between individuals who lie about future actions and individuals who tell the truth about future actions.

Overview of studies on true and false intentions

Although the research interest in examining true and false intentions has only recently started to grow, there are a number of studies in this field that focus on different aspects. For example, while some studies use *strategic interviewing* to distinguish between true and false intentions, others use *physiological* measures or *implicit* measures (for a review, see Granhag & Mac Giolla, 2013). Although some of these measures may be difficult to apply in real-life settings, they might be considered promising. Strategic interviewing (e.g., asking for a mental image) may be a viable alternative to the use of physiological and implicit measures.

To date, two complementary designs are used in strategic interviewing to elicit differences between true and false intentions. Granhag and Mac Giolla (2013) call these designs the *Portsmouth design* and the *Gothenburg design*. The Portsmouth design is more liberal because it does not control for possible factors that may influence an intention. Hence, it is more ecologically valid because it examines intentions under real-life circumstances (i.e., interviewing people about their genuine intentions). The Gothenburg design is more conservative because it imposes restrictions on the planning of a future action (i.e., the experimenter has ground truth). Hence, while the ecological validity is reduced, the Gothenburg design allows the experimenter to control for factors that may influence the data.

The first wave of empirical studies

The first wave of empirical studies on true and false intentions examined differences in content and addressed some basic features such as plausibility, length, and detail. In addition, these studies addressed how true and false statements about the future differed from true and false statements about the past. In one study, Vrij, Granhag, Mann, and Leal (2011a) took a more ecologically valid approach (they asked people waiting at an international airport about their upcoming trip). In another study, Vrij, Leal, Mann, and Granhag (2011b) used an experimental design that controlled for ground truth (participants were asked to plan a particular action and were interviewed about it afterwards). In both studies, the researchers asked half of the participants to lie about their intentions in a follow-up interview; they asked the other half to tell the truth. Both studies (Vrij et al., 2011a; Vrij et al., 2011b) revealed that statements about true intentions were more plausible than statements about false intentions. However, the length of the responses was not affected by their veracity. The first study revealed that the truth tellers provided more details than the liars when talking about their intentions. Although this finding was not replicated in the second study, it revealed that the

type of recall (past vs. future activities) influenced the level of detail the participants gave. The truth tellers gave more details than the liars in talking about past activities. However, no difference was found between the liars and the truth tellers with respect to the details they gave in talking about a future activity. In general, statements about past activities were more detailed and more plausible than statements about future activities.

In conclusion, even though these two studies offer little theoretical guidance or practical recommendations, they provide evidence that statements on future actions differ from statements about past actions. It is clear that the knowledge researchers have acquired in the past 40 years of systematic research on deception about past activities is relevant for the study of true and false intentions. However, the findings from these initial studies point to a new research direction.

Strategic Interviewing

A large body of the deception detection literature supports the idea that strategic interviewing is a valid approach to lie detection (e.g., Hartwig, Granhag, Strömwall, & Kronkvist, 2006). This research, however, has mainly focused on detecting deception about past actions. The results from strategic interviewing methods, which have also been applied to true and false intentions, are promising (Clemens, Granhag, & Strömwall, 2011). The approach of this thesis, to use mental images to distinguish between true and false intentions, can be sorted to the strategic interviewing approach. Below I discuss two strategic interview approaches that have been examined in relation to true and false intentions.

Strategic Use of Evidence (SUE) technique and intentions. In brief, the SUE technique draws on suspects' counter-interrogation strategies. Truth tellers are typically more forthcoming in interviews whereas liars are typically more evasive and avoidant (Granhag & Hartwig, 2008). As a consequence, liars choose more aversive strategies such as avoidance and/or denial with respect to potentially self-incriminating information about a crime. Based on empirically tested assumptions (e.g., Granhag, Mac Giolla, Strömwall, & Rangmar, 2013; Hartwig et al., 2007; Strömwall, Hartwig, & Granhag, 2006), the SUE technique proposes the disclosure of evidence in a strategic manner. In its simplest form, the SUE technique is used to disclose the evidence to the suspect later in an investigative interview rather than earlier. Due to the tendency of liars to withhold information (e.g., 'I have never been at the crime scene') they will make statements that are likely to be inconsistent with the existing evidence (e.g., CCTV-footage that show the suspect at the crime scene). In short, statement-evidence inconsistency is a rather reliable cue to deceit (Granhag & Hartwig, 2008; for more sophisticated forms of evidence disclosure, see Granhag, Strömwall, Willén, & Hartwig, 2013).

Clemens and her colleagues (2011) extended the SUE technique to detect deception about future activities. They compared two versions of the SUE technique (where evidence was disclosed at a later stage of the interview) with a control group (where evidence was disclosed at an early stage of the interview). Their results showed that the two SUE conditions revealed

more inconsistent statements by liars than the control condition. Furthermore, the study showed that suspects, seem to strive for a high correspondence between their stated intentions and their past planning activities. In conclusion, the study shows that the SUE technique can be used to elicit reliable cues about deception and truth in a situation in which suspects are asked about their intentions and their related planning activities. Despite its benefits, however, the SUE technique has some limitations. Unlike the unanticipated questions approach (the second strategic interview approach described next), the SUE technique requires prior evidence against the suspect if it is to reveal potential inconsistencies with the suspect's statements.

Unanticipated questions approach. Liars often anticipate and prepare for the questions they think will be asked. This may explain why – in many cases – liars are able to pass as truth tellers. Research lends empirical support to this approach when it is used with past activities (e.g., Lancaster, Vrij, Hope, & Waller, 2012; Sooniste et al., 2013a; Vrij et al., 2009). Clemens and her colleagues (2013) examined suspects' counter-interrogation strategies with respect to questions about their intentions. Their study showed that "sticking to a cover story" is a common strategy liars use to hide their intentions. Hence, if lie catchers want to find out whether a suspect is lying or telling the truth about a future action, they first have to know which questions liars do *not* anticipate. Sooniste and colleagues (2013a) examined whether questions in the planning phase were unanticipated, and whether they could be used to explain the differences between truth tellers' and liars' statements. As previously noted, planning is an inherent part of many intentions (Malle & Knobe, 2001). Whereas it is expected that truth tellers can give detailed information about the planning of their true intentions, it is expected that liars are less likely to give such information about their planning activities. In short, truth tellers can draw upon their memory to answer questions about the planning phase; liars have to invent their answers spontaneously.

Two studies have empirically tested the hypothesis that questions on the planning phases are useful for discriminating between true and false intentions. These studies examined both individual suspects (Sooniste et al., 2013a) and groups of suspects (Sooniste, Granhag, Strömwall, & Vrij, 2013b). The results from these studies revealed that the liars were as capable as truth tellers when answering expected questions on intentions. In contrast, the truth tellers gave both longer and more detailed answers for the unexpected questions in the planning phase. In the same vein, the study on groups of suspects found that the degree of consistency within the group was at the same level for the truth tellers and the liars for expected questions (Sooniste et al., 2013b). However, for the unanticipated questions, the truth tellers' responses were significantly more consistent within the group. Another important finding was that the truth tellers' descriptions of their intentions contained more information pertaining to *how* a stated goal should be achieved than the liars' descriptions. Yet the liars gave more information than the truth tellers on *why* it was necessary to achieve the stated goal.

Summary of the empirical studies

The main research question of this thesis is the following: How can mental images help to differentiate between true and false intentions. The first aim of the thesis is to identify the trademarks with respect to mental images which may be characteristic for true intentions (and lacking for false intentions). The second aim is to examine how a number of factors may moderate the usefulness of these trademarks (i.e., the effect of time, repeated questioning, and familiarity). Study I was the first to examine the relevance of mental images for discriminating between true and false intentions. Study II examined the *effects of time,* Study III examined the **effects of** *repeated questioning,* and Study IV examined the *effects of familiarity.* The same general research procedure, although with some variations, was used in the four studies (planning phase, interview(s), and Post-Interview Questionnaire (PIQ)).

In general, half of the participants planned a criminal act (i.e., the liars) whereas the other half planned a non-criminal act (i.e., the truth tellers). Before executing the planned act, all participants were intercepted and asked several questions about the mental image they may have experienced when planning the stated future actions. The truth tellers told the truth whereas the liars, as they had been instructed, used a cover story to mask their criminal intentions.

Study I

The purpose was to examine to what extent mental images help people discriminate between true and false intentions. The trademarks examined in the investigative interview were the number of *reported mental images* in the interview and *the number of words* used in describing a mental image. The PIQ examined the trademarks related to the *clarity* and *content* of the mental image (i.e., its vividness) and the *planning* of the future actions.

Method

A between-factor design (Veracity: Truthful vs. Deceptive) was employed and the procedure consisted of three distinct phases: *(1) Planning:* Half of the participants (*n* = 35), referred to as the truth tellers, were instructed to plan a non-criminal event (purchasing a gift for a friend). The other half of the participants (*n* = 35), referred to as the liars, were instructed to plan a mock criminal act (to place a memory stick containing illegal material in the store at a shopping mall) and a cover story. They were instructed to use this cover story, which was similar to the true intention of the truth tellers. This cover story was to be used in case they were stopped and asked questions about their future actions. All participants were provided with enough time and background material allowing them to plan their actions thoroughly. In

addition, they were informed about a number of specific constraints (e.g., time pressure at the shopping mall). After they had finished planning, all participants were asked what they were going to do next. This was to make sure they were following the instructions. *(2) Interview:* Thereafter all participants were intercepted. They were asked to imagine being stopped by the security police before entering the shopping mall. In other words, they never had the chance to carry out their plans. Then they were informed that they would soon be interviewed. The truth tellers were asked to answer all questions truthfully, based on their true intention. The liars were asked to mask their criminal intentions, based on their cover story. In other words, both groups were instructed to convincingly describe a shopping trip. They were informed that the interviewer did not know whether they were lying or telling the truth. After the interview, each suspect was left alone in the room without being further instructed of what to expect. *(3) Post-Interview Questionnaire*: After the interview, all participants were asked to truthfully rate the vividness of their mental image. They rated the content and clarity of the mental image they had experienced when they planned their shopping trip / criminal actions on different dimensions.

Results

The results revealed that significantly more truth tellers (97%) reported (in the interview) that they had experienced a mental image while planning their future actions in comparison to the liars (66%). Even if the liars described a mental image during the interview, they provided significantly fewer words than the truth tellers when describing this image.

The PIQ showed that the truth tellers experienced mental images to a significantly higher *extent* in the planning phase than the liars. Also, the truth tellers experienced the *spatial location of people*, the *temporal order*, and the *overall pre-experiencing* of the mental image more clearly than the liars. The mental image of the liars and the truth tellers did not differ with respect to sensorial information (*visual, auditory and smell/taste*). Furthermore, the liars and the truth tellers did not differ with respect to how clearly they experienced the *spatial location of objects* or the *time of the day*. In conclusion, the truth tellers experienced their mental images more vividly than the liars (see Table 1).

The liars (vs. the truth tellers) experienced the question about the mental image during the interview as significantly more difficult to answer. Both truth tellers and liars were generally satisfied with their planning and experienced it as easy and stimulating. Liars considered the time they had for planning as significantly more sufficient than truth tellers.

Conclusions

A crucial finding was that significantly more truth tellers than liars reported (during the interview) that they had experienced a mental image in the planning phase. If a participant did report a mental image during the interview, the truth tellers provided significantly more words to describe this image. Moreover, the PIQ showed that the truth tellers' (vs. the liars') mental

images tended to be more vivid with respect to the clarity and the content. In sum, both the descriptions given in the interview and the ratings in the PIQ support the assumption that EFT is a helpful concept when eliciting differences between forming true and false intentions.

Study II

The purpose was to examine the effect of time on liars' and truth tellers' descriptions of a mental image. For this purpose, all participants were asked to describe their mental images in a first interview, which was conducted after the planning phase, and in a second interview six to eight days later. The trademarks under examination were the number of *reported mental images* during the interview and, if a mental image was reported, *the number of words* and *number of details*. Also, the *consistency* between the two interviews (i.e., the between-statement consistency) was examined. Furthermore, in the PIQ the trademarks with respect to the *clarity* and *content* of the mental image (i.e., the vividness) and the *planning* of the future actions were examined.

Method

A 2 (Veracity: Truthful vs. Deceptive) × 2 (Time: Interview 1 vs. Interview 2) mixed-factor design was employed (liars = 42, truth tellers = 42). The first two phases of this study - (1) *Planning phase* and (2) *Interview 1* - were identical to the procedure used in Study I. However, after Interview 1 all participants left the Psychology Department where the interview had been conducted. Importantly, they knew that they would come back a week later but they did not receive any information on what would happen then. A week later (between six to eight days) the participants returned for the next phase of the experiment. (3) *Interview 2:* All participants were asked to imagine they left the shopping mall immediately after the first interview (one week before) and had not carried out their plans at the shopping mall. All participants were asked to imagine that the security police had interviewed them a week before, had called them in for yet another interview. The liars were instructed to again use their cover story and the truth tellers were asked to again tell the truth about their planned shopping-trip. It was stressed that all participants should try to be as convincing as possible. All participants were interviewed by a different interviewer than in Interview 1 who again asked them about the event they reported about a week earlier. After the interview, the interviewer left the room. Both the first and the second interview were audio-taped and the interviewers were blind to the participants' truth status. (4) *Post-Interview Questionnaire*: Identically to Study I, the experimenter asked all participants to truthfully rate the vividness of their mental image in the PIQ. Unlike Study I, the PIQ was completed after Interview 2. More precisely, the participants rated how they had experienced the content and clarity of the mental image – taking their subjective experience of Interview 1 and Interview 2 together in one PIQ - when they planned their shopping trip / criminal actions.

Results

As there were two different interviews, each participant could report a mental image at both occasions, at one or at none. Looking first at the participants who - at both interview occasions - reported to have had a mental image activated when forming the intention, significantly more truth tellers (39 [92.9%]) than liars (30 [71.4%]) reported to have had this. As expected, looking at the result for the two interview occasions separately, the same pattern appeared. For Interview 1 the difference between the number of truth tellers (39 [92.9%]) and the number of liars (33 [78.6%]) who reported to have had a mental image activated when forming the intention was bordering on significance and for Interview 2 the same difference was significant (39 [92.9%] vs. 32 [76.2%]).

If participants described a mental image then these descriptions were examined for possible differences with respect to the *number of words* and the *number of details*. The results indicate that the liars and the truth tellers provided a similar number of words and details. Overall, the participants' descriptions revealed that in Interview 2 more details were added (commission) and left out (omission). Only few details were repeated in Interview 2. Hence, both liars and truth tellers reached a relatively low degree of consistency over time. If a detail was repeated in Interview 2, it was significantly more often a truth teller than a liar. Hence, despite the general low level of consistency between the statements of both groups, the truth tellers' statements contained slightly more consistent descriptions than the liars' statements.

Then followed the PIQ which all participants truthfully completed after Interview 2. The ratings of the PIQ referred to the experience of Interview 1 and Interview 2 combined. The results revealed that all 39 truth tellers who (during both interview occasions) reported to have pre-experienced a mental image in the planning phase were telling the truth about this. Of the 30 liars who reported (at both interview occasions) to have experienced a mental image activated in the planning phase, 7 (23.3%) lied during the interview. Differently put, the liars reported a mental image during the interview but, in fact, they had not experienced one when planning their intentions.

The ratings after the interview showed that there were only a few differences between how truth tellers experienced the mental image of their shopping trip compared to how liars experienced their mental image of the cover story. That is, the truth tellers experienced the *location* more clearly than the liars. This difference was bordering on significance. In contrast, the liars experienced the *time of the day* more clearly than the truth tellers. The mental image of liars and truth tellers did not differ with respect to the sensorial information (*visual, auditory and smell/taste*) they experienced in their mental image. Furthermore, they did not differ with respect to how clearly they experienced the *spatial location of objects*, *spatial location of people,* and *temporal order*. The two global ratings (the clarity of the *overall pre-experiencing* of the mental image and the *extent* to which mental images had been experienced during planning) did not reveal differences (see Table 1).

Even though neither liars nor truth tellers anticipated to be asked about the mental image that they may have experienced in the planning phase, the liars experienced this question as

more difficult to answer than the truth tellers. Apart from this specific question, the liars (vs. the truth tellers), albeit more satisfied with the time allocated, were less satisfied with their planning. Both truth tellers and liars experienced the planning phase as rather easy and stimulating.

Conclusions

The results of this study add further support to our core assumption that EFT is a helpful concept when trying to elicit differences between true and false intentions. It is an important finding that the truth tellers' (vs. the liars') descriptions were characterized by a higher degree of repetitions. However, the liars' (vs. the truth tellers') descriptions were not characterized by more commissions. Hence, the assumption that the truth tellers (vs. the liars) would be more consistent over the two interviews could only partly be supported. Importantly, we were able to replicate a key finding of Study I; if a person did *not* report a mental image during the interview, he or she is much more likely to be a liar than a truth teller.

The ratings in the PIQ showed that there were only a few differences between how the truth tellers experienced the mental image of their shopping trip compared to how the liars experienced their mental image of the cover story. One explanation for this might be the temporal distance between the initial experience of the mental image (before Interview 1) and the ratings in the PIQ (after Interview 2 a week later). This explanation is in accordance with research suggesting that the 'phenomenological characteristics' of memories (which relate to the experienced vividness) tend to become less clear over time (Suengas & Johnson, 1988).

Study III

The purpose was to examine the effect of repeated questioning. Therefore, all participants were asked to describe their mental images on two different interview occasions on the same day. The trademarks under examination were the number of *reported mental images* in the interview and, if a mental image was described, the *number of words* provided in the descriptions. In addition, the focus of the analysis was on the *type of details* the liars and the truth tellers provided when describing their mental images. Again, in the PIQ the trademarks with respect to the *clarity* and *content* of the mental image (i.e., the vividness), and the *planning* of the future actions were examined.

Method

A 2 (Veracity: Truthful vs. Deceptive) × 2 (Time: Interview 1 vs. Interview 2) mixed-factor design was employed (liars = 30, truth tellers = 30). The first two phases of this study - (1) *Planning phase* and (2) *Interview 1* - were identical to the procedure used in Study I and Study II. However, after Interview 1, each participant was left alone in the room without being further instructed of what to expect next. (3) *Interview 2:* After about 10 minutes the

same interviewer came back to ask some further questions. All participants were asked the same questions as in Interview 1. (4) *Post-Interview Questionnaire*: Identically to Study I and Study II, all participants were asked (after Interview 2) to truthfully rate the vividness of their mental image in the PIQ. More precisely, they rated how they had experienced the content and clarity of the mental image when they planned their shopping trip / criminal actions.

Results

Significantly more truth tellers than liars reported that they had experienced a mental image during the planning. Both interviews showed that (almost) all of the truth telling suspects (Interview 1: 29 [96.7%]; Interview 2: 30 [100%]) claimed that they had experienced a mental image while planning their actions. In contrast, significantly fewer lying participants made the same claim (Interview 1: 23 [76.7%]; Interview 2: 25 [83.3%]). Of the 23 liars who - in both interviews - reported to have experienced a mental image, 9 admitted in the PIQ that they had lied about this during the interview.

Even if the liars described a mental image during the interview, they provided significantly fewer words than the truth tellers. In addition, both liars and truth tellers used more words in Interview 1 than in Interview 2. It is noteworthy that the *type of details* (navigation, visual detail, and spatial detail) did not indicate differences between the two interviews, the veracity of participants, or an interaction between the interviews and the veracity of participants. More precisely, the participants' descriptions contained a similar amount of visual and spatial details and information with respect to how to navigate the 'self' through the scene. In addition, we found that the majority of the liars (76%) used the same specific shop in their cover story as had been relevant for their true criminal intention.

The ratings after the interview showed that the truth tellers (vs. the liars) experienced the sensorial information (*visual, auditory and smell/taste*) with respect to the mental image of their shopping trip to a much higher extent. The rating for *visual details* was at the upper end of the scale, whereas *sound* and *smell/taste* were at the lower end of the scale. Also, the truth tellers experienced the *location* and the *position of other objects* more clearly. In comparison, no differences were found for the *position of other persons*, *time of the day* and *temporal order*. No differences were revealed for the two global ratings with respect to the clarity of the *overall pre-experiencing* of the mental image and the *extent* to which mental images had been pre-experienced during planning (see Table 1).

Even though liars and truth tellers did not anticipate the question about the mental image, they experienced it as rather easy to answer. Furthermore, both groups experienced their planning as rather stimulating and easy. Although the liars (vs. the truth tellers) were more satisfied with the time allocated for planning their future actions, they were not more satisfied with their planning.

Conclusions

We again replicated that significantly more truth tellers than liars report to have experienced a mental image in the planning phase. Unexpectedly, no difference was found regarding the type of details that liars and truth tellers provided when describing their mental images. One reason that may account for this finding is that 76% of the liars were found to embed their lies in truthful statements (note that this was not examined in Study I and Study II). From a negative point of view, this makes accurate deception detection more difficult. From a positive point of view, however, the liars had willingly shared crime-relevant information during the interviews. In brief, if this result holds true also for other contexts, it is informative for lie catchers as they could use this information to draw conclusions about the liars' true criminal intentions. Another explanation for the absence of an effect for the type of details may be insensitivity of our coding method. That is, our coding system may not have captured differences that may actually have been present. This venue was explored in Study IV.

Study IV

The purpose of Study IV was to examine to what extent location-familiarity affects how the liars and the truth tellers describe their mental images. The trademarks under examination were the number of *reported mental images* during the interview and, if a mental image was described, the *number of words* and the *type of details* provided in these descriptions. Compared to Study III, the analysis with respect to the *type of details* was expanded (i.e., the extent to which participants referred to the target location, navigation in the library, navigation to the library, visual details, sensation/perception, and obstacles). Again, in the PIQ the trademarks with respect to the *clarity* and *content* of the mental image (i.e., the vividness) and the *planning* of the future actions were examined.

Method

A 2 (Veracity: Truthful vs. Deceptive) × 2 (Location: Familiar vs. Unfamiliar) between-factor design was employed. For this study, the familiarity of each participant with a particular location had to be established before handing out the instructions. Hence, all participants were asked to rate how familiar they were with specific libraries in Gothenburg, Sweden. Based on their responses the participants were assigned to either the group which was highly familiar with the location, the *familiar participants* ($n = 57$), or to the group which had never visited a particular library before, the *unfamiliar participants* ($n = 63$).

 (1) Planning: As in the three previous studies, half of the participants, the truth tellers, were instructed to plan a non-criminal event (i.e., searching for books in a particular library to get information about courses; $n = 58$). The other half, the liars, were instructed to plan a mock crime (i.e., search for a book containing illegal material in a particular library; $n = 62$).

In addition, the liars were asked to plan a cover story which was to be used if they were questioned about their intentions. Based on their previous experience, the *familiar participants* planned their future actions in a familiar library (*n* = 57). In comparison, the *unfamiliar participants* planned their future actions in a library they had never visited before (*n* = 63). All participants were provided with enough time and background material that allowed them to plan their actions thoroughly. In addition, the participants were motivated to plan by a number of explicit constraints (e.g., time-pressure at the library). After they had finished planning, all participants were asked what they were planning to do next. This was to make sure they were following the instructions.

(2) Interview: Thereafter all participants were intercepted. They were asked to imagine being stopped by the security police before entering the library. In other words, they never had the chance to carry out their plans. Then they were informed that they would soon be interviewed. The truth tellers were asked to answer all questions truthfully, based on their true intention. The liars were asked to mask their criminal intentions, based on their cover story. In other words, both groups were instructed to convincingly describe their planned search for books in the library. The participants were informed that the interviewer did not know whether they were lying or telling the truth. After the interview, each suspect was left alone in the room without being further instructed of what to expect.

(3) Post-Interview Questionnaire: As in the previous three studies, the experimenter asked all participants to truthfully rate the vividness of their mental image. More precisely, they rated the content and clarity of the mental image they had experienced when they planned their actions in the library / criminal actions.

Results

Replicating the results of the previous three studies, significantly more truth tellers than liars reported that they had experienced a mental image in the planning phase. The interviews showed that almost all truth tellers (55 [93.2%]) claimed that they have had experienced a mental image while planning their actions. Critically, significantly fewer liars made the same claim (43 [69.4%]). The descriptions revealed that liars and truth tellers did not differ with respect to the type of details they provided in the interview. It is noteworthy that the familiar participants spoke more about the particular library and navigating (in that location), compared to unfamiliar participants.

The PIQ showed that the truth tellers experienced *visual details* and *smell/taste* to a much higher extent than liars. The rating with respect to *visual details* was at the upper end of the scale, whereas the rating with respect to *smell/taste* was at the lower end of the scale. The *overall pre-experiencing* of the mental image was experienced more clearly by the truth tellers. In contrast, the liars experienced the *position of other people* more clearly. No differences were found with respect to *auditory information, location,* the *position of other objects,* the *time of the day* and *temporal order*. No differences were found with respect to the *extent* to which participants had experienced mental images in the planning phase.

Furthermore, the analysis showed that *visual information*, *location*, and *position of objects* were experienced more clearly by familiar participants than by unfamiliar participants (see Table 1).

In addition, the familiar participants rated their familiarity with the location as high. This indicates that assigning them to the familiar-condition was valid. Although liars and truth tellers were both satisfied with the time allocated for the planning, truth tellers were more satisfied with their planning than liars. Both liars and truth tellers experienced the planning as rather easy, but the truth tellers experienced the planning as significantly less difficult than liars. The liars rated their planning significantly more stimulating than the truth tellers.

Conclusions

The main purpose of this study was to examine to what extent familiarity moderates how liars and truth tellers describe a mental image of a future action. The results showed that the truth tellers reported a mental image significantly more often than the liars. If a mental image was reported, the content of the descriptions did not differ between liars and truth tellers. The PIQ revealed that the truth tellers' mental image was experienced more vividly than the liars' mental image. In other words, despite this difference with respect to the experienced vividness, this difference did not show in the descriptions given in the interview. The results suggest, however, that the participants tended to rely on past (familiar) experiences when describing their mental image in the interview. Hence, it is possible that the liars' and the truth tellers' descriptions may, at least in part, draw on past experiences rather than on genuine EFT. The data did not support the assumption that familiarity with location is a moderating factor in discriminating between true and false intentions.

Table 1
Means of the liars' and the truth tellers' ratings with respect to how vividly they experienced their mental image in the planning phase

Subjective ratings	Study I		Study II		Study III		Study IV	
	Lie	Truth	Lie	Truth	Lie	Truth	Lie	Truth
Global								
Extent, mental image	4.8	5.5*	5.2	5.2	5.3	5.8	5.2	5.4
Clarity, pre-experience	4.7	5.7*	5.1	5.5	5.1	5.6	5.0	5.5*
Specific								
Visual	5.4	6.0	5.4	5.6	5.5	6.3*	5.5	6.1*
Auditory	2.5	2.0	2.2	1.7	1.6	2.6*	2.2	1.9
Smell/taste	1.6	1.7	1.7	1.7	1.3	2.2*	1.3	1.7*
Location	5.2	5.8	5.0	5.7	4.5	5.4*	5.0	5.3
Position of other objects	5.0	5.5	5.0	5.0	4.8	5.9*	4.9	5.2
Position of other people	2.5	3.5*	3.2	3.1	2.9	2.8	4.2*	3.1
Time of day	3.1	3.6	4.0*	2.9	2.7	3.0	3.2	4.5
Temporal order	4.2	5.0*	4.6	4.7	4.1	5.1	4.7	4.9

Note that all ratings for the liars refer to how they experienced their cover story.
* $p < .05$. Significant difference between liars and truth tellers with respect to the experienced vividness of the mental images

General Discussion

The research question is how mental images evoked by thinking of a specific future event can help to discriminate between true and false intentions. The aim of this thesis is contribute to theory-driven deception research on true and false intentions. The first aim is to identify the trademarks (of the mental images) that are rather characteristic of true intentions and that are lacking or less distinct in false intentions. In other words, the focus of the thesis is not mind-reading (i.e., the content of a liar's true intention) nor the liar's motivation for lying. Hence, the thesis aims only at discovering ways to differentiate between true and false statements. The second aim is to examine several factors that might moderate the usefulness of the identified trademarks (i.e., the effects of time, repeated questioning, and familiarity).

Trademarks

Reporting a mental image

The four studies in this thesis showed that truth tellers report a mental image more often than liars. In other words, if a participant did *not* report a mental image, he or she was much more likely to be a liar than a truth teller. It should be noted that the proportion of liars who reported a mental image varied among the four studies. That is, 66% of the liars reported a mental image in Study I whereas 79% of the liars reported a mental image in the corresponding figure for Study II (Interview 1). It is difficult to identify the cause of this difference. Future research should explore this variation more systematically.

There are two possible explanations that can account for the finding that liars reported a mental image less often than truth tellers. First, it is possible that false intentions evoke less vivid (if any) mental images than true intentions. This possibility would support the assumption that EFT is responsible for differences between true and false intentions. Liars, on the other hand, may not have been in the position to describe a detailed mental image. Second, it is possible that liars and truth tellers used different strategies for handling the interview situation. Deception research for past events has established that truth tellers favor the strategy of "telling it like it was", and "keeping the story real", whereas liars try to keep their story simple and try to avoid mentioning possibly incriminating information during an interview (Granhag & Strömwall, 2002; Strömwall et al., 2006). Hence, it is possible that liars did not report a mental image to avoid that this piece of information could potentially be used against them.

In sum, the first explanation attributes the differences to variations in liars' and truth tellers' experiences whereas the second explanation attributes this to variations in their strategies. Regardless of what may have caused the effect, the fact that a person does not

report a mental image is a strong trademark of false intentions. One should, however, be cautious in jumping to the conclusion that a person who reports a mental image is a truth teller. After all, a rather large proportion of the liars (between 66-79%) tend to report a mental image in the interview.

Number of words

In general, if a mental image was reported, the liars provided fewer words than the truth tellers to describe this image (Studies I and III). As for the previous trademark, it is possible that the liars experienced a less vivid mental image, thus producing descriptions with fewer words than the truth tellers' descriptions. Alternatively, the liars may have used strategies that made them avoid giving overly detailed descriptions (Granhag & Strömwall, 2002; Strömwall et al., 2006).

Despite the truth tellers' tendency to use more words to describe their mental images, this trademark is a rather crude measure for capturing possible differences between true and false intentions. Also, it is difficult to use the number of words as a cue outside the experimental setting. The reason is that studies, such as the four studies in this thesis, compare liars and truth tellers at the group level. However, this comparison does not allow a lie catcher to make a reliable veracity-assessment of one single statement. Thus, although the finding that liars tend to use fewer words than truth tellers is informative, it is of limited value in a real-life setting.

Content of descriptions

No differences were found with respect to the content of the liars' and the truth tellers' descriptions of their mental images. Thus, the content of descriptions did not provide clear cues for discriminating between true and false intentions. This may be explained by methods which were too insensitive to arrest existing differences. That is, the questions of the interview and the analysis of the information provided in this interview may not have been specific enough to elicit differences in liars' and truth tellers' descriptions. For example, our results showed that 3 of 4 liars described the location, which was relevant for their criminal intention, in their cover story. Information about places is often stored in memory as abstracted knowledge (Berntsen & Rubin, 2012). It should therefore not be difficult to use this knowledge to provide a detailed and credible story. As suggested by the results discussed in this thesis, participants (liars as well as truth tellers) tended to describe spatial information which they were familiar with. Thus, it is possible that their descriptions may draw on past experiences rather than on genuine EFT. This may be particularly true for routinized future events that therefore require little or no planning.

In sum, relying on (a) information from the criminal intention which is close to the truth but not self-incriminating and on (b) information from past experiences may explain why no differences were revealed in the content of descriptions. Spatial information, though often

used in deception research to capture difference between true and false statements (Vrij, 2008), may not be a sensitive method for discriminating between true and false intentions. Future research should use more sensitive interview questions which address critical information that allow a more accurate veracity-assessment between true and false statements.

The experienced vividness of the mental image

Based on the finding that liars and truth tellers did not differ with respect to the information they provided in the interview, one may come to think that this may be because they experienced their mental image in the planning phase in a similar manner. However, the findings derived from the PIQ indicate that this explanation may not be true. The general finding is that truth tellers experienced their mental image more vividly than liars. Vividness, as defined in this thesis, consists of different dimensions pertaining to the clarity and content of an imagined future event. The PIQ revealed that truth tellers experienced several dimensions of the mental image more clearly than liars. However, the specific dimensions varied among the four studies (see Table 1). In spite of this inconsistent pattern, it is possible that the more intense vividness of the mental image is a trademark of true intentions.

Looking at the different dimensions (as experienced by both liars and truth tellers), the most vivid dimensions were the *visual information*, the *location*, the *position of objects,* and the *temporal order.* In comparison, the least vivid dimensions were the *temporal order*, *auditory information*, *smell/taste, location of other people,* and *time of the day*. It does not come as a surprise that *visual information* was the most distinct sensorial information as it is a key dimension of autobiographical memories (Conway & Pleydell-Pearce, 2000; Greenberg & Rubin, 2003). Furthermore, the finding that the *location*, the *position of objects,* and the *temporal order* were experienced more clearly may be explained by that they were of a more fixed nature whereas the *time of the day* and the *location of other people* who change positions are not. It is possible that past experiences, hence schemas, may explain why fixed features are experienced more clearly. McDermott, Szpunar, and Arnold (2011) argue that "places" may be a key element that links memory and EFT. However, the finding of this thesis is that the most vivid dimensions of the mental image were of a fixed nature. This observation indicates that at least not all mental images of the future may rely on genuine EFT. Instead, it is possible that some of these representations of the future rely on details that are, though *experience-near* (i.e., representative of experience), of a more generic nature in the sense that they summarize numerous past experiences (for a similar view see D'Argembeau & Mathy. 2011; Berntsen & Rubin, 2012).

The planning phase

A consistent finding from the four studies was that both groups experienced the planning phase rather easy. This finding may explain why both liars and truth tellers were generally satisfied with their planning and the amount of time allocated for it. Although the lairs were

somewhat more satisfied with the planning time allocated, they were somewhat *less* satisfied with their planning than the truth tellers. One may ask why liars were dissatisfied with their planning if they thought it was an easy task. One answer may be that satisfaction with a plan is assessed in light of the actual outcome (in this research, the performance in the investigative interview). This explanation lends support to our approach of focusing on mental images to discriminate between true and false intentions.

Anticipation and difficulty of the questions

Although neither the liars nor the truth tellers seemed to anticipate questions about their mental images, the liars found the question more difficult to answer than the truth tellers. This suggests that a question about a mental image in an investigative interview may elicit differences between liars and truth tellers. The general results of the thesis are consistent with the unanticipated question approach (e.g., Liu et al., 2010) that claims that asking an unanticipated question prevents liars from using a ready-made answer. In brief, liars are forced to invent their answers on the spot whereas truth tellers can draw on their memory.

The moderators

This thesis examined how certain relevant factors may moderate the usefulness of the trademarks identified. The results showed that the experienced vividness of the mental image is the only trademark that was moderated by time, repeated questioning, and familiarity.

The effect of time. Study II examined to what extent *time* moderated how participants experience and describe their mental images in an interview. Study II was the only study that revealed no differences between the liars and the truth tellers. It is possible that this finding may be due to the truth tellers who, in comparison to the other three studies, experienced their mental image less vividly in Study II. On the other hand, the vividness seems stable for the liars in the four studies. One explanation may be the temporal distance between the initial experience of the mental image in the planning phase (just before the first interview) and the subjective rating in the PIQ conducted a week later. This is consistent with other research which suggests that the *phenomenological characteristics* (which relate to vividness) of memories tend to be forgotten over time (Suengas & Johnson, 1988).

Repeated questioning. Study III examined to what extent *repeated interviews* moderate how participants experience and describe their mental images in an interview. The results suggest that when participants were asked about their mental image repeatedly on the same day, the truth tellers experienced their mental images more vividly than the liars. Compared to the other three studies, Study III found more clear differences between liars' and truth tellers' experienced vividness of a mental image.

A possible reason why this 'practice effect' increased the vividness of truth tellers' mental images but not that of the liars may be explained by the *repeat vs. reconstruct* hypothesis (Granhag et al., 2000), which draws on the constructive nature of memory (see

Bartlett, 1932). This hypothesis proposes that liars tend to repeat what they have said in a previous interview, whereas truth tellers tend to reconstruct the event from memory. Although this research refers to memory, the same reasoning may apply for EFT (Note: the *constructive episodic simulation hypothesis* supports this notion; Addis & Schacter, 2008). In other words, truth tellers may reconstruct their mental images when they are interviewed. As a result, the repeated reconstructions of the mental image may produce more vivid representations than a one-time reconstruction. In comparison, liars may try to repeat what they have previously said in order to produce consistent statements. This repetition, however, does not necessarily involve the reconstruction of the mental image, and is therefore unlikely to have the same practice effect.

Familiarity. Study IV examined to what extent familiarity moderated how the liars and the truth tellers experience and describe their mental images. Although familiarity did not moderate this effect, this research shows that familiar participants experienced the visual information, the location, and the position of objects more clearly than the unfamiliar participants. This finding agrees with the memory research that contextual setting is one of the main contributors to the similarities between (episodic) future thinking and episodic memory (McDermott et al., 2011).

In sum, our data suggest that repeated interviews on the same day increase how truth tellers experience the vividness of their mental image, whereas temporal distance decreases their experienced vividness. This finding suggests that a lie catcher has to take these moderators into consideration when questioning a suspect.

Limitations

This thesis is a first step toward theory-driven research on true and false intentions with mental images. It does not claim to provide a detailed overview of all relevant moderators that might potentially affect true and false intentions. Therefore, caution is recommended with respect to generalizing the results of the four studies to other deception detection scenarios. The situations described in the studies are well-defined in time and space, and also required some amount of planning. Moreover, the participants were interviewed immediately after planning their future actions; such a procedure likely affected how vividly they experienced and described their mental images. Although the generalizability is limited, the results of this thesis are relevant for situations commonly found in real life. Such situations are those that require the assessment of a suspect's veracity with respect to his or her stated intention. A specific example is the situation when a person in authority is in charge of granting access to sensitive areas (e.g., airport boarding areas).

Furthermore, these four studies have a limited ecological validity. The participants were given information about the location (where), the time frame (when), and the goal (what) related to their intention. It is possible that the formation of an intention and its related processes (e.g., planning and mental images) may be produced differently when someone

other than an external source (i.e., an experimenter) provides this information. These limitations should be addressed in future research on true and false intentions.

Future directions

As 'true and false intentions' is a rather new line of research in legal psychology, there are numerous new research avenues. One such avenue is the systematic manipulation of different aspects of the design. First, research on EFT has shown that the individual differences in visual imagery (D'Argembeau & Van der Linden, 2006), in personality traits (Quoidbach, Hansenne, & Mottet, 2008), and in self-regulation strategies (D'Argembeau & Van der Linden, 2006) influence our ability to pre-experience the future. Hence, future research might focus on individual differences and the generation of mental images. Second, future research could fine-tune the methods used to elicit differences and analyze the descriptions liars and truth tellers give in interviews. In the studies of this thesis, the question about the mental image during the interview was rather open and allowed the participants to volunteer a mental image of their own choice. This freedom may have affected the content of their descriptions. One possible problem is that this degree of freedom was too great because it allowed both the liars and the truth tellers to give descriptions that may lack the typical characteristics of genuine EFT. Future research could focus on developing interview protocols, such as the memory-enhancing techniques, that might elicit differences between true and false intentions more efficiently.

Furthermore, it may be argued that a more complete model of future thinking is required. To date, most future-oriented concepts have been studied in isolation. The conduct of meaningful psycho-legal research requires a model on future thinking. For example, Gollwitzer (1993) states that people may benefit from forming specific plans. However, it is yet unclear how people actually form such plans in their daily activities. In addition, most EFT research uses the word-cueing technique to examine how people experience mental images of the possible future (Szpunar & Tulving, 2011). Therefore, it may be worthwhile to examine how people generate simulations in more realistic settings.

Conclusions

A claim in this thesis is that one way to conduct psycho-legal research on true and false intentions is to draw on research about future-oriented thinking, including intentions, planning, and episodic future thinking (EFT). This claim is based on the assumption that the underlying mechanisms relevant to intentions are more distinct in the formation of true intentions than in the construction (and description) of a cover story.

The first specific aim of the thesis was to identify trademarks that are characteristic for true intentions (and missing in false intentions). Although this thesis is only the first step toward theory-driven research on true and false intentions, it has resulted in some tentative

suggestions. First, the results suggest that *if* a person describes a mental image, that image is a more reliable cue for discriminating between liars and truth tellers than it is for *how* the image is described. Second, liars' and truth tellers' descriptions of the mental image do not reveal any systematic differences with respect to the content of descriptions. Third, truth tellers tend to experience their mental images more vividly than liars. This is in accordance with our assumption that EFT trademarks are typical for true intentions (and less clear for false intentions). These trademarks are, however, not very evident in the investigative interviews.

In sum, the findings from the four studies of this thesis suggest that there is a gap between (a) how people *experience* the future event in the planning phase and (b) how they *describe* this mental simulation in an investigative interview. It is possible that a modified version of a memory-enhancing technique may help maximize the differences between liars and truth tellers who are asked to describe their mental image of a future event. This area has recently been successfully examined for related trademarks in a true and false intention context (Sooniste, Granhag, Strömwall, & Vrij, 2013c).

The second specific aim of this thesis was to examine several factors that might moderate the usefulness of the identified trademarks (i.e., the effects of time, repeated questioning, and familiarity). First, these moderators did not affect the extent to which liars and truth tellers *reported a mental image*. Regardless of the moderator examined, truth tellers almost always reported – in the interviews – that they had experienced a mental image in the planning phase. Second, the moderators did not affect the *content of the descriptions*. The number of details and the type of details provided did not vary as a function of the moderators. Third, the moderators had an effect on the liars' and the truth tellers' *experienced vividness* of their mental images. That is, *repeated questioning* (on the same day) increased how vividly the truth tellers experienced their mental image, whereas *time* decreased this vividness. In contrast, familiarity did not moderate how vividly liars and truth tellers experienced their mental images of the future.

In conclusion, the results of this thesis lend partial support to the assumption that EFT is a helpful concept when conducting deception research on future events. Although no clear differences were found in the content of liars' and truth tellers' descriptions of their mental images, it may be too hasty to reject the assumption that EFT is a helpful concept for discriminating between true and false intentions. The absence of differences between liars and truth tellers may be due to methods that were too insensitive to elicit descriptions reflecting genuine EFT. Framing questions that more efficiently address genuine EFT is a topic for future research.

The research on true and false intentions is still in its infancy. There are numerous opportunities for future work in this domain. As research on EFT will continue to inform us about the trademarks of true intentions (Bar, 2011), it may be possible to find use for such knowledge in the attempt to arrest trademarks that can differentiate true intentions from false. In this regard, this thesis is a promising starting point for future research.

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