Can hostile intent be detected by means of signaling?

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Summary

An experiment was conducted in order to uncover if a (non-) verbal signal sent at greater than interpersonal distance by a police officer could aid in the detection of hostile intentions. The experiment, which was recorded on video, consisted of several people with and without hostile intent walking past a police officer, carrying a package that contained either illegal or normal material. The police officer utilized a strong (clearly aimed at the participants) or a weak, ambiguous (not directed at the participants) signal to elicit behavioral responses. A main effect supported our theory that individuals with hostile intent experienced themselves as being the target of social interaction more often than those without hostile intent, yet this effect was most pronounced when a strong signal was present. Contrary to what was hypothesized, a strong signal also led participants to be more publicly self-conscious when harboring hostile intentions; no differences between hostile and non-hostile intent were revealed for public self-consciousness when a weak signal was present. The videos from the first experiment were also coded for behavioral differences, but our hypothesized effects regarding differences in the amount of gestures and the orientating reflex remained absent. To complement our experiment, a second study was set up to provide more definitive answers regarding the usage of signals to uncover intent. Our second study revealed the expected differences in expertise; experts gave more accurate judgments, rejecting the individuals in the videos who were not harboring hostile intentions and correctly marking those who were burdened with hostile intent, as compared to laypersons. Surprisingly, the second study showed a similar effect of the strong signal; accuracy scores were significantly better when a strong signal was present, as compared to when a weak signal was present in the videos. In addition, this was supported by more behavioral cues being reported for strong signal videos, as compared to weak signal videos. Why a strong signal instead of a weak signal evoked better discrimination is elaborated on in the general discussion.

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Introduction

The last decade has been marked by the 'War on Terror'. Following 9/11/01 the world now has a watchful eye on anyone who could potentially be harboring hostile intentions. One of the newly implemented security measures is called the SPOT ("Screening Passengers through Observational Technique") program and has its roots in deception and emotion research (Kölbel & Selter, 2010). The focus of this program is the identification of facial cues, so-called micro-expressions, which are the result of trying to mask hostile intentions (Ekman, 2009). In order to identify any hidden intentions the special "Behavior Detection Officers" (BDO) may strike up an ordinary conversation with travelers. While this conversation may appear harmless, the BDO's are actually looking for suspicious visceral expressions[1].

Various drawbacks can be identified from employing a strategy such as this one to identify individuals harboring hostile intentions. For one, the scientific basis of these micro-expressions, as researched by Paul Ekman (2009) and colleagues (Ekman & Friesen, 1978), appears to be subject of scientific debate. Various researchers have expressed their critiques to Ekman's widely cited work (see for example Porter & ten Brinke, 2008; and Vrij, 2008). In an attempt to verify Ekman's work, Porter and ten Brinke (2008) found that micro-expressions lasted longer, but were more subtle (only partial micro-expressions were manifesting in the upper or lower face) than originally hypothesized, making them harder to detect. Furthermore, the partial micro-expressions were also occurring in genuine expressions, thus rendering their usefulness in discerning intent disputable (Porter & ten Brinke, 2008).

However, deviant behavior exhibited by those who are harboring hostile intentions is still detectable, but not necessarily at interpersonal distance and it remains a very difficult task. Lousberg and colleagues (2009) summarize in their findings a list of more than 150

[1] Info on SPOT program and BDO's from the Transport Security Agency website. http://www.tsa.gov/what_we_do/layers/bdo/index.shtm. Accessed May 11th 2012.

possible deviant behaviors, which are largely location and time specific. Detecting all of the relevant behaviors by a single person is obviously a difficult task. Another important point is that this must also be done in a timely manner: one needs to observe, at precisely the right time, the precise behavior that would constitute hostile intent. This is a difficult task in its own right, as people with hostile intentions can mask their behavior and show mostly behavior that does not deviate from normal people and not all behavior is deviant at every location (Frank & Ekman, 1997; Lousberg, et al., 2009). Even when all these requirements are met, some hostile intentions rely on knowing or perceiving more than just that single expression or behavior. For example, Jian, Matsuko and Nickerson (2006) have shown that when individuals have to avoid certain areas in order to fulfill a goal, people tend to resort to flanking; they initially avoid the target in order to later circle back towards it. This means that in order for an agent to successfully detect this movement pattern he or she has to know the starting point, the route and the goal of the individual with hostile intentions. In short, an agent should gather multiple behavioral cues before behavior portrayed by individuals is sufficiently suspicious to constitute hostile intent, as is also suggested by Lousberg and colleagues (2009).

One way to address the gap between detecting hostile intent by passively observing and by striking up a conversation, while also uncovering (enough) additional deviant behavior, is to employ a (verbal) signal at greater than interpersonal distance to elicit behavioral responses from people. This would allow officers to maintain a distance from any potential target, thereby securing the possibility to observe more than just visceral expressions. It would also allow them to obtain more information, in the form of behavioral cues, from suspicious individuals' reactions towards this signal. We expect that the behavioral differences between individuals with or without hostile intent will be magnified as a result of this signal, as some will interpret this signal as potentially threatening to their goals

depending on the cognitive accessibility of certain themes (Moskowitz & Skurnik, 1999; Pilkington & Woods, 1999). To illustrate this point, individuals with hostile intentions should experiences increased feelings of threat by a police officer, as he or she can be seen as a potential roadblock for the mission or task an individual with hostile intentions needs to carry out. Individuals without hostile intent should not experience such feelings, as they would not be focused on criminal activity. In our research we aim to provide the currently lacking evidence for the utilization of signals, while also providing a new theoretical foundation for the effects of the signal on individuals with or without hostile intent. Our main research question is:

Can a signal that relies on a greater than interpersonal distance be employed to successfully distinguish between individuals with hostile intentions and those with no hostile intentions?

We will first focus on exploring hostile intent and the behavioral implications that follow from masking ones true intentions, as well as formulate the subsequent hypotheses. Secondly, we will focus on integrating the signal and its effects. This will result in our second set of hypotheses. We will conclude with the hypothesized interactions between different intentions and the variations of the signal.

Hostile Intent. We will define hostile intent as the intent to do deliberate and premeditated damage, pain, devastation, or other harmful or illicit act to fulfill a specific goal at a specific location and time. This includes, but is not limited to: terrorism, larceny, vandalism, loitering and other troublesome or crime-related behavior. A range of different actions are covered by this definition, as not all deviant behavior is limited to, for example, terrorism. Scouting a train station and looking at the security measures could be a sign of someone obtaining this information for a terrorist act, or simply to avoid these measures as a pickpocket. Both

individuals would have hostile intent and thus display this deviant behavior, but with two clearly different goals.

In general, hiding hostile intent is a difficult and stressful task (Burgoon et al., 2009; Eachus, Stedmon, & Baillie, In Press). To illustrate this point we turn to research on stigmata (i.e. non-visible characteristics which are considered taboo in society; being gay, having HIV or a mental illness), which shows that suppressing such stigma results in a pronounced motivation to keep it a secret, worry about what to do if such a stigma is discovered, as well as being constantly alert as to whom might suspects their secret (Pachankis, 2007). Hostile intent should warrant similar vigilant behavior, as it implies similar non-visible secrets with similar high costs associated with discovery. This vigilant behavior can manifest itself in distrust towards one's immediate surroundings, while also creating increased self-conscious thoughts (Mendoza-Denton, Downey, Darvis, Purdie, & Pietrzak, 2002; Santuzzi & Ruscher, 2002). An evaluation, by means of self-conscious thoughts, of any behavior exhibited by a person with hostile intent (or who is burdened with a stigma) is warranted, as these behaviors could betray their hidden intentions and any person in their immediate surroundings will be scrutinized to ascertain if they suspect anything about these intentions or other secrets. Therefore any behavior perceived in their direct surroundings will be noticed (Riggio & Kwong, 2009) and it will appear that social information from their direct surroundings is projected at them (Galbraith, Manktelow, & Morris, 2008). If, for example, someone mentions the word 'criminal', a person with hostile intent would reason that this person is mentioning this word at them. These processes show an activation of the cognitive 'self', a very clear image of oneself in their immediate surroundings and taking into account all the (social) information that could possible affect them. This results in people perceiving themselves as responsible for the outcome of (hypothetical) situations (Fenigstein, 1984). To clarify, people with hostile intentions should see themselves as the target when a police

officer points in their direction when standing in a group of people, as they are the ones with hostile intentions and as such think that they are somehow responsible for the behavior exhibited by the police officer. Importantly, this effect is amplified by the cognitive accessibility of certain subject matter (Srull & Wyer, 1979). For example, a person who is very vigilant towards threat and danger will perceive ambiguous signals from their direct surroundings as threatening or dangerous more often than a person who does not have these cognitive themes accessible (Moskowitz & Skurnik, 1999; Pilkington & Woods, 1999).

In short, masking true intentions and the vigilant behavior that is the results of this, creates a significant load on a persons' cognitive capacity. This is supported by research into secret keeping and deception (DePaulo et al., 2003; Lane & Wegner, 1995; Smart & Wegner, 2000; Vrij et al., 2008; Zuckerman & Rosenthal, 1981). For example, keeping such tremendous secrets results in a constant cognitive effort to suppress interfering thoughts (Lane & Wegner, 1995; Smart & Wegner, 2000). Hiding the truth imposes a significant strain on someone's cognitive capacity (Vrij, Granhag, Mann, & Leal, 2011). Hiding intentions or keeping secrets involves control over body movement, monitoring situational responses, all the while simultaneously fulfilling certain tasks (Vrij, et al., 2008). This type of self-control leads people to unconsciously leak certain behavior they are trying to actively suppress, as not all behavior can be monitored and suppressed simultaneously; people tend to decrease movement of fingers, arms and hands, of their legs and their head (Burgoon, et al., 2009; Ekman, 2009; Ekman & Friesen, 1972; Vrij, Akehurst, & Morris, 1997; Vrij, Edward, & Bull, 2001; Vrij & Mann, 2004; Vrij, et al., 2008). Even though one might argue that experience with performing certain tasks decreases these signals (McCornack, 1997), it has been shown that telling people of these signs and their capability to betray their intent still results in people displaying this behavior (Vrij, Semin, & Bull, 1996). This concept is supported by research showing that people show stronger signs of deceit when they are more highly

motivated to succeed (DePaulo, 1992).

To summarize, we expect people with hostile intent to portray fewer movement of the arms and head, when compared to people without hostile intent. Furthermore, we expect those with hostile intent to show an increased sense of themselves in their immediate surroundings, and to see themselves as the target of social interaction more often than those without hostile intent.

H1: Individuals with hostile intent show fewer hand and arm gestures, as compared to individuals without hostile intent.

H2: Individuals with hostile intent show fewer head movements than those without hostile intent.

H3: Individuals with hostile intent show an increased self-awareness and awareness of their immediate surroundings, as compared to individuals without hostile intent.

H4: Individuals with hostile intent show an increased perception of themselves as target of social interaction, as compared to those without hostile intent.

Signal. In order to create a greater discernible difference between individuals with and without hostile intent we aim to utilize a (non-) verbal behavior to elicit behavioral responses from individuals. A key aspect that has to be present in order for this concept to work is attention to the signal. Fortunately, attention is (when under cognitive load) exceedingly focused on relevant information (Lavie, 2000, 2005). Research shows that people will pay additional attention to stimuli from their direct surroundings which could be dangerous (Dijksterhuis & Aarts, 2003, 2010) or interfere with their goals (Papies, Stroebe, & Aarts, 2008; Vogt, De Houwer, Moors, Van Damme, & Crombez, 2010). When combining these

findings with our previously outlined explanation regarding interpretation of stimuli as threatening or dangerous, one could expect different reactions towards ambiguous and non-ambiguous stimuli. This warrants the exploration of two different signals to elicit behavioral responses. A strong signal, clearly directed at a person or group should evoke an orientating reflex (i.e., turning your head towards the sound you heard, Ashcraft, 2006, p. 128). Since it is unexpected (Sussman, Winkler, & Schroger, 2003) and presented in a way that it is not open for interpretation as to whom the signal was meant for - it will be perceived as having the potential to threaten or interfere with current goals (i.e., Dijksterhuis & Aarts, 2003; Vogt, et al., 2010) regardless of the individuals' intent. Consequently, it justifies the orientating reflexes. An ambiguous or weak signal, not directed at anyone and without a clear purpose, would thus be open to interpretation and therefore not always enjoy the same orientating reflex[2]. This notion will be clarified in the next paragraph.

H5: A strong signal will result in more orientating reflexes from all individuals, as compared to a weak signal.

An ambiguous signal should be perceived as threatening only by individuals with hostile intent. As was argued above, they are more likely to interpret such a signal as threatening due to the cognitive accessibility of the concepts of threat and danger (Moskowitz & Skurnik, 1999; Pilkington & Woods, 1999). For example, they would reason that behavior exhibited by the police officer is directed towards them (even though this behavior does not have a clear purpose or direction), because they have leaked behavior or other clues as to their intentions and as such actively try to manage their behavior (DePaulo, et al., 2003). Individuals without hostile intent should pay less or even no attention to this signal, as this signal has no clear purpose or direction and can therefore be interpreted by them as irrelevant

[2] Weak and ambiguous are used interchangeably throughout the paper.

and not goal-interfering or threatening (Corbetta & Shulman, 2002). This enables them to focus their attention to more pressing matters (i.e., finishing their goal). Summarizing these differences one expects individuals with hostile intent to display more orientating reflexes towards an ambiguous signal, as compared to individuals without hostile intent. Returning to the exercise of self-control on their behavior, individuals with hostile intent, confronted with a ambiguous signal, experience great strain on their mental resources (cf., Baumeister & Vohs, 2007) and this results in rigid behavior (less arm, hand, finger gestures; e.g., Vrij, et al., 2008). In contrast, we expect individuals without hostile intent to display no rigidity in their behavior when confronted with an ambiguous signal as these individuals do not have to mask their behavior or suppress their intent.

When unraveling the effects of a strong signal, we expect the same behavioral differences to be present. A strong signal is directed at an individual or group, there is less room for debate on whether or not the signal was meant for the group/individual. Therefore an individual with hostile intent should interpret this strong signal as a direct consequence of their own behavior (Fenigstein, 1984; Galbraith, et al., 2008) and reason that he or she has to increase management of his or her behavior. An individual without hostile intent should not have to mask behavior or intent and thus react to a strong signal with an orientating reflex (Ashcraft, 2006, p. 128). This argument raises one question: Does the process of behavior control suppress the orientating reflex? Research shows that humans are capable of suppressing behavior (i.e. when masking the truth, Vrij, 2008) and that behavior is easier to control in the case of expertise (a seasoned criminal for example, see also Ericsson, Charness, Hoffman, & Feltovich, 2006). However, research also shows that behavior suppression is harder when under duress (DePaulo, et al., 2003; Vrij, et al., 1996). We expect that individuals with hostile intent will not be able to suppress this orientating reflex, as they are under duress and because it is a very basic instinct of human nature (Ashcraft, 2006, p. 128).

The result is that they should not differ from individuals without hostile intent when being confronted with a strong signal.

H6: Individuals with hostile intent will show fewer gestures, but more orientating reflexes towards the source of the signal, than individuals without hostile intent, but these differences between individuals will particularly be visible when they are confronted with an ambiguous signal and will be absent when confronted with a strong signal.

Experiment One

Method

Participants and Design. A total of 35 students of the University of Twente took part in our experiment in exchange for one credit (as part of fulfillment for their bachelor degree) and a chance to win an Apple iPod Nano. Participants were randomly assigned to the conditions of a 2 (Intent: Hostile vs. Non-hostile) x 2 (Signal: Strong vs. Weak) design. Seven participants were excluded due to failing equipment or strong external interference during the experimental procedure (i.e., a bystander approaching either the police officer or the participants). This resulted in a total of 28 participants (12 males and 16 females) in a total of 10 sessions. Table 1 shows the distribution of participants in the various conditions. The mean age of the participants was 20.29 years (*SD* = 1.86, *range* = 17 - 25). The sample consisted of 18 German students and 10 Dutch students. All individuals were fluent in Dutch.

Procedure. We conducted the experiment on the campus of the University of Twente. Participants were welcomed in groups of two, three, or four at the same time and asked to read and sign a consent form. The experimenter then proceeded to explain a short experimental outline. We asked participants to wear a heart rate meter, Equivital™ EQ-01

Physiological Monitor, and they took place behind one of four laptops, on which they viewed a prerecorded video briefing[3]. This briefing gave participants an outline of what the experiment would entail. We explained that the goal of the experiment was to evaluate an experimental training in behavioral analysis, which was given to cadets of the police academy. We also used the video briefing to manipulate hostile intent. This video briefing lasted 5 minutes.

We instructed participants that they were going to bring a package from one point on campus to another point. In the hostile intent condition participants were told that they would be carrying a package that contained illegal material (which was a small box, containing sand to weigh it down, which was sealed). If they were stopped by the police cadets who were standing alongside the route, they would be apprehended and detained for questioning and paperwork; as a result the experiment would take longer, for which they would not be compensated. They would also lose their chance at winning an iPod. If they were not apprehended participants would win an extra ticket, doubling their chances at winning an iPod. In the non-hostile intent condition participants were told that they would be carrying a normal package (in fact the same package) and if they were stopped nothing would happen. They would receive an extra ticket just for finishing the experiment, regardless of what would happen. The rest of the instructions were identical. Participants carried the package in an identical white paper bag, regardless of intent.

A confederate (unaware of our hypotheses and Intent conditions), positioned along the short route, dressed in a police uniform, was allowed to stop participants and ask them to show the contents of their bag. For participants with hostile intent this would pose a significant problem; they would be apprehended and detained for questioning and paperwork. Participants without hostile intentions would just be stopped and could continue and finish the

[3] Heart rate data was analyzed separately by colleagues at TNO, Defense, Safety and Security.

experiment. None of the participants were in fact stopped and apprehended.

After the video briefing the experimenter escorted the participants to the starting point and we asked participants to keep a steady pace, but not to run in order to create suspicion. The participants first saw the police officer after turning a first corner. After crossing a predetermined marker the police officer initialized the signal condition. He or she alternated between two predetermined signals to evoke a behavioral response from the participants. This signal consisted of the confederate saying the following phrase in his or her radio: "Code red perceived!" (Dutch = "Code rood gezien!"). The strong version of the signal also consisted of the police officer looking in the direction of the participants, but avoiding eye-contact. The ambiguous, weak signal involved the police officer looking and turning away from the participants while saying the same phrase. We videotaped several seconds before participants turned the first corner until approximately 20 meters along the path after passing the police officer (during, and after the signal) using a high-definition camera from a high vantage point.

The first experimenter awaited their arrival at the end of the route and escorted them back to the same room. Here, participants each filled in a questionnaire on the laptops and received a funneled debriefing in order to ascertain if they had any clue to as what was being tested. The funneled debriefing consisted of several open ended questions to explore how much of the true goal of the experiment was known by the participants. None of the participants indicated that they were aware of the true goal of the experiment.

Measures

Hostile Intent. Three questions were included to evaluate if participants were convinced by our two hostile intent conditions and if they experienced differences in intent. These items were: *"My role in the experiment gave me the feeling that I was doing something illegal."*, *"My role in the experiment gave me the feeling that I had hostile intentions."*, *"My*

role in the experiment gave me an evil goal.". These were answered on a 7-point Likert-scale (1 = *Absolutely disagree* – 7 = *Absolutely agree*, α = .87).

Signal. In order to assess whether participants had correctly perceived the signal of the police officer, we coded the open ended question: *"What did the police officer say?"* (1 = *Left blank*, 2 = *Wrong*, 3 = *Partially correct, code red was mentioned*, 4 = *Correct*). Participants also had to indicate their degree of confidence on correctly hearing what the police officer said. This question could be answered using a 7-point Likert-scale (1 = *Not at all* - 7 = *Definitely*).

Self as target. We included five questions that were used to measure the degree in which participants would see themselves as the target (derived from Galbraith, et al., 2008). These five questions were scored using a 7-point Likert-scale (1 = *Not at all* – 7 = *Definitely*, α = .74). The items were: *"I thought the signal from the police officer was meant for me."*, *"I thought the police officer meant me."*, *"I had a feeling that I was going to be stopped."*, *"I felt like I was the one being addressed by the officer."* and *"I had the idea that the others were paying attention to me."*.

Situational self-awareness. In order to measure the degree as to which participants were aware of their surroundings during the experiment we used the Situational Self-Awareness Scale (SSAS, Govern & Marsch, 2001). This 9-item scale, which was measured using a 7-point Likert-scale (1 = *Absolutely disagree* – 7 = *Absolutely agree;* full scale α = .82), was adapted to focus on the time during the experiment and yields three subscales reflecting private self-awareness (e.g., *"At the time of the experiment, I was having deep thoughts of what my life is like"*; α = .51), public self-awareness or self-consciousness (e.g., *"At the time of the experiment, I was aware of the way I presented myself"*; α = .74) and awareness of immediate surroundings (e.g., *"At the time of the experiment, I was keenly*

aware of everything in my direct surroundings"; α = .88). The subscale regarding private self-awareness was excluded from further analysis, as no improvements to the inadequate reliability could be made.

Awareness of behavioral changes. A self-report measure (see Appendix I for the full measure) was created to measure conscious awareness of any behavioral changes in participants. Participants were asked if they consciously experienced any effects of police presence, made any conscious changes in their cognitive state, or if they made any conscious changes in their physical behavior. A principal component analyses and alphas are reported in the results section. Examples of the twelve items are: "*I felt nervous by the presence of the police.*", "*I tried to hide my emotions.*", and "*I tried to not be conspicuous.*". These questions could be answered on a 7-point Likert-scale (1 = *Not at all* – 7 = *Definitely*).

Video coding. We set up a coding schema based on lie detection research and relevant behavior to our hypotheses, while still being detectable by cameras or police officers (Burgoon, Blair, & Strom, 2008; Vrij, et al., 2008; Vrij, Mann, Leal, & Fisher, 2010). Three intervals were used: the period prior to the signal, the second interval consisted of the period during the signal and a one second period directly afterwards and the third interval started after the second period and lasted until participants were out of viewing range. This enabled us to accurately and separately measure behavioral reactions during those three phases. Unfortunately, only one coder was available. To minimize any observer-expectancy effects (Rosenthal & Rubin, 1978), coding data was merged with experimental data afterwards to ensure the coder was blind to the exact conditions of individuals in the videos.

Several behaviors which participants could exhibit were coded. The number of gestures were coded for each of the three time intervals (e.g., putting your hands in your pocket, going through your hair, touching your face, would each be coded as one gestures

being present). Looking behavior was coded in terms of number of head movements made by participants (e.g., participants could look at the police officer or the ground multiple times before, during or after the signal). If, as a reaction towards the signal, the participants looked in the direction of the police officer, the orientating reflex was coded as being present. An absence of this reaction was coded as the orientating reflex not being present. In addition, for the time periods during and after the signal facial expressions of laughter was coded on a 7-point Likert-scale (1 = *explicitly no expression of laugher present* – 7= *an explicit expression of laugher is present*). Due to limitations of the camera equipment, only the last two time intervals allowed this type of observation.

Results

All questions were analyzed using a 2 (Intent: Hostile intent vs. Non-hostile intent.) x 2 (Signal: Strong vs. Weak) ANOVA, unless otherwise specified. Any violations of ANOVA assumptions are reported per measure.

Manipulation checks

Hostile Intent. The check of the hostile intent manipulation did not show the expected main effect for Intent, F (1, 24) = .22, p < .64. Furthermore, results show that the Signal condition did not significantly affect the experienced intent (F (1, 24) < 1) and no interaction effect was found, F (1, 24) < 1. However, it is imperative to note that this manipulation check was completed after the experiment and only through these explicit questions was experienced intent measured. It could very well be that individuals without hostile intent experienced more duress from their tasks after they saw the police officer, than before the tasks commenced (activating cognitive themes; Srull & Wyer, 1979). The exact opposite could have occurred for individuals with hostile intent, as they would have experienced positive feelings when successfully completing their mission (duping delight; Vrij, 2008).

This negates the differences between participants on such questions. Furthermore, all participants were fluent in Dutch and indicated, after the video instructions, that they did not have any questions. Consequently, we believe that our manipulation of intent was still successful. As a result all subsequent analyses will be done with Intent included as an independent factor.

Signal. Results indicate that participants in the strong signal condition were more confident in their understanding of what the police officer said (M = 5.67, SD = 1.72), than those in the weak signal condition (M = 4.15, SD = 2.44), as a main effect for Signal was found, F (1, 24) = 3.42, $p < .08$. No main effect for Intent or interaction between Signal and Intent was found, Fs (1, 24) < 1. These results are further supported by analysis of the open-ended question pertaining to whether they correctly heard what the police officer said, which showed a significant main effect for Signal, F (1, 24) = 12.38, $p < .002$. Those in the strong signal condition scored higher (M = 3.13, SD = 0.83), indicating a more correct deducting of what the police officer said, as compared to those in the weak signal condition (M = 2.00, SD = 0.82). No main effect for Intent or interaction between Intent and Signal was found, Fs (1, 24) < 1.

Dependent variables

Self as target. Participants in the hostile intent condition perceived themselves as being the target of interaction more (M = 4.47, SD = 1.08), than those with no hostile intentions (M = 3.51, SD = 1.18), F (1, 24) = 5.37, $p < .03$. An interaction effect followed the previous results, as shown in Figure 1, F (1, 24) = 6.68, $p < .02$. A significant simple contrast (F (1, 24) = 12.95, $p < .001$) showed that participants with hostile intent perceived themselves as being the target of interaction significantly more often (M = 4.78, SD = 1.23), than participants without hostile intent (M = 2.86, SD = 1.07), when a strong signal was present.

The other simple contrast did not reach significance (F (1, 24) < 1), indicating that when a weak signal was present the differences between participants with hostile intent (M = 4.07, SD = 0.73) and those without hostile intent (M = 4.17, SD = 0.93) did not differ. No main effect was found for Signal, F (1, 24) < 1.

Situational self-awareness. A marginal significant interaction effect was revealed between the intent and signal conditions on the public awareness subscale, F (1, 24) = 3.49, p < .07. A significant simple contrast qualified this interaction effect (F (1, 24) = 5.32, p < .03), showing that participants with hostile intentions (M = 4.42, SD = 1.34) were significantly more aware of their public appearance than those without hostile intentions (M = 2.95, SD = 1.39), when a strong signal was present. The differences between participants with hostile intent (M = 4.06, SD = 0.88) and without hostile intent (M = 4.33, SD = 1.15) when a weak signal was present did not differ significantly from each other, F (1, 24) < 1. No main effect for Signal or Intent was present for the public awareness subscale, Fs (1, 24) < 1.62, ps > .22.

The analyses of the subscale regarding awareness of the immediate surroundings showed no significant main effects for Signal or Intent, as well as no interaction effect, Fs (1, 24) < 2.80, ps > .11

Awareness of behavioral changes. A principal component analysis (PCA) with varimax rotation on the full range of questions revealed that one questions did not load on any of the three subscales and separate analysis showed no significant results on this question, Fs (1, 24) < 1.26, ps > .27. As this was the only deviating result the analysis was continued with the three presumed subscales, save for this question (see Table 3 and 4). Satisfactory alpha scores are reported for all three subscales, the police presence subscale (α = .90), conscious changes in participants' cognitive state (α = .88), and conscious changes in participants' physical behavior (α = .67). Participants reported being aware of executing more conscious

adjustments in their physical behavior when burdened with hostile intent (M = 3.14, SD = 1.37), as compared to those with no hostile intentions (M = 2.26, SD = 1.33), as a main effect for Intent was found, F (1, 24) = 4.46, $p < .05$. Interestingly, a main effect for Signal was also found (F (1, 24) = 9.04, $p < .01$), as participants confronted with a strong signal reported employing less conscious physical behavior interventions (M = 2.11, SD = 1.22), than those who were confronted with a weak signal (M = 3.38, SD = 1.31). No interaction effect was found, F (1, 24) = 1.36, $p < .26$.

Furthermore, participants reported using more active suppression of sensations, emotions and nerves in the weak signal condition (M = 5.90, SD = 0.97), than in the strong signal condition (M = 4.80, SD = 1.09), as a significant main effect was found for the reported adjustments in their cognitive state as a function of Signal, F (1, 24) = 7.20, $p < .01$. No other main effect for Intent or interaction were revealed for the cognitive state scale, F (1, 24) < 1, as well as for the full scale concerning the effects of police presence, Fs (1, 24) < 1.

Video coding. Where applicable, the results were checked for sphericity (using Mauchly's Test of Sphericity), in order to utilize repeated measures analysis (Field, 2009). Any violations are reported per items.

Gestures. Only one participant exhibited non-verbal gestures without a distinct purpose before the signal. No one displayed any gestures during or after the signal.

Orientating Reflex. A 2 (Intent: Hostile intent vs. Non-hostile intent.) x 2 (Signal: Strong vs. Weak) ANOVA yielded no significant differences when analyzing the presence or absence of the orientating reflex (M = .64, SD = 0.49) of the participants towards the signal, Fs (1,24) < 1.29, ps > .27. This indicates that neither intent, nor signal strength, significantly affected the orientating reflex of participants at the time of the signal.

Looking behavior. As previously noted, the differences in the time intervals are inherent to our experimental procedure and we are therefore interested in any interaction effects, as main effects can be inherently caused by the differences in time intervals (longer time intervals can thus include more occurrences of behavior). A repeated measures analysis was performed, with a Greenhouse-Geisser correction due to a sphericity violation (χ^2 (2) = 10.73, $p < .005$, $\varepsilon = .73$), for Looking behavior being measured at the three time intervals. A main effect for Looking behavior was found, F (1.46, 34.96) = 8.95, $p < .002$. A paired – samples t-test reveals that the number of head movements between time interval one (before the signal; $M = 1.93$, $SD = 1.96$) and two (during the signal; $M = 0.93$, $SD = 0.60$) differed significantly from each other, t (27) = 3.00, $p < .006$. The difference in head movements between time interval one and three (after the signal; $M = 0.82$, $SD = 1.02$) was also significant, t (27) = 3.73, $p < .001$. The total number of head movements did not differ between time interval two and three, t (27) < 1. These results are illustrated in Figure 2 and indicate that participants exhibited significantly more head movements before the signal, as compared to during or after the signal. Unfortunately, we found no other effects that showed any interaction of the different time intervals in which Looking behavior was measured with Intent, Signal, or if a three-way interaction was present, Fs (1.46, 34.96) < 1. Furthermore, when analyzing the results of Looking behavior collapsed over the time intervals no main or interaction effects for Signal and Intent were found, Fs (1, 24) < 1.

Facial expression: Laughing. The analysis of Laughing showed a significant main effect for the time intervals in which Laughing was observed (F (1, 24) = 5.61, $p < .03$), indicating that more participants exhibited laughing facial expressions after the signal ($M = 2.36$, $SD = 2.15$), as compared to when the signal was introduced ($M = 1.57$, $SD = 1.62$). More importantly, a marginally significant interaction effect was found between the time intervals in which laughing was observed and Intent, F (1, 24) < 3.72, $p < .07$. However,

contrasts reveal that the differences between laughing facial expressions during the signal for those with hostile intent (M = 1.43, SD = 1.60) and non hostile intent (M = 1.71, SD = 1.68) were not significant, F (1, 24) < 1. The second simple main contrast was also not significant (F (1, 24) = 1.60, p > .22), indicating that for the time interval after the signal, participants with hostile intent (M = 2.86, SD = 2.35) also did not significantly differ from those without hostile intent (M = 1.86, SD = 1.88). The absence of significant contrasts is likely due to the small sample size (Field, 2009). Furthermore, no interaction effect was present between Laughing and Signal, as well as no significant three-way interaction between Laughing, Signal, and Intent, Fs (1, 24) < 1. In addition, no main effect for Intent or Signal was present, as well as no interaction effect of Intent and Signal, Fs (1, 24) < 1.85, ps > .19.

Discussion

In our experiment we focused on magnifying the behavioral differences between individuals with and without hostile intent by means of a signal sent at greater than interpersonal distance by a police officer. Our primary results lend partial support to our theory as it was shown that being burdened with hostile intent does lead people to experience themselves as being the target of social interaction more often, than those without hostile intent, however, this effect was most pronounced when confronted with a strong signal instead of the originally hypothesized weak, ambiguous signal. Furthermore, individuals with hostile intent confronted with a strong signal were more self-conscious than those without hostile intent and confronted with the same signal, but no significant differences occurred for the ambiguous, weak signal. However, participants did report being more aware of using conscious effort to suppress nerves and emotions, and physical behavioral signs when a weak signal was present over a strong signal and participants with hostile intent also indicated being more aware of consciously suppressing their physical behavior, as compared to those without hostile intent.

In the following paragraph we will argue why a strong signal instead of a weak signal presented our expected results. In addition to these results there was also no difference between participants when looking at their sense of immediate surroundings. However, this form of attention towards the environment is most likely measured more accurately by implicit measures, not available to our experimental setup (e.g., eyetracking; De Houwer, 2006; Gawronski, 2009). The secondary results from the video coding reveal that the orientating reflex and total head movements did not differ between signals or intent conditions. An absence of any gestures was also noted. These surprising results contradict our hypotheses that these differences would be more pronounced when a weak signal, instead of the strong signal, was present. Several explanations are presented for these and our previously mentioned results.

To start with, our experimental setup might affect the preconceived differences in signals. The signal was not presented until individuals crossed a predetermined marker, which means that individuals had already seen the police officer. The police officer is therefore quite possibly, in itself, the unexpected stimulus. This could result in the signal as being less surprising and more probable in general. Some support is derived from the results that show the most head movements in the first period before the signal (i.e., analyzing the police officer), as compared to the other periods. When this theory is merged with our different signals it would result in both signals being interpreted as weaker than anticipated; the strong signal would be the most pronounced signal, while the weak signal might even be interpreted as trivial. Relating this to our theory would result in behavioral signs being visible for only the strong signal, as a less pronounced version of the strong signal should nonetheless be interpreted as threatening due to the cognitive accessibility of the concepts of threat and danger (Moskowitz & Skurnik, 1999; Pilkington & Woods, 1999) and still require the theorized cognitive effort to interpret when hiding intent (cf., Vrij, et al., 2011) as it would not

be considered trivial to the goal of the participants (Corbetta & Shulman, 2002; Dijksterhuis & Aarts, 2010).

Alternatively, a shift in attention could simply be present mentally for both signals, but absent in any physical behavior (spotlight attention; Ashcraft, 2006). This would result in participants not showing dramatic differences in behavior, but nonetheless experiencing the cognitive strains, as is supported by the high overall means for the awareness of cognitive behavior scale and the absence of behavioral differences in the results from the video coding. It can be argued that the absence of behavioral differences could also be the result of the measurement methods. Coding three separate segments might be less effective than looking at the complete video. We elaborate on this possibility in the final paragraph.

A limitation of this experiment must be acknowledged in accordance to the hostile intent check. It would have been better replaced with an information check (e.g., "*What was your goal in the experiment?*"). This would have provided more complete and sufficient information on the hostile intent manipulation. Our manipulation of intent followed suggestions on manipulating intentions by Granhag (2010); there was a clear differences in risk for those with hostile intent, as compared to non-hostile intent and it was similar in design as depicted in the recent paper by Eachus and colleagues (In Press). In addition, the results from the laughing facial expression support the reasoning of experiencing positive feelings when successfully completing the mission, as smiling after getting away with an evil deed, for example a lie, is a key characteristic of duping delight (cf., Ekman, 2009; Vrij, 2008).

Concluding on the effectiveness of the signal is hard at this stage, as behavioral differences are scarce when utilizing our current method of measurement. We believe that it will be more useful to see if intent can be derived from having experts in the detection of deviant behavior analyze the complete videos. The direction of our current results, that a

strong signal is most effective, can then be verified. In a second study, we let experts and non-experts in detecting deviant behavior watch and judge the recorded videos from this experiment.

Experiment Two

Introduction

In our first experiment we set out to explore the concept of using strong or weak signals to distinguish between individuals with hostile and non-hostile intentions. In the second study we further test our methods by having expert and non-expert observers watch the material recorded in the first experiment and judge the intentions of the individuals in the videos. This will allow us to verify our theory, as well as provide additional insights into the inference of intent by means of deviant behavior. In the current study we propose that experts, police officers who have received training in detecting deviant behavior or where it is part of their daily job routine, outperform laypeople in a detection task of deviant behavior and that the perceived reactions of individuals with and without hostile intent towards a strong or ambiguous signal can aid the detection.

Expertise. To elaborate on our expectations we turn to the concept of expertise (for a complete discussion on the definition see Ericsson, et al., 2006, chapter one). Expertise can be seen as having or displaying extraordinary skill or knowledge derived from training and/or experience (Merriam-Webster, 2012). Expertise can be considered highly relevant in camera-observer situations. Expertise allows individuals to accurately discriminate multiple, critical, cues and patterns in hard to perceive situations (Chi, 2006), with which they infer the best answer to a problem (Ericsson, et al., 2006), or in our case to judge intent. In short, experts will achieve greater accuracy (more hits and correct rejections, than misses and false alarms,

see signal detection theory, Green & Swets, 1967) in the judging of intent, than laypeople. Furthermore, experts tend to be able to elaborate their choices better than laypeople (Chi, 2006). We expect the statements of experts to include more behavioral cues as to why they think certain individuals are suspicious, because they will be able to state which precise behaviors they perceived.

H1: Experts in detecting deviant behavior will achieve greater accuracy when inferring intent, than laypersons.

H2: Experts' statements on why individuals are suspicious will contain more cues to why certain individuals are suspicious, as to the statements of laypersons.

Drawing on our proposed theoretical framework, it is further expected that both signals will compliment experts' judgments of intent. Specifically, an ambiguous signal should reveal clear behavioral differences between individuals with and without hostile intent, as it should only be perceived as threatening to those with hostile intent and therefore aid the discrimination between intentions. However, it can be deemed possible that not only experts benefit from these behavioral differences, as a better contrast between individuals with and without hostile intent should also benefit laypeople (Green & Swets, 1967; Parasuraman et al., 2009). Therefore we expect that the overall accuracy of both experts and laypeople is high when an ambiguous signal is present in the video material. Contrary to the expected effects from the ambiguous signal, a strong signal should only complement experts' judgments. To clarify, we expect all individuals, regardless of intent, to react towards a strong signal. Therefore the contrast should be less obvious for laypeople judging a video in which an ambiguous signal is present. Experts, on the other hand, can discern patterns and cues in these types of complex situations (Chi, 2006) and combine these cues to infer the best possible judgment (Ericsson, et al., 2006). The resulting reactions of individuals with and without

hostile intent adds to the cues already perceived by experts and could therefore be decisive for their more accurate judgment.

H3: Experts in detecting deviant behavior will achieve higher accuracy scores than laypeople when the individuals they are judging are confronted with a strong signal, as opposed to a weak signal.

In order to create a better contrast one can also focus the attention of those viewing the material towards certain aspects in the detection task, thereby honing attention towards relevant information (i.e., Lavie, 2005; Parasuraman, et al., 2009). To test if this concept can be generalized to our experimental setting, we included an instruction condition, designed to focus attention towards the reactions of the individual when the signal was presented. It is expected that providing a reference point will aid in the accuracy of the detection task (cf., Green & Swets, 1967; Parasuraman, et al., 2009; Vrij & Mann, 2004) and thereby creating better accuracy scores when this instruction is present, as compared to when this instruction is absent.

H4: Experts and laypeople who receive an instruction to focus on the moment the signal is presented will achieve greater accuracy in determining intent, than those who do not receive an instruction.

Method

Participants and design. A total of 60 people took part in our experiment. Nine participants were excluded due to various reasons (i.e., all open ended questions were answered with complaints about the experiment or not following instructions).This resulted in 51 useable participants; 17 of which were experts from the DKDB (Royal and Diplomatic Security Service) and KLPD (Dutch National Police Department) and 34 were students. Experts took

part as an activity in their training and students received one credit (as part of fulfillment for their bachelor degree). The expert and student groups were comprised of 15 and 16 males, and 2 and 18 females respectively, with mean ages being 35.94 years (*SD* = 7.48, *range* = 27 - 47) for experts and 22.71 years (*SD* = 3.01, *range* = 18 - 31) for students. All participants were randomly assigned to the two instruction conditions (Instructions: Present vs. Absent). We obtained ten videotaped sessions from experiment one (average length was 29.6 seconds). One of these sessions contained only two participants with hostile intent as a result of the randomization. This video was used as practice video in order for participants to become familiar with the procedure of the second study and excluded from the final analyses. As a result, the remaining nine videos from experiment one were used as material in the second study (five with a strong signal present, four with an ambiguous signal present). Of the 28 people in these videos, 14 people were burdened with hostile intent and 14 were without hostile intentions.

Procedure. The experimenter welcomed the participants, asked them to read and sign a consent form and then proceeded to explain a short experimental outline. Participants took place behind a laptop and received further information on the laptop. The experiment was coded in Authorware 7.0. The first task consisted of participants judging the videos recorded in experiment one. Each video was shown in full screen without the video controls present. Participants were told that they had to indicate which person or persons in each video they suspected of carrying illegal material with them. We stated per video how many people were carrying illegal material (cf., Macmillan & Creelman, 2005). We included one practice video, after which participants could redo the complete practice round one additional time before continuing to the rest of the experiment. In addition, participants randomly received one of two instruction conditions. In the instruction condition the participants read: *"Tip: Pay attention to the behavioral responses when the participants walk by police officer."*. In the

other condition this instruction was absent. Participants viewed each video once, after which participants indicated, on a still image of the video, which people in the video were carrying illegal material in their bag and how sure they were of this judgment. After answering these questions they viewed the video again and could repeat the video a maximum of three times. Following the second viewing, participants again answered an open-ended question on which people were suspicious and they were asked to write down what behavior(s) constituted this choice for them. This procedure was the same for all videos in the first task. After the participants watched all videos, they answered several questions on what behaviors the individuals in the videos displayed that were used most often to infer their judgments on who carried illegal material, on the police officer and the videos themselves. Followed by demographic questions and a debriefing in the program, but were also allowed to ask the experimenter any remaining questions.

Measures

Total accuracy. Participants indicated for each person in the videos if they were carrying illegal material. Because each video contained both people with and without illegal material, several possibilities were derived depending on the role of the people in the video. People carrying illegal material were classified as a hit (when correctly identified) or a miss (when not identified as a person carrying illegal material). The people not carrying illegal material in the videos were classified as a false alarm (when he or she was identified as carrying illegal material when he or she was in fact not doing so) or a correct rejection (when he or she was identified as not carrying illegal material). For example, any participant judging a video in which three people were shown with one these people carrying illegal material makes one judgment on which individual in the video is carrying illegal material. By marking

one person the participant is automatically casting a verdict over the other individuals as well. If the participant marked a person not carrying illegal material as the one who they think is carrying illegal material a false alarm is coded for that judgment. Because the participant only has to mark one person, the other two individuals (the one with the illegal material and the one without) are then automatically marked as one miss, as the person carrying the illegal material was not successfully identified, and one correct rejection, as the last person is indeed not carrying illegal material.

Hits, misses, correct rejections and false alarms were calculated separately for Signal (Strong vs. Weak signal videos) and times Viewed (Video was viewed once vs. Video was viewed multiple times). A subsequent total accuracy measure indicating both hits and correct rejections was then computed and is reported as a percentage for each of the four possible combinations (after one viewing for strong signal videos, after one viewing for weak signal videos, after multiple viewings for strong signal videos, and after multiple viewings for weak signal videos). A perfect score of successfully identifying all hits and correct rejections reflects 100% accuracy, while scoring only false alarms and misses reflects a 0% accuracy score (see also, Porter, Juodis, Ten Brinke, Klein, & Wilson, 2010). If participants indicated that no one was suspicious in their eyes and they only made a forced choice due to the given distribution after the first viewing, a miss or correct rejection was coded in the multiple viewing measures.

Discrimination accuracy (d') and response bias (β). Participant's discrimination accuracy (d') and response bias (β) were calculated using Signal Detection Theory (SDT; Green & Swets, 1967) methods. These are two powerful, theoretically independent measures (Macmillan & Creelman, 2005; Stanislaw & Todorov, 1999). d' measures sensitivity (i.e., the ability to (successfully) distinguish between those carrying illegal material and those who do not). When d' is negative and low, the participant is misperceiving the stimuli (those with

illegal material as those without and vice versa). When d' is positive and high, the participant is displaying accurate discrimination of stimuli and when d' is near zero the participant is not discriminating between either stimuli (i.e., perceiving those with or without illegal material as correct only part of the time). β, also called likelihood ratio, captures the participant's response bias. A positive value of β shows that the participant has a liberal tendency to rule that he or she observed that illegal material is being carried. A negative value of β shows that the participant has a more conservative response to who is carrying illegal material (i.e., the tendency to rule that illegal material is not being carried).When β is near zero it shows that the participant has no response bias and therefore shows approximate equal errors (equal amounts of misses and false alarms)[4]. We calculated these measures for the results following the first viewing of the videos, as well as for the results after watching the videos multiple times. This was done for strong and weak signal videos separately. This resulted in four measures.

Instructions. We included two control questions to see if the instructions focused participants' attention towards the moment in the video where the participants reacted to the signal. We asked participants to indicate if they inferred their judgment at the specific moment of the signal and if they made use of the reactions of the people in the video at the moment they walked past the police officer, using a 7-point Likert-scale (1 = *Absolutely disagree* – 7 = *Absolutely agree*).

Confidence. Participants indicated each time they made a judgment on who was carrying illegal material how confident they were of the judgment they just made, using a 7-point Likert-scale (1 = *Very unsure* – 7 = *Very sure*). The scores for weak and strong signal videos were calculated separately.

[4] As participants were informed beforehand on the distribution, the differences in β should be marginal between groups, as neither group should be indicating more or less individuals with illegal material than the given distribution.

Expertise. To further uncover expert and laypersons differences we asked if participants could indicate if they were distracted by the police officer when he or she spoke. We also included two more questions to see if participants making these judgments were experiencing any uncomfortable feelings and if they felt that they saw any difference between participants in general. These questions were all answered using a 7-point Likert-scale (1 = *Absolutely disagree* – 7 = *Absolutely agree*).

Basis of judgment. In order to uncover on what grounds the judgments were made participants were asked: *"I utilized [nonverbal signs; physical signs or body movement; facial or emotional signs; the signs pertaining to the reaction towards the police officer] to infer if the participants in the videos were carrying illegal material."*. Using 7-point Likert-scales (1 = *Absolutely disagree* – 7 = *Absolutely agree*).

Suspiciousness. We coded the open-ended questions regarding why certain individuals in the videos were or were not suspicious using the same indicators that were answered for the basis of judgment questions, as well as reactions towards the signal and another separate category for any other statements that did not fit with the previous five categories. To clarify, a statement of a participant could read that he or she utilized the walking pattern of the people in the video to infer his or her judgment, while simultaneously using the facial expression of the individuals to finalize his judgment. In this example we would code that physical behavioral signs were present in his or her statement, as well as facial signs. Therefore two behavioral cues were present in his statement. Due to the question being open-ended and not providing any guidelines in regard to how the participants should answer this question, we only coded if any of these behavioral cues were absent or present per statement. The statements for videos in which a strong or weak signal was present were calculated separately,

forming two measures indicating the amount of signs used for either strong signal videos or weak signal videos.

Elaborateness of the statements. We also coded the open-ended questions regarding why certain individuals were suspicious using a word count. Two average measures were calculated for both strong and weak signal videos.

Results

Total accuracy[5]. A repeated measures ANOVA was conducted with Signal (Strong vs. Weak signal videos) and times Viewed (Video was viewed once vs. Video was viewed multiple times), as within-subjects variables with Expertise (Experts vs. Students) as a between-subjects factor. Confidence intervals are reported in order to reflect the difference in accuracy scores within each group more accurately, as depicted by Porter and colleagues (2010). A significant main effect for Signal was found (F (1, 49) = 10.95, $p < .002$), indicating that participants achieved greater accuracy rates for the videos in which a strong signal was present (M = 56.05% [95% CI = 51.84 – 60.27%] ± 2.10%), as compared to the videos in which a weak signal was present (M = 45.77% [95% CI = 41.79 - 49.75%] ± 1.98%). No main effects were found for viewing the videos once or multiple times, as well as no further interaction effects between Viewing and Expertise, Signal and Expertise, Viewing and Signal or three-way interaction, Fs (1, 49) < 2.40, ps > .17.

A significant main effect for Expertise was uncovered, F (1, 49) = 6.44, $p < .01$, indicating that experts achieved higher overall accuracy scores (M = 54.26% [95% CI = 49.93

[5] Preliminary results showed only a significant, but unexpected, four-way interaction on total accuracy (F (1, 47) = 5.84, $p < .02$), of Viewing (Video was viewed once vs. Video was viewed multiple times) x Instructions (Present vs. Absent) x Expertise (Expert vs. Student) x Signal (Strong vs. Weak signal videos). Only three contrasts reached significance, whereby two contradicted the instruction condition (results showed significant difference in accuracy scores for experts and students on weak signal videos both with and without instructions present). Furthermore, instructions showed no significant main effects on the manipulation checks as well, Fs (1, 47) < 1.12, ps > .30. It was therefore decided to omit the instruction condition as a between-subjects factor and collapse the data over these conditions for all analyses.

– 58.60%] ± 2.16%), as compared to students (*M* = 47.56% [95% CI = 44.49 – 50.62%] ± 1.53%). See Table 4 for a summary of the accuracy scores.

Discrimination accuracy (d') and response bias (β). A repeated measures ANOVA was run for *d'* with the four scores on the strong and weak signal videos after watching the videos once or multiple times as the within-subjects variables and Expertise as the between-subjects factor. Only a significant main effect for Signal was found, F (1, 49) = 7.22, $p < .01$. This indicated that strong signal videos (M = 0.33, SD = 0.87) enjoyed greater discrimination accuracy, than weak signal videos (M = - 0.10, SD = 0.77). As outlined in the previous section, a mean close to zero indicates bad discriminatory power of the stimuli. Therefore, a positive mean shows here that participants were better able to discriminate between individuals with and without hostile intent when a strong signal was utilized by the police officer in the video. No main effect for Expertise or Viewing and no further interaction effects between Viewing and Expertise, Signal and Expertise, Viewing and Signal or three-way interaction were found, Fs (1, 49) < 2.49, ps > .12.

A repeated measures analysis was also run for *β*. A significant main effect for the times watching the videos emerged (F (1, 49) = 8.39, $p < .006$), as participants were having slightly less response bias after watching the videos multiple times (M = 1.01, SD = 0.29), as compared to after just watching it once (M = 1.14, SD = 0.38). Furthermore, a marginal significant interaction effect was present between Expertise and Signal, F (1, 49) = 3.16, $p <$ .08. However, as it only approached significance no significant simple contrasts were present for strong signal (F (1, 49) = 2.26, $p > .14$) or for the weak signal videos, F (1, 49) < 1. No main effect for Expertise and no further interaction effects between Viewing and Expertise, Signal and Expertise, Viewing and Signal or three-way interaction were found, Fs (1, 49) < 2.19, ps > .15.

Basis of judgment. Four univariate analyses of variance were run with Expertise as the independent variable and the various questions pertaining to the signs used to infer judgment as the dependent variables. A significant main effect for Expertise was found on the usage of the reactions of the people in the video towards the police officer (M_{total} = 6.10, *SD* = 1.06), *F* (1, 49) = 6.51, $p < .01$. Students indicated that they used this reaction more (*M* = 6.35, *SD* = 0.77), as compared to experts (*M* = 5.59, *SD* = 1.37). Even though the usage of facial expressions and emotions had the lowest average score (M_{total} = 3.67, *SD* = 1.68) it did show a marginal significant main effect for Expertise, *F* (1, 49) = 3.75, $p < .06$. Experts indicated that they relied more on these specific signs (*M* = 4.29, *SD* = 1.80), as compared to students (*M* = 3.35, *SD* = 1.56). However, neither the use of non-verbal gestures (M_{total} = 5.67, *SD* = 1.26), or the use of physical behavior and appearance (M_{total} = 5.08, *SD* = 1.92) to infer judgment showed any differences between Expertise, as no significant main effects were found, *F*s (1, 49) < 1.83, *p*s > .18. See Table 6 for a summary of the means for experts and students.

Expertise. Several other differences between students and experts were uncovered. A significant main effect for Expertise was found on the questions *"I had more attention for the police officer when he or she spoke, than for the students."* (*F* (1, 49) = 7.18, $p < .01$), indicating that students (*M* = 3.68, *SD* = 2.32) were more easily distracted by the actions of the police officer in the videos when watching these videos, than experts (*M* = 2.00, *SD* = 1.58). Another significant difference between expertise was found on the question *"I thought there was no difference between participants in the videos."*, *F* (1, 49) = 9.65, $p < .003$. Experts saw greater difference between participants as they scored significantly lower (*M* = 2.71, *SD* = 1.36), than students (*M* = 4.18, *SD* = 1.70). Even though both groups did not seem to experience a lot of uncomfortable feelings towards judging others in these videos, students (*M* = 2.88, *SD* = 1.84) did show a marginal significant difference from experts (*M* = 1.94, *SD* = 1.25), *F* (1, 49) = 3.61, $p < .06$.

Confidence in judgments. A mixed ANOVA was run with the confidence in judgments made for strong signal and weak signal videos as the within-subjects variables and Expertise as the between-subjects factor. A significant main effect for Signal emerged (F (1, 49) = 9.98, $p < .003$), indicating that the judgments that followed weak signal videos surprisingly enjoyed significantly more confidence (M = 4.10, SD = 1.34), than those that followed strong signal videos (M = 3.65, SD = 1.31). A significant main effect for Expertise was also present (F (1, 49) = 5.91, $p < .02$), indicating that experts (M = 4.45, SD = 1.32) were more confident in all their judgments, as compared to students (M = 3.59, SD = 1.31). No interaction effect was present, F (1, 49) < 1.

Suspiciousness. A mixed ANOVA was run with the suspiciousness scores for strong and weak signal videos as the dependent variables and Expertise as a between-subjects factor. The statements showed a significant main effect for the differences between signal strength, F (1, 49) = 28.92, $p < .001$. Participants stated more cues towards why they thought certain people were suspicious following the strong signal videos (M = 9.28, SD = 2.28), as compared to the videos in which a weak signal was present (M = 7.75, SD = 2.65). No interaction effect was present and no main effect for Expertise was present, Fs (1, 49) < 1. Indicating that experts did not include significantly more cues in their statements, as compared to students. Table 6 shows the means and standard deviations for strong and weak signal videos for students and experts separately.

Elaborateness of the statements. The average word count for strong and weak signal videos was used as a within-subjects variable with Expertise as a between-subjects factor. A significant main effect for Signal was revealed, F (1, 49) = 12.06, $p < .001$. Participants used on average less words in the statements for strong signal videos (M = 23.32, SD = 14.17), as compared to the weak signal videos (M = 25.79, SD = 14.34). Furthermore, a significant

interaction effect between Signal and Expertise was found, F (1, 49) = 7.56, p < .008. However, none of the contrasts reached significance (Fs (1, 49) < 1), suggesting that this might be affected due to the large deviation in average words used per statement (Field, 2009). Table 7 shows the means and standard deviations in greater detail. No main effect for Expertise was found, F (1, 49) < 1.

Discussion

As was expected experts outperformed laypersons in their performance judging individuals bearing hostile intentions (supporting hypothesis 1). Contrary to our third hypothesis, both students and experts seemed to benefit more when a strong signal was present, as compared to when a weak signal was present in the videos. For one, all participants, regardless of expertise, reported more behavioral cues following strong signal videos, as compared to the weak signal videos. This was reflected in greater discrimination accuracy between individuals with and without hostile intent when a strong signal was present. Curiously, these unexpected results do compliment our results from the first experiment, seeing as how the hypothesized differences occur when a strong signal is present instead of a weak, ambiguous signal. Finally, the reported confidence in these judgments was contrary to the accuracy results; higher confidence was reported for weak signal videos, as compared to strong signal videos and it was higher for experts than for students. We will elaborate on the differences in signal strength more in the general discussion. For now we will converse on the possibility of successfully detecting intent through the observation of multiple cues, absence of effects from the repeated viewing and the instructions, as well as noting limitations of this study.

As was hinted towards at the end of the first experiment, analysis of the complete video could allow individuals judging the videos to carefully observe multiple cues per person in the video and compare these observations with those made of the other people in the

videos. Following our second hypothesis, we expected this to be reflected in the statements given by the participants, especially by experts, who would be better able to elaborate their thought process and thereby provide more elaborate statements (Chi, 2006; Ericsson, et al., 2006). Contrary to our expectations, experts and laypeople did not differ significantly from each other when comparing cues obtained from their statements, as well as no significant differences in length of their statements were obtained. However, we believe that due to the length of the videos, all participants were able to identify multiple cues in each video (see Table 6). In short, one can conclude that watching the full videos did enable all participants to observe multiple cues, and that a strong signal complemented these observations.

On a more definitive note is the fact that repeated viewing only showed a slight, but significant, decrease in response bias. Because we included the distributions of hostile intent and non-hostile intent an already stable response bias was ensured. Including the distributions negates forced choices and preconceived distribution models (Leal, Vrij, Mann, & Fisher, 2010; Vrij, et al., 2008), which occur with these types of observer experiments (Vrij, 2008). Thus the small change in response bias might have occurred due to the coding of the repeated viewing measures. Participants who indicated none of the people in the video were suspicious might have unknowingly lowered their response bias, because individuals in the videos were then coded as correct rejections and misses.

Of further interest is the absence of any effects from the instructions, which contradicts our fourth hypothesis. One possible explanation lies with the task itself; judging a video is longer than an average attention response task in which stimuli are presented at a fast pace, which is the usual task in which an instruction can (dramatically) increase performance (Parasuraman, et al., 2009). The relevance of the signal could very well have been figured out by participants due to the length of a video. This is supported by the fact that a large portion of the participants indicated that they utilized this moment, in addition to the other cues, to

infer their judgment and that it was not limited to the group who received the instructions.

One key limitation of this study must be acknowledged. Unfortunately, the programming of the experiment did not allow for us to pinpoint the exact time which it took for participants to make a judgment during the first viewing. A response time could possibly reveal greater differences between experts, as well as signal efficiency. Especially since experts can master difficult tasks quicker (Ericsson, et al., 2006).

We can concluded that experts clearly outperformed laypeople, but the differences between groups were small when a strong signal was present and only when comparing all participants' scores on the strong signal video with the weak signal did significant differences appear in performance appear. Taken together, the scores of the weak signal were significantly lower, but as the accuracy levels show these are mostly due to the dramatic differences in scores of laypersons, as compared to experts, on weak signal videos. Thereby suggesting that the strong signal aided students the most, but as an interaction effect was absent, a definitive answer has yet to be revealed. In our general discussion we will elaborate on the effectiveness of the signal.

General Discussion

In this paper we set out to answer the question if an agent can successfully use a signal that relies on a greater than interpersonal distance to distinguish between individuals with and without hostile intentions. Our first experiment suggests that hostile intent leads people to experience the proposed increased feelings of being the target of social interaction and increase conscious suppression of behavior, while also making them more aware of their presentation in public when a strong signal was present. Generating a visible behavioral gap between individuals with and without hostile intent proved more difficult when looking at the

direct responses to the signals. However, as our second study showed, these differences can be detected by experts in the field of deviant behavior, as they outperformed laypersons in a detection task with the videos that were the result from the first experiment.

The vocal point of our study, the use of a signal from greater than interpersonal distance, reveals promising results. However, contrary as to what was originally hypothesized, most of the effects did not occur when a weak signal was present, but when a strong signal was present. Several arguments can be made for which version of the signal is the 'better' one. On the one hand, if one looks solely at the accuracy scores from the detection task, a strong signal is better for all; experts rise above chance and students improve dramatically as compared to a weak signal. A weak signal revealed dreadful scores for laypeople, but experts still displayed scores around the level of chance, indicating that they either benefitted from the weak signal, or alternatively, were drawing on their expertise to make correct judgments. On the other hand when looking at the differences in behavior we see from our first experiment that hardly any differences were noticeable when only looking at the moment either of the signals was used. When taking into consideration the total time for which participants were visible, more definitive behavioral cues were reported when a strong signal was present. But individuals in the first experiment who were confronted with a weak signal reported being more aware of suppressing behavior (while also suppressing emotions and nerves), when comparing it with the strong signal, thereby possibly negating this difference. It can therefore be argued that experts scored better due to their experience with deviant behavior, but this does not account for the quite dramatic increase in accuracy scores when a strong signal, instead of a weak signal was present for laypersons. In clearing up these results one could utilize a more elaborate, but for us unavailable, setup to provide further clarification. A 2 (Intent: Hostile vs. Non-hostile) x 3 (Signal: Strong vs. Weak vs. No signal present) design would clarify if a weak signal aided experts or if they utilized their expertise

and thus achieving analogous accuracy scores across two or all possible conditions of the signal. Furthermore, as was previously suggested, the theoretical weakening of both signals by the presence of the police officer could also prove a fruitful subject to uncover in an additional research project. If a weak signal would have appeared trivial, can this be proven by current scientific methods? No clear answer can be provided from our data, but the effect of a signal can nevertheless severely aid the detection of hostile intentions, as additional behavioral information always aids the total amount of information that is needed to infer a judgment on intent (Lousberg, et al., 2009). In short, a strong signal is believed to be effective. More behavioral cues were reported, accuracy scores were higher, regardless if it was weakened.

An additional point, pertaining to the role of the police officer, is raised following our results. It was shown that the reactions of individuals with and without hostile intent towards the police officer were used to infer judgments in the second experiment. It was furthermore noticeable that individuals with hostile intent showed more head movements before the signal was present. It can be argued that this behavior is linked to a form of scrutinizing the police officer. The police officer in itself might therefore function as a type of signal, or better yet as a precursor for the signal; enabling people to prepare themselves for whatever the action would be from the police officer. It is questionable whether the police officer reduced the behavioral signs by just being there, but our experiment does not allow us to control for this possibility. Our setup did include every effort to mask the true actions and intentions of the police officer, as he or she was not visible until individuals turned the corner and they were told that the police officer could apprehend them, which he or she in fact did not.

The current research into (the detection of) hostile intent is only just taking off. It is interesting to see that the results following our first experiment validate several of the theorized psychological phenomenon that can occur when burdened with hostile intent and

complement recent findings of elevated stress levels (both psychological and physiological) when individuals are burdened with hostile intent in an experimental setting (Eachus, et al., In Press). Eachus and colleagues (In Press) also obtain an interesting finding that they found no significant observable differences in visible behavior. This further supports our research goal of evoking clear behavioral differences between individuals with and without hostile intentions to successfully aid the detection of intent. Drawing on research into deception, we believe that the most fruitful road to follow is that of cognitive load (cf., Vrij, et al., 2011). The concept of a limited amount of mental resources that are still available while hiding intentions, the truth or regulating behavior (e.g., Baumeister & Vohs, 2007; Vrij, et al., 2008) should enable future research to pinpoint the optimal moment in time when to utilize a signal to uncover the most dramatic differences in behavior.

Several limitations to this contemporary study need to be acknowledged. The sample size was small for our first experiment and a bigger and different pool of experts could reinforce the results from our second experiment. Therefore the results need to be interpreted with caution and replication of our study is warranted. Furthermore, some comments from the experts revealed that they would like to test their expertise with deviant behavior judging a more realistic setting. For example, an environment in which other people, unrelated to the experiment, would also be present when the police officer utilizes the signal. Their comments indicated that this would aid the discrimination effect as individuals with hostile intent should then be less limited in their means of avoiding the police officer.

What is now needed for future research is a more elaborate experimental setup in which hostile intent can be manipulated in a more ecological valid environment, but at the same time a more controlled experimental setup is also warranted to explore the various forms of the signal and its effectiveness. Providing additional data will create unison as to which signal should be employed.

Conclusion

This paper aimed at uncovering the potential use of a (non-) verbal signal from greater than interpersonal distance to magnify the differences between individuals with hostile intent and those with normal intentions. It was verified that individuals with hostile intent showed an increased experience of being the target of social interaction and that they were more publicly self-aware. Behavioral differences were scarce, but experts were able to detect which individuals were harboring hostile intention significantly better than laypersons. Contrary to expectations a strong signal produced these pronounced effects. More behavioral cues were reported following videos in which people were confronted with a strong signal, as well as both experts and students achieving a greater accuracy in their judgments of which person was harboring hostile intent, as compared to when a weak signal was present. Future research should replicate and validate these fruitful results in a more elaborate and natural setting, and include a specific condition in which no signal is used to track detection changes from a baseline accuracy score by experts and laypersons.

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Appendix

Appendix I: Experimental questions

	Self as target	Zeker Niet						Zeker wel
	Ik dacht dat het signaal van de agent betrekking had op mijzelf.	1	2	3	4	5	6	7
	Ik dacht dat de agent mij bedoelde.	1	2	3	4	5	6	7
	Ik had het idee dat ik zou worden aangehouden.	1	2	3	4	5	6	7
	Ik voelde mij aangesproken door de agent.	1	2	3	4	5	6	7
	Ik had het idee dat de anderen op mij lette.	1	2	3	4	5	6	7
	Awareness of behavioral changes Tijdens het experiment (heb ik)…	Zeker niet						Zeker wel
	… mijn spanning proberen te verbergen.	1	2	3	4	5	6	7
	… mijn zenuwen proberen te verbergen.	1	2	3	4	5	6	7
	… mijn emoties proberen te verbergen.	1	2	3	4	5	6	7
	… geprobeerd niet op te vallen.	1	2	3	4	5	6	7
	….geprobeerd extra normaal over te komen.	1	2	3	4	5	6	7
	…de agent expres niet aangekeken.	1	2	3	4	5	6	7
	…zodra ik de agent zag mijn looppad aangepast.	1	2	3	4	5	6	7
	…zodra ik de agent zag mijn looptempo verhoogd.	1	2	3	4	5	6	7
	…voelde ik mij gespannen	1	2	3	4	5	6	7

	door de aanwezigheid van de politie.							
	…voelde ik mij zenuwachtig door de aanwezigheid van de politie.	1	2	3	4	5	6	7
	…voelde ik mij in de gaten gehouden door aanwezigheid van de politie.	1	2	3	4	5	6	7
	…voelde ik mij verdacht door de aanwezigheid van de politie.	1	2	3	4	5	6	7

Tables and Figures

Tables

Table 1. *Number of participants per experimental condition (N).*

	Weak Signal	Strong Signal	Total
Hostile Intent	6	8	14
Non-hostile Intent	7	7	14
Total	13	15	28

Table 2. *Means (M), Standard Deviations (SD) and Correlations between experimental scales.*

		M	*SD*	1	2	3	4	5	6	7	8
1.	Intent: Hostile intent (1) / Non-Hostile intent (2)	1.50	0.51	1	.07	-.12	.15	-.32	-.40*	-.24	-.33
2.	Signal : Strong signal (1) / Weak signal (2)	1.46	0.51	.07	1	.07	.48**	.46*	.10	.18	.03
3.	Awareness of behavioral changes: Police presence subscale	4.87	1.26	-.12	.07	1	.48**	.34	.51**	.09	.10
4.	Awareness of behavioral changes: cognitive behavior subscale	5.31	1.16	.15	.48**	.48**	1	.33	.32	.21	-.01
5.	Awareness of behavioral changes: physical behavior subscale	2.70	1.40	-.32	.46*	.34	.33	1	.38*	.44*	.03
6.	Self as target scale	3.99	1.21	-.40*	.10	.51*	.32	.38*	1	.30	.14
7.	SSAS: Public self-awareness	3.95	1.30	-.24	.18	.09	.21	.44*	.30	1	.49**
8.	SSAS: Awareness of Surroundings	4.20	1.52	-.33	.03	.10	-.01	.03	.14	.49**	1

*** = p < 0.01, * = p < 0.05 Scale Categories: (1 = Not at all – 7 = Definitely)*

Table 3. *Results of the factor analysis of the twelve items used to measure awareness of behavioral changes.*

Items	Component			
During the experiment…	1	2	3	4
Factor 1: Effects of police presence				
I felt nervous by the presence of the police.	.87			
I felt watched by the presence of the police.	.86			
I felt tense by the presence of the police.	.86			
I felt suspicious by the presence of the police.	.75			
Factor 2: Cognitive state				
I tried to hide my nerves.		.91		
I tried to hide my tension.		.87		
I tried to hide my emotions.		.80		
I tried to be extra normal.		.66		
Factor 3: Physical behavior				
I raised my walking tempo, as soon as I saw the police officer.			.82	
I purposely did not look at the police officer.			.77	
I adjusted my walking path, as soon as I saw the police officer.			.71	
Factor 4:				
I tried to not be conspicuous.				.92
Eigenvalue	5.00	1.75	1.58	1.09
Percentage of variance explained	41.68	14.62	13.2	9.09

Table 4. *Means (M), Standard Deviation (SD) and correlation between variables awareness of behavioral changes.* [a]

	During the experiment…	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	I tried to hide my tension.	5.39	1.29	1	.92**	.62**	.10	.65**	.30	.17	.12	.58**	.54**	.43*	.39*
2.	I tried to hide my nerves.	5.07	1.36	.92**	1	.72**	.11	.61**	.31	.09	.17	.59**	.55**	.44*	.29
3.	I tried to hide my emotions.	5.29	1.49	.62**	.72**	1	.27	.41*	.20	.22	.06	.34	.33	.26	.03
4.	I tried to not be conspicuous.	5.75	1.40	.10	.11	.27	1	.35	.09	.23	-.15	.18	.12	.03	.03
5.	I tried to be extra normal.	5.50	1.26	.65**	.61**	.41*	.35	1	.42*	.43*	.13	.38*	.33	.06	.26
6.	I purposely did not look at the police officer.	3.71	2.43	.30	.31	.20	.09	.42*	1	.37	.52**	.23	.24	.25	.17
7.	I adjusted my walking path, as soon as I saw the police officer.	2.29	1.36	.17	.09	.22	.23	.43*	.37	1	.44*	.19	.28	.19	.21
8.	I raised my walking tempo, as soon as I saw the police officer.	2.11	1.42	.12	.17	.06	-.15	.13	.52**	.44*	1	.24	.34	.25	.34
9.	I felt tense by the presence of the police.	4.86	1.46	.58**	.59**	.34	.18	.38*	.23	.19	.24	1	.93**	.73**	.56**

10.	I felt nervous by the presence of the police.	4.71	1.61	.54**	.55**	.33	.12	.33	.24	.28	.34	.93**	1	.75**	.56**
11.	I felt watched by the presence of the police.	5.11	1.34	.43*	.44*	.26	.03	.06	.25	.19	.25	.73**	.75**	1	.56**
12.	I felt suspicious by the presence of the police.	4.79	1.37	.39*	.29	.03	.03	.26	.17	.21	.34	.56**	.56**	.56**	1

*** = p < 0.01, * = p < 0.05 Scale Categories: (1 = Not at all – 7 = Definitely)*

[a] *N = 28*

Table 5. *Total Accuracy scores (Hits + Correct Rejections in percentages) for times watching the video x signal strength x instructions.*

	Strong signal				Weak Signal					
	Once		Multiple times		Once		Multiple times		Total	
	M (%)	*SD* (%)	*M* (%)	*SD* (%)	*M* (%)	*SD* (%)	*M* (%)	*SD* (%)	*M* (%)	*SD* (%)
Experts	58.82	12.45	55.66	14.27	50.53	14.36	52.04	15.51	54,26	14,15
Students	55.20	17.09	54.53	15.43	38.87	15.29	41.63	13.54	47,56	15,34
Total	56.41	15.66	54.9	14.92	42.76	15.84	45.10	14.92	50,91	14,75

Table 6. *Means and standard deviations for the basis of judgments.*

	Experts		Students	
	M	*SD*	*M*	*SD*
Non-verbal signs	5.47	1.33	5.76	1.23
Physical and body signs	5.59	1.46	4.82	2.08
Facial and emotional signs[a]	4.29	1.80	3.35	1.56
Reaction towards the police officer**	5.59	1.37	6.35	.77
Reaction towards the signal*	4.59	2.06	5.56	1.33
Average amount of cues stated for weak signal videos[b]	8.00	3.14	7.50	2.40
Average amount of cues stated for strong signal videos[b]	9.29	3.51	9.26	2.39

** = Significant at p < .05, ** p < .01.*

[a] = Was marginally significant p < .06.

[b] = Difference between Signal was significant at p < .001, but no main effect for Expertise was present.

Table 7. *Means (M) and Standard Deviations (SD) the average word count per statement.*

Signal	Students		Experts	
	M	*SD*	*M*	*SD*
Strong Signal	24.58	15.28	20.80	11.64
Weak Signal	25.28	14.52	26.35	14.38

Figures

Figure 1. *Interaction effect self as target.*

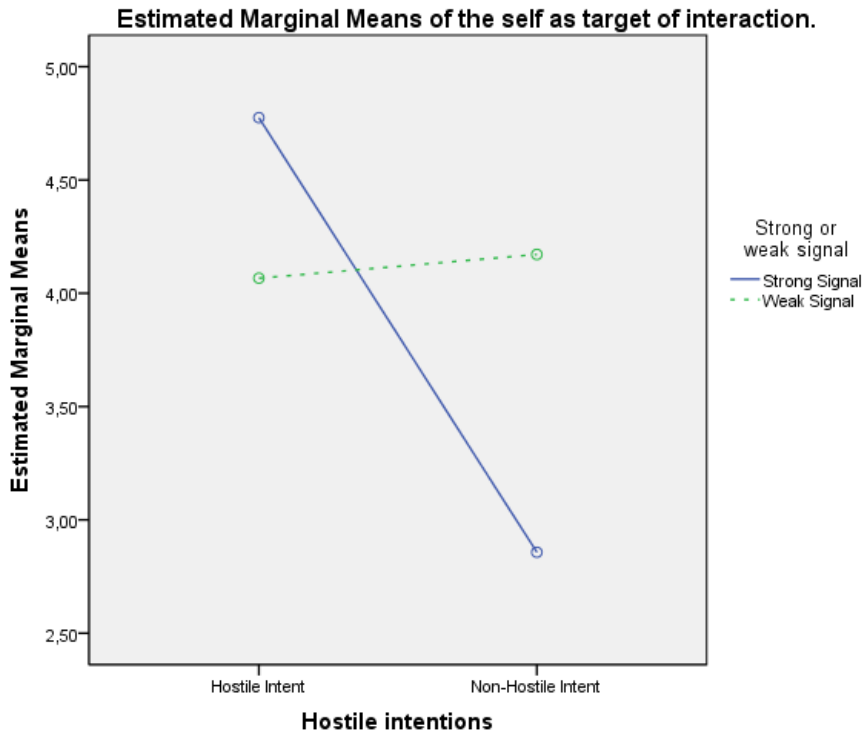

Figure 2. *Main effect comparing looking behavior at three time intervals.*