Deception and Communication Media

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Abstract

Much research investigating deception and its detection has focused upon face-to-face communication, but over recent years the variety and extent of new communication media has changed the contexts in which deception might take place. Although work has attempted to characterise communication media, a much smaller body of research exists which has investigated the frequency with which people lie with different media and the detection of deceit under different communication media conditions. Through questionnaires and experimental studies, this work investigated the perceptions that both deceivers (senders) and those attempting to identify lies (receivers) have about communication media and how this relates to their observed behaviour. Results from questionnaire studies suggested that both the characteristics of deception and media influence people's perceived discomfort and believability when lying and the media choices they might make if they are planning to deceive. Some important factors appeared to be the seriousness of the deception, who senders are lying to, and the general frequency with which they use particular means to communicate. Communication media were judged to be similar and dissimilar to each other on a range of characteristics which may impact their appropriateness for deception and lie detection. There was evidence that media used at low frequency in daily life may be more likely to be chosen for deception. In laboratory studies, senders were found to lie more frequently using audio-only media compared to audio-video. There was evidence from experimental studies that detection of deceit was more successful when communication was audio-only compared to audio-video. There was little consistent evidence that judgement biases varied between media conditions, but a truth bias was identified in experimental studies. No evidence was identified that interactivity between senders and receivers significantly influenced response biases or lie detection accuracy. A small corpus of messages recorded under audio-video and audio-only conditions were selected for their detectability or believability from two senders, and presented in modified formats to receivers. Stimuli had video removed or introduced, and were presented as audio-only, audio-video, text-only and video-only. The results suggested that detectability of audio-video and audio-only stimuli was dependent upon the condition stimuli were recorded under rather than presented. When messages were only seen and not heard or read, accuracy of lie detection was compromised. There was evidence that judging transcriptions could allow successful detection, but the accuracy of lie detection was typically lower than demonstrated in richer media conditions. These findings may imply that a combination of information channels and/or paraverbal information is important for accurate classification of honesty and lies. Limitations of the studies and directions for further research were discussed.

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Contents

1. Introduction

Before reporting the motivation for, design and findings from the questionnaire and experimental work conducted, we first briefly introduce the key areas which have driven research in deception and in particular, deception and communication media. We then review the previous research themes which have emerged in the literature in more detail. These include the frequency of deception, perceptions and media choices which are made by people who may be deceiving. We also review work investigating the perceptions and behaviour of those attempting to detect deception and the accuracy of detection. We review work which has focused upon communication media and the interaction with deception research. Chapter 3 introduces the approach and methodology which will be employed for the research studies reported here and raises some general questions which we attempt to provide evidence to help answer. We summarise some key findings from previous literature which drive the research questions and the analyses we conduct. Introductory sections conclude by outlining the structure of this thesis.

Research investigating the frequency of deception has found it to be fairly commonplace. Diary studies have revealed that up to a third of interactions may be deceptive (e.g. DePaulo, Kashy, Kirkendol, Wyer & Epstein, 1996a; Hancock, Thom-Santelli & Richie, 2004). Deception is significant, not only because it may be so prevalent, but also because of the negative consequences that may result. Some authors have argued, however, that it is an important "social lubricant" (Vrij, 2008). Deception conceivably pre-dates language, but for the purposes of this work, only deception using written or spoken language will be considered. Hereafter, people attempting to engage in deception will generally be termed ***senders*** but may also be referred to as deceivers or liars. The targets of senders' deception, will generally be termed ***receivers***, but may also be termed observers or detectors, depending on the context.

Many definitions of deception have been considered, but in this work it will be regarded as "**a deliberate communicative act in which the intention is for one person (the sender) to bring about a false belief or conclusion in another person (the receiver) who does not know that they are being deceived.**"

Although many of our interactions are face-to-face, over recent decades, a greater variety of communication media have become available, they have become more common in our daily interactions and they have become increasingly embedded in both civil society and the state. This trend appears set to continue. Many of us communicate daily with friends, family and work colleagues via email, telephones, text-chat services, videoconferencing and mobile phone texts (SMS). Videoconferencing services are becoming important means to facilitate collaborative work and negotiate and build interpersonal links across continents. Recently, video and audio conferencing has brought both young offenders and adults into courtrooms as defendants and witnesses, and allowed prisoners to argue their case for parole without leaving prison.

Communications linking social, political and sometimes terrorist organisations routinely cross the globe through a myriad of channels. Given the potential consequences of not identifying deception and disbelieving those telling the truth, it is important to investigate whether there is evidence that the means by which people communicate influences the likelihood and characteristics of deception and its accurate detection.

The influence of communication media on deception might be upon the:

- **Perceptions of senders** about their deceptive behaviour and of communication media
- **Behaviour of senders** when faced with the opportunity to lie or tell the truth
- **Perceptions by receivers** about deceptive behaviour, detection and communication media, and the tendency to judge others as honest or deceptive
- **Behaviour of receivers,** the ability of receivers to discriminating truth from deception

Various theories of deception have emerged from research over the last few decades. These theories can be categorised into those that focus upon the sender, what they do and why they do it, and those that focus upon the receiver and how they may successfully discriminate deception from honesty. In terms of the sender, research has investigated the frequency of deception, the varying motivations for deception, the targets of deception and the behaviours that deceivers exhibit (both verbal and non-verbal). Diary studies have suggested that people tell lies quite frequently, but that the majority of lies are of little consequence to the deceiver (DePaulo, et al., 1996a). It has been suggested that lies are qualitatively different if classified as self-serving or other-oriented lies (Vrij, 2000) or high and low stakes lies (Mann, Vrij & Bull, 2002). These conceptualisations have driven the research that has been looking for systematic differences in behaviour between deceptive and truthful senders.

A number of reviews (Vrij, 2000, 2008; DePaulo, et al, 2003; Sporer & Schwandt, 2007) have analysed the myriad of studies of cues to deception. Vrij (2000) stated that "research has shown that deception itself is not related to a unique pattern of specific behaviours" (p. 241), but suggested that liars may experience greater negative emotion, stress and a higher cognitive load than truth tellers. In later work, Vrij (2008) also writes that "no theoretical perspective predicts that diagnostic nonverbal cues to deception, akin to Pinocchio's growing nose, exist" (p. 37).

In a comprehensive review of the literature regarding the cues to deception, DePaulo et al. (2003) found a number of non-verbal behaviours that were significantly different between liars and truth tellers. There were some non-verbal behaviours identified that reliably indicated dishonesty, such as pitch and vocal tension, however there were few visual cues.

These cues to deception are of most importance for receivers and their attempts at detection. In terms of receivers, the focus has been upon how people perceive deceptive behaviour, how good people are at distinguishing truths from lies and what needs to be done in order to detect deception more successfully. Research has consistently indicated that people believe there to be signals that reveal deception. This work has shown that lay people are not alone in making this assumption, members of the security services and judiciary tend to assume that there are a number of behaviours that will change when people are engaged in deception, and that these tend to be non-verbal behaviours (e.g. Taylor & Hick, 2007). There is little evidence to support this supposition. However, there *is* evidence that under some circumstances detection of deception can be better than chance performance would suggest (for reviews see e.g. Bond & DePaulo, 2006; Vrij, 2008). For example, Vrij, Edward, Roberts & Bull (2000) reported a study where 85% of liars were correctly classified using nonverbal behaviour alone. However, relatively few studies have compared lie detection accuracy under different communication media conditions.

In parallel, a number of theories of communication media and media choice have emerged over the last few decades which have implications for deception and detection. One strand of research has investigated senders and their choice of communication media with which to deceive. The theories are based on the idea that media vary in their characteristics and affordances, including, for instance, their capacity to transmit classes of behavioural cues. Media which are interactive and which have multiple information carrying channels are said to be richer than those that are asynchronous, lacking feedback and with few informational channels (Daft & Lengel, 1986). Media richness theory (Daft & Lengel, 1986) predicts that deceivers would choose media that are richer and more interactive because deception is a complex task and deceivers are assisted by the opportunity to use cues to persuade and observe receivers' reactions. Some research has been reported which support the concept of media richness as a driver behind media choice for deception (e.g. Carlson & George, 2004). On the other hand, social distance theories as described by Hancock et al. (2004) suggest that senders would try to minimise the transmission of cues that might lead to their detection and would choose leaner media (e.g. text-chat or email) with which to deceive. Hancock et al. (2004) suggest that such uni-dimensional characterisations of media are inappropriate and it is the interplay of a range of features that predict which media senders are likely to choose for deception. Diary studies have led to the suggestion that senders are most likely to deceive with the telephone, followed by face-to-face and text-chat and least with email (Hancock et al., 2004). In the majority of media choice studies, it has been hard to distinguish when people choose media with which to attempt preplanned deception, and when they choose to deceive while already using a communication media.

Theories that people hold about the behaviour and motivations of liars influence the beliefs people have about detection. The beliefs people have about lie detection also interact with the assumptions and attitudes they have about communication media. These perceptions might also be expected to influence actual lie detection and interact with actual media characteristics. The telephone, for example, carries the majority of verbal cues that may reveal deception (DePaulo et al., 2003), but it may be possible that people also believe they will be less detectable when using a telephone and consequently not control their behaviour as carefully.

This work investigates the influence that communication media has on deception and detection through two main methodological strands. Firstly, questionnaire studies were reported which aimed to assess people's general use of communication media, perceptions of media characteristics and the likelihood they would use media for various examples of deception. These studies were intended to provide evidence with external, real-life validity and complement experimental studies. Laboratory-based experimental studies examined the behaviour and perceptions of senders and of receivers in paired interactions, telling the truth, deceiving and attempting to detect deception with various communication media. These media types are: audio-video and audio-only conferencing, and face-to-face. These studies were conducted in order to produce internally valid comparisons of some communication media and used restricted categories of media and deception. Further experimental studies attempt to unpack the features of the messages which might lead to biased judgements of honesty or deception and the impact they had on people's ability to accurately classify senders' veracity. Some practical outcomes and suggestions for further work are discussed.

2. Review of the literature

Our social lives are built upon communication; one might argue that our social lives *are* communication. We communicate with and about other people and our environment; we communicate our feelings, opinions and desires.

Though many definitions of deception have been conceived, current research tends to use those similar to that proposed by Buller and Burgoon (Buller & Burgoon, 1996) "a message knowingly transmitted by a sender to foster a false belief or conclusion by the receiver" (p. 98). This definition is worth scrutinising as it has a number of important characteristics. Firstly, it suggests an acceptance of the information transmission model of communication. According to this conceptualization, communication consists of messages which are constructed and transmitted by senders through some communication channel(s) to receivers. Secondly, in terms of Buller and Burgoon's (1996) definition of deceptive communication, it is important that the message is deliberately and knowingly constructed by senders in order to create a false belief in receivers, which therefore excludes accidental misunderstandings by receivers, unintentionally misleading messages and messages which are factually false, but the sender believes to be truthful. This conceptualisation of deliberate does not imply a deliberate intention to harm, but is intended to exclude unintentionally, and with no awareness, misleading other people.

However, an appropriate definition of deception also needs to exclude jokes and irony where the intention may be to foster a false belief in the receiver, but only for a socially defined period of time. The Buller and Burgoon definition also does not encompass deception by omission. Ekman (1988) defines deception such "in a lie one person makes the choice to mislead another person. No prior notification is given about this intent" (p.163). This definition does not include an appreciation that deception is a communicative act and therefore for this thesis I will use a working definition of deception as "a deliberate communicative act in which the intention is for one person (the sender) to bring about a false belief or conclusion in another person (the receiver) who does not know that they are being deceived."

It does not make any moral statement about the nature of the communication. Deception might be argued to pre-date language, but for the purposes of this work, only deception using written or spoken language will be considered. Hereafter, people attempting to engage in deception will be termed ***senders*** and the targets of their deception ***receivers.***

The conceptualisation of communication as a process of exchanging information through channels of some kind reveals its origins in information theory. This supposition may be contentious but it is a useful analytic tool in which to think about the role of communication medium. The typical setting of communication is face-to-face, but the range of communication media available has enormously expanded in variety and extent over the last few decades. Given the ubiquity of both deception and the variety of communication media in our everyday lives, it is important to ask whether there is evidence for an interaction between communication media and deception. This interaction is encapsulated in the research approach discussed in later sections.

2.1.1 *Motivations for lying and the characteristics of lies*

The motivation to lie may be in order to protect oneself, to protect others or merely to amuse the sender, the so-called *duper's delight* (Ekman, 1988). According to the self-presentational theory of deception (DePaulo et al., 2003) the majority of lies are not planned long in advance. They arise from spontaneous conversation as a response to immediate demands of the interaction. They are of little consequence to the deceiver and they are told in order to avoid embarrassment, to flatter and to manage the impressions receivers have of senders. Lies come in many shapes and forms, ranging in content, type and importance from perhaps inconsequential "white lies" told to protect other people's feelings or out of politeness such as "I like your new shirt" when in fact you do not, to serious, consequential lies to avoid being caught for crimes. They may be outright lies, exaggerations, subtle or merely avoidance of telling the truth. Some researchers have functionally separated lies on the basis of: high and low-stakes lies, ***self-serving*** and other-oriented lies (Vrij, Akehurst, Soukara & Bull, 2004) and the targets of lies (DePaulo et al., 1996a).

2.1.2 *Frequency of lies*

Lies are common. In diary studies, DePaulo et al. (1996a) found that a general community sample of people reportedly told on average a lie a day and they told a lie in 20 percent of their interactions. A college student sample reported telling two lies a day and lied in one out of three interactions. Hancock et al. (2004) found that a university student population reported lying approximately 1.6 times a day on average and a third of their interactions involved some deception. According to some research, deception also pervades negotiations (Haselhuhn, Schweitzer & Kray, 2008; Schweitzer, Brodt & Croson, 2002). Although deception appears common, some studies have indicated that people do not all lie to the same degree. Serota, Levine & Boster (2010) asked participants to record in a diary when they told lies, and found that on average people told a lie once or twice a day. However, they report a highly skewed distribution; a few people told many lies, the majority told very few. People have also been shown to lie less to close relationship partners compared to casual acquaintances and strangers (Millar & Millar, 1995 cited in Millar & Millar, 1998; DePaulo & Kashy, 1998)

2.2 Theories of Deception

It has become common in deception literature to state that people are rarely able to distinguish lies from honesty more accurately than would be expected by chance. However, in an extensive meta-analysis, Bond and DePaulo (2006) reported that although discrimination accuracy is often found to be poor, there is evidence to suggest that people are capable of detecting deception at a small, but significantly non-trivial level of accuracy. In practise this may mean that the majority of lies go undiscovered. The finding also suggests that under some circumstances detection accuracy may be impressively high. Some of the low findings of low detection accuracy may be accounted for by the methods used for investigation. Many studies of deception detection have perhaps suffered from ecological validity. Studies have been laboratory based, where senders have been telling lies with little motivation to escape detection. DePaulo et al. (2003) and Vrij (2008) report a number of studies which have indicated that more motivated senders may be detected significantly more often than unmotivated senders (e.g. DePaulo & Kirkendol, 1989). Even for lies told in daily life, there is evidence that the majority of deceptions are generally unplanned, and people do not worry about being caught; they regarded the majority of lies as trivial (DePaulo et al. 1996a). DePaulo, Kirkendol, Tang and O'Brien (1988) reported that classification of lies and truths was more accurate when the stakes for participants were high compared to when low.

There is evidence that many receivers (including professional lie detectors, such as police officers) pay attention to cues which are not diagnostic of deception (e.g. Akehurst, Kohnken, Vrij & Bull, 1996). Such receivers often achieve low detection accuracy, but when receivers pay attention to some verbal cues they may be much more accurate in their judgements (e.g. Mann et al., 2002). Vrij (2008) reports that trained receivers can classify truths and lies with average accuracy of 58% compared to untrained receivers who achieve an average accuracy of approximately 53%. A number of studies have used actors as senders (e.g. Stiff et al., 1989) which raise questions about the ecological validity of any deception cues they might produce. The low accuracy often found for detecting lies may also be in part a result of judgement biases. Bond and DePaulo (2006) report in their meta-analysis, that receivers judged 56% of messages as honest and only 44% as deceptive. This truth bias has been identified in a number of studies (e.g. Levine, Park & McCornack, 1999) and may be in part responsible for low lie detection accuracy. In summary, although the accuracy of detecting lies has often been reported as low, there are a range of contexts in which detection may be improved (Vrij, 2008). These contexts are typically where senders are motivated to escape detection and/or consequences of being caught are high and when receivers listen to what receivers say rather than observe how they behave. There is also evidence that detection may also be improved when senders' statements are spontaneous rather than planned, and the behaviour of senders when being truthful is also observed (Vrij, 2008).

A number of researchers have developed theories to account for people's accuracy at detecting deception. Of course, these theories all assume that there are differences in the observable behaviour of deceivers compared to people being honest (including verbal behaviour). A number of aspects of these various theories can predict the influence that communication media may have on deception detection.

- Theory of non-verbal leakage (Ekman & Friesen, 1969, cited in Vrij, 2008)
- Motivational impairment effect (DePaulo et al., 1988)
- Self-presentational theory of deception (DePaulo et al., 2003)
- Interpersonal deception theory (Buller & Burgoon, 1996)
- Cognitive demands (e.g. Vrij, Granhag, Mann & Leal, 2011)

Ekman and Friesen's non-verbal leakage theory makes a number of claims about liars. They argue that when liars are highly motivated to succeed (certainly with high stakes lies), they experience affective feelings associated with arousal, anxiety, guilt, shame and excitement. Senders intending to deceive will attempt to control the nonverbal signals they believe will alert receivers to their arousal. They also claim that the face is easiest to control as it provides high levels of feedback to the sender and as such will be least likely to display signals of arousal and is therefore not useful as a tool for detecting deception. Ekman and Friesen (1969) contend that the body and limbs, in contrast: provide little feedback to senders, are hard to control and are most likely to show any nonverbal signs of arousal. The limbs and body therefore are argued to be a more effective channel through which receivers might detect deceit. They argue that the hands are moderately controllable and fall somewhere between the face and limbs in revealing internal levels of arousal. However, the evidence to support these claims has been limited. Vrij (2000) reported evidence that body movement is actually reduced during deception. According to Warren, Schertler and Bull (2009), there is "substantial evidence that facial expression are of prime importance in the leakage of suppressed affective reactions" (p. 60). They cite evidence that felt emotions automatically trigger facial affective displays for the majority of universal emotions and that although masking or inhibition of these displays is learnt from a young age, leakage of these expressions occurs through facial muscles or micro-expressions (e.g. Ekman et al., 1983; Ekman 2001 cited in Warren et al., 2009). Warren et al. (2009) reported an average accuracy of classifying lies and truthful responses to emotional stimuli of some 64%. They found a much reduced accuracy of classification for unemotional stimuli and argue that their results support the emotional leakage theory.

The motivational impairment effect (DePaulo et al., 1988) suggests that deceivers who are highly motivated will have: reduced control over leakage cues, increased behavioural rigidity and improved verbal performance. The theory predicts that this impairment as a result of elevated motivation will result in an increased likelihood of detection (e.g. DePaulo et al., 1988; Mann et al., 2002). There is some evidence that more motivated liars are more easily detected (DePaulo & Kirkendol, 1989). DePaulo, Lanier and Davis (1983) reported that motivated liars were less easily detected when vocal cues were available, but more successfully detected when nonverbal cues were available. The theory is similar to the emotional leakage conceptualisation which suggests that liars experience negative emotion which results in various behaviours which may reveal their deception. There is however, much evidence that the majority of lies induce little negative emotion in senders (DePaulo et al, 1996a).

The central tenet of the self-presentational theory of deception (DePaulo et al., 2003) is that lies are an everyday part of our social lives and are mostly told in order to assist in positive self-presentation. The majority of lies are unplanned, they are of little consequence to the sender and they are told in order to avoid embarrassment to either sender or receiver, to flatter and to manage the impressions receivers have of senders. Vrij (2008) argues that receivers are not always motivated to discover the lies they are told, the so called "ostrich effect" as discovery may not be in receivers' interests. This suggests that the majority of deceptions may also be of little consequence to receivers. DePaulo and Bond (2006) suggest that the self-presentational approach to deception is one side of a double standard that people hold about deception, and that this is the reason detection is so often unsuccessful. When engaged in deception, people regard their lies as socially necessary, inconsequential and unexceptional. DePaulo et al. (1996a) found that liars often feel little anxiety, guilt or shame. However, when being deceived, receivers expect liars to be feeling high levels of anxiety, guilt and fear of exposure because of a stereotypical view of deception as uncommon and immoral. Characterised as such, liars are expected to show all the signs of such negative affect, they fidget, avoid eye contact and leak the non-verbal signs of their deceit. There is much evidence to support the suggestion that this stereotypical view of liars' behaviour holds for much of the population (e.g. Akehurst et al., 1996; Vrij, Edward & Bull, 2001). This theory attempts to explain why the majority of lies, which are trivial and do not induce guilt, will be hard to detect. Receivers are likely to be looking for the stereotypical signs of deception, that is, negative affect. As senders are unlikely to be experiencing such emotion, these signs will rarely be displayed. However, the more uncommon serious, consequential lies may be more likely to be accompanied by negative emotions and may be used for effective detection. Of course, these signals of negative emotion may also accompany many other communicative contexts including situations inducing embarrassment and innocent denials of guilt.

Interpersonal deception theory (Buller & Burgoon, 1996) proposes that the dynamic interaction between senders and receivers is of crucial importance. A fundamental proposition is that the cognitions and behaviours of both senders and receivers will vary systematically with factors related to the interactivity of deceptive communication contexts. According to the theory, senders strategically plan and construct their messages, attempt to suppress cues that may reveal their deception and watch for signs of suspicion. Receivers try to suppress any signs of suspicion. Communicating partners will behave differently depending on the degree of interactivity that the communication medium provided. The theory makes some quite specific predictions about how the communicating partners will behave under conditions of more and less context interactivity.

Buller and Burgoon (1996) claim that in more interactive contexts such as face-to-face, senders will a) behave more strategically i.e. more information, behaviour and image management; b) behave less non-strategically i.e. less arousal, lower performance, less positive affect and c) engage in more self-monitoring. In more interactive contexts receivers will a) judge senders as more credible and b) achieve lower accuracy in detecting deception. The theory also makes a number of predictions regarding the interaction for both partners. Specifically that a) the degree of communication interactivity will be positively related to expectations of honesty and b) senders will perceive suspicion when it is present.

Burgoon and her colleagues (Burgoon, Buller & Floyd, 2001) have attempted to unpack the factors which constitute interactivity and have identified;

- Contingency – that each person's discourse is dependent upon and responsive to the other's discourse
- Transformation – that interdependence and feedback result in a dynamic communication
- Participation – that the communication is between both parties
- Synchronicity – that the communication is in real-time and not delayed

Factors which may influence interactivity are also suggested to include;

- Mediation – whether communication is mediated by technology
- Propinquity – whether participants are geographically co-located or not
- Modality and information richness – the range of informational channels and cues that participants have access to

- Retrievability – whether messages be retrieved and reviewed

Interpersonal deception theory has been criticised by DePaulo, Ansfield and Bell (1996b) and DePaulo et al. (2003) who have suggested that despite numerous theoretical assumptions and considerable research effort, interpersonal deception theory fails to explain the mechanisms responsible for deceptive message production. They argue that it also fails to explain the cognitive processes involved in the interpretation by receivers of deceptive messages. They claim that interpersonal deception theory is a useful description of the processes which characterise deceptive interactions but no central explanatory mechanism is ever described. They also criticise interpersonal deception theory for confusing interpersonal and interactive processes. However, some findings which lend support for the predictions of interpersonal deception theory have been reported. Burgoon, et al., (2001) presented evidence that if senders interacted with strangers, behavioural and perceptual mutuality were initially higher under dialogue than monologue, and the behavioural advantage was sustained over time. They argue that mutuality takes the form of a perceived connectedness which leads people to behave differently than if they had not interacted. Information and speech management (clarity, relevance, directness and fluency) were found to be better for truths than lies, but also for dialogue over monologue. Little evidence was identified that detection accuracy was influenced by interactivity and the study suffers from some methodological drawbacks. Participants did not have the same stimuli for interactive/non-interactive conditions and each pair of interactants only assessed a single truthful and deceptive message. DePaulo et al. (2003) reported that in interactive contexts, liars offered fewer details in their verbal statements than did truth-tellers. This finding may not support the predictions of interpersonal deception theory that deceivers will achieve greater involvement and fluency.

A considerable body of research has posited that deception is a more cognitively demanding task than truth telling (e.g. Anolli & Ciceri, 1997; Vrij, Akehurst & Morris, 1997; Zuckerman, DePaulo & Rosenthal, 1981). Vrij (2008) proposes that extra cognitive resources may be required for: the construction of lies, and remembering details to ensure coherence; they may tend to take the effort to monitor receivers' reactions more closely than when telling the truth; they may be preoccupied with role-playing and reminding themselves to act in a certain way; and liars have to suppress the truth while they are deceiving. Lying may not always be more difficult of course. When asking for the reason for being late for an appointment, it may be easier to lie and say traffic was bad rather than explain the complex series of events that actually caused the delay.

If deceptive communications can be distinguished from honest messages, there must be differences between the behaviour that people display when deceiving, compared to when truthful, be that verbal or nonverbal behaviour. A significant body of work has attempted to find out what these cues to deception might be. A consequence of such work has also been to assess whether, if such cues exist, they may be used in applied settings to improve detection rates. These investigations have focused on non-verbal behaviours, conceivably driven in part by folk psychological theories of deception. If such cues to deception exist, their nature and modality will influence whether they have any predictive value to receivers when communicating with visual, textual, auditory or communication media which support a combination of modalities.

2.2.1 *The behaviour of deceivers - cues to deception*

As mentioned earlier, a number of recent reviews (Vrij, 2000; Vrij, 2008; DePaulo, et al., 2003; Sporer & Schwandt, 2007) have struggled to demonstrate that deception is related to a unique pattern of specific behaviours. Some research has identified a range of non-verbal behaviours that were significantly different between liars and truth tellers (DePaulo, et al., 2003). There were a number of non-verbal behaviours that were associated with dishonesty, and they tended to be those related to a self-presentational perspective on deception.

2.2.1.1 Gestural cues to deception

Limb movements, self manipulations (for instance, touching the face or grooming hair) and illustrators (hand movements which accompany and illustrate speech) have been found to decrease with deception (Vrij, 1991, reported in Vrij, 2000). Gaze aversion, smiling and head movements are not systematically associated with deceptive behaviour and eye contact is more likely to increase. DePaulo et al. (2003) reviewed more than 300 articles and examined the association of 158 different cues with deception. They found evidence for only two facial behaviours that increased during deceptive behaviour (eye contact and eye-blinks) from a list of 16 facial cues, and no body movements from a list of thirteen cues. They also identified a number of non-verbal behaviours that were significantly different between liars and truth tellers. Liars displayed fewer of the gestures used to illustrate and accompany speech. Using a measure termed non-verbal immediacy (which included an assessment of interpersonal proximity, leaning and facing the other person) they found that liars were less immediate, they were more distanced from their partner and were described as more impersonal. They also reported that when people were motivated to succeed, liars made significantly less eye contact than when telling the truth. The discrepancy in eye-contact findings between DePaulo et al. (2003) and other studies may illustrate the importance of moderators of cues to deception and the potential importance of context and the pitfalls of generalisation.

2.2.1.2 *Verbal cues to deception*

The majority of reliable cues to deceit have been found in the verbal content or delivery of senders' speech (Porter & Brinke, 2010). They suggest that liars are more likely to repeat words, details and phrases, and they may appear more evasive, unclear and uncertain in their answers. When responses were not planned in advance, there was a longer latency between the question and answers given by liars, a finding previously reported by Walczyk, Roper, Seemann & Humphrey (2003). In terms of the verbal content, deceivers show fewer first-person and more third-person references, vague descriptions and repeated details, and more terms which indicate negative affect. In terms of paralinguistic features, that is the non-word elements of speech such as prosody, intonation and pitch, DePaulo et al. (2003) found that liars were more vocally tense and tended to speak at a higher pitch. Liars also tend to show increases in speech disturbances and decreases in speech rate (Vrij & Heaven, 1999, cited in Taylor & Hick, 2007; Porter & Brinke, 2010).

2.2.2 *Perceived cues to deception*

Many studies have indicated that people believe liars are likely to display certain behaviours (e.g. Zuckerman, DeFrank, Hall, Larrance & Rosenthal, 1979), that tend to be those they assume to be associated with nervousness and anxiety. These findings are consistent with the notion that deception arouses negative emotions in senders (Ekman, 1988). Akehurst et al. (1996) report that people believe liars are nervous and will therefore exhibit nervous behaviour. In their questionnaire study, participants rated 64 items of facial behaviour, body movements, speech characteristics and Statement Validity Analysis criteria with regard to whether they believed them to increase or decrease in frequency during deception. Statement Validity Analysis is a technique designed to assess the qualities of the content of a statement, such as descriptions of others' feelings, or logical consistency (Steller & Kohnken, 1989). The items were rated with reference to both their own and others' behaviours. The vast majority of behaviours were thought by participants to increase in frequency or intensity for themselves and others. These included non-verbal behaviours such as smiling and limb and head movements. Some behaviours were expected to decrease, such as eye contact. Facial behaviours may be attended to more closely than bodily or verbal cues, however, there is little evidence that facial cues are diagnostic of deception (e.g. Hocking, Bauchner, Kaminski & Miller 1979 cited in Stiff, et al., 1989).

There are also verbal behaviours which people appear to believe are associated with deception. According to Bond and DePaulo (2006) it's commonly believed that deceivers tell longer stories and that pauses in speech will be more frequent. Burgoon et al. (2008) argue that contrary to stereotypical views "deceptive messages may be briefer with sparser details; less clear and straightforward; and more indirect, depersonalized and irrelevant" (Burgoon, Blair & Strom, 2008, p. 577). Some evidence has been reported that there are differences in perceived cues depending on the seriousness of the deception. Taylor and Hick (2007) investigated the beliefs which people hold regarding the cues to deception. Participants associated more nervous behaviours with serious lies in comparison to when people tell trivial lies. Some behaviours were expected to occur less frequently when people tell trivial lies in comparison to when telling the truth.

Some research has suggested that it is a combination of behaviours which leads people to believe deception is taking place, particularly when some cues appear to be incongruent with others. Senders have been found to be judged as more likely to be deceiving when speech and facial cues appear to contradict each other in a number of studies (Zuckerman, Driver & Koester, 1982b; Rotenberg, Simourd & Moore, 1989). Heinrich and Borkenau (1998) also found evidence that receivers' judgments of deception were related to perceived cross-modal discrepancies in impressions of senders' agreeableness (they measured other personality traits and found little relation between discrepancies and deception ratings).

A study by Gilovich, Savitsky and Medvec (1998) investigated the *illusion of transparency*. This is the tendency for people to overestimate the extent to which others can discern their internal states. These states are felt to "leak out" and be more visible to observers than is actually the case. It is suggested by Gilovich et al. (1998) that this "leakage" only occurs when a person is experiencing an intense emotional state, such as when lying or feeling disgust. They reported a study in which participants consistently overestimated the likelihood that they would be discovered when required to deceive a panel of observers. In one study, they found that senders believed they would be discovered as a liar by 49% of the receivers when in fact only 26% were. The actual accuracy rate of lie detection was indistinguishable from chance. Savitsky (1997, reported in Gilovich, et al., 1998) found evidence that people overestimate how clearly their facial expressions communicate their emotional states. Gilovich et al. (1998) proposed that a precondition for the illusion of transparency is that the individual must believe that there is a route by which their internal state can leak out and be detected by others. A key point is that the beliefs which people hold regarding deception and communication channels may predict whether senders will experience the illusion of transparency. A prime example is deception, where people appear to commonly have theories about the non-verbal behaviours that unconsciously accompany their falsehoods.

There is a general expectation that deceptive communications are revealed by visual information even within the research community (for example, Lewis, 2009) and are consistent across culture and country (Bond & DePaulo, 2006). A large body of work has revealed that even trained and professional lie detectors including police and customs officers, tend to judge deception on irrelevant cues, perform no better than lay people, use the same cues as lay people and do not change their views regardless of experience (e.g. Masip, Alonso, Garrido & Anton, 2005; Akehurst et al., 1996; Meissner & Kassin, 2002; Vrij, 2004).

People may attribute deception to those that behave in a stereotypically deceptive manner; gaze aversion, speech disturbances and so forth. However, there have been inconsistent findings in the expectancies that people have of the cues to deception. For example, whereas Riggio and Friedman (1983) found that liars were perceived as smiling less, Stiff et al. (1989) and others have found that increased smiling was associated with perceptions of deception. Some have suggested that when receivers have reason to question veracity, they infer deception from violations of nonverbal norms (Bond et al., 1992). Deception judgements may not be tied to a set of behaviours, more that violations of behavioural norms suggest deception. Bond and his colleagues found that receivers judged senders as more deceptive when nonverbal expectancy violations took place which were not stereotypical of liars (e.g. tilted head, thrusted jaw). They claim that deception judgements are "a judgemental tendency aroused by socially inappropriate behaviour" (Bond et al., 1992).

When people are attempting to detect deception, they do not only pay attention and make judgements according to some objective assessment of sender behaviour, they also may have tendencies and biases towards judging people and their communications as true or false. These potential judgement biases (such as the bias toward judging senders as truthful, the truth bias reported by Buller and Burgoon, 1996) arise from many different sources, certainly in part from their perceptions of lies and deceivers. These perceptions will clearly impact on detection accuracy. At its most obvious level, if everything a sender says is disbelieved, then every lie will be detected, but nothing truthful will be correctly identified. If everything senders might say is believed, then all deceptions go undetected.

2.2.3 *Perceptions and biases of receivers*

How do people make judgements of veracity? How do they integrate a vast amount of verbal and non-verbal information, past history, possible biases and heuristics?

Fiedler and Walka (2006) suggest that people lack the cognitive resources to make *accurate* use of non-verbal cues to make veracity judgements and so rely on heuristics. Cognitive heuristics are simple decision making rules that arise from conventional beliefs and expectations (Kahneman, Slovic & Tversky, 1982).

The processing framework provided by Thagard (1989), and Miller and Read (1991) (discussed by Seiter, 1997) assumes that at any given time, there may be multiple interpretations of the same behaviours. Strongly activated concepts win out over weaker ones and we use strongly activated concepts to make attributions (Seiter, 1997). Seiter found that individuals attempted to detect deception by searching for verbal and nonverbal signs indicative of deceit. Seiter suggests that when people are motivated to detect deception, they pay more attention to the message and use a greater number of cues than when people are unmotivated and may just use apparent signs of deception.

People may make use of both heuristics and the processing framework discussed by Seiter depending on the degree of motivation that they have to detect deception.

According to Buller and Burgoon (1996), people often rely on top down processing e.g. schemata, stereotypes, or "deception scripts". Some research has focused on a bottom-up processing model, e.g. some verbal/nonverbal behaviours activate attributions of deceit and suspicion.

One of the suggested reasons for people's relatively poor ability to detect deception is the existence of judgement biases. These biases include:

- truth biases
- lie biases/suspiciousness
- visual biases
- interactive biases
- investigator biases
- demeanour biases

The truth bias is the tendency to assume that people are telling the truth independently of the actual veracity of communications (Levine, Feeley, McCornack, Hughes & Harms, 2005). Burgoon et al. (2008) suggest that truth biases may arise from a tendency or expectation that communicators are truthful most of the time, a truthfulness heuristic can be derived from Grice's principle of cooperative discourse (Grice, 1989, cited in Burgoon, et al., 2008). Why should such a truth bias exist? A functional explanation is reported by Millar and Millar (1997) which proposes that truth biases facilitate communication and help to maintain relationships. Kraut and Higgins (1984, cited in Millar & Millar, 1997) proposed that the "assumption of truthfulness in a conversational partner is a fundamental part of most conversations" (p. 2). Stiff, Kim & Ramesh (1992) have claimed that truth biases are simply decision-making heuristics, which allow veracity judgements to be made without scrutinizing each message carefully. They argue that honesty may be reasonably expected to occur more frequently than deception, and a simple heuristic is easy to apply, especially in complex situations.

Levine, Kim, Park and Hughes (2006) have presented evidence of a truth bias or truthfulness heuristic. They found a significant bias towards judging messages as honest when equal proportions of truthful and false statements were presented (66% of messages were judged as truthful). They argue that this truth bias is the reason why message veracity accounted for 24% of the variation in the accuracy of judgements when the frequency of lies in their study was varied between 0% and 100%.

A tendency to be suspicious and judge communications as deceptive may also exist in some circumstances. Lie biases or receivers' suspicion may lead to more frequent judgements of deception (Stiff et al., 1992). According to Millar and Millar (1997), "suspicion initiates more mindful processing and less reliance on heuristics" (p. 3). They claim that when cognitive demands are high, highly suspicious receivers may need to rely on heuristics and adopt a lie bias. Not surprisingly, they found that when receivers were more suspicious they made more judgements of deception and they were more accurate in identifying deception. However when they were less suspicious, receivers were more accurate in identifying truthful communication. The tendency towards suspiciousness has been found in professional investigators. Meissner and Kassin (2002) suggest that "training and prior experience lead to a perceptual bias towards judgments of deceit" (p. 473). This suspiciousness leads to more judgements of deception but not better overall accuracy i.e. because there are fewer correct judgements of truthfulness. Meissner and Kassin (2002) reviewed a number of studies and found that trained investigators exhibited a bias towards judging senders as guilty of deceit, showed greater confidence in their judgements but were found to have accuracy no better than naive controls. Kassin, Meissner and Norwick (2005) found an investigator bias in police officers whose veracity judgements had more false alarms than non-trained controls. Some authors have suggested that suspicion, or a tendency to disbelieve senders might be more apparent in richer media conditions (Boyle & Ruppel, 2005). They argue that richer media may result in a greater leakage of cues which induce suspicion. This leakage may result in more equivocation and "mixed messages". In a study using the prisoner's dilemma task (Rapoport & Chammah, 1965) they assessed media richness and suspicion in three media conditions; face-to-face; telephone; and text-chat. They found that media richness and suspicion were greater in the face-to-face and telephone conditions compared to the text-chat.

Biases towards visual information appear to influence judgements of veracity. Burgoon, Blair and Strom (2005) suggest that there is a tendency to assign primacy to visual information over other forms of social information. They also cite evidence that facial cues are attended to more closely than verbal or bodily cues. Stiff et al. (1989) reported a visual primacy effect, where visual cues had a greater impact on judgements of truthfulness than vocal cues. Stiff et al. (1989) suggest two explanations for this primacy effect: A distraction hypothesis - that visual cues distract people from the verbal cues which are more reliably diagnostic of deception, and a situational familiarity hypothesis - that in familiar communication contexts, verbal content is relied upon over both verbal and nonverbal information.

Interpersonal deception theory predicts that there will be an interactive bias. According to Burgoon et al. (2008) "processing deceptive messages should be less taxing for observers than for participants, inasmuch as observers are freed from the complex multitasking that occupies conversational participants" (p. 574). Interpersonal deception theory predicts that in more interactive contexts receivers will: a) judge senders as more credible, and b) achieve lower accuracy in detecting deception. Why should this be the case? According to interpersonal deception theory, interaction fosters *mutuality*, a sense of relational connectedness that leads people to behave differently to one another than if they were not interacting. This perceived connectedness leads to increased ratings of rapport and similarity. This increased rapport can be observed as responsive, coordinated and synchronous communication, with gestural matching and smooth turn-taking. Also, in addition to elevated positive affect towards interactional partners, interpersonal deception theory claims that if receivers are suspicious of message veracity, this will be revealed to senders. Senders are then in the position to modify their performances to achieve greater believability (Burgoon et al., 2001). These predictions from interpersonal deception theory have been tested in a number of studies with mixed support. Compared to passive interrogators, face-to-face interactants have been shown to evaluate each other with greater leniency and more positivity (Burgoon, Buller, Floyd & Grandpre, 1996 cited in Burgoon, et al., 2008).

Zuckerman et al. (1979) have suggested that some people appear to be consistently rated as truthful or dishonest regardless of the actual veracity of their answers. They termed this the demeanour bias. Burgoon et al. (2008) claim that it is the components of strategic communication, i.e. a combination of cues which in combination lead to the demeanour bias and that visual cues are particularly significant.

2.2.4 *Detection of deception*

A substantial body of research has indicated that success at detecting lies by observing non-verbal behaviour is typically at the level of chance, A recent review of detection studies by Vrij (2008) cites work indicating that even professional "lie detectors" such as police officers and customs officials perform no better than at chance levels. The review reported an overall classification accuracy of 57%, which was made up of 67% accuracy for truths and 44% accuracy for lies. Bond and DePaulo (2006) also reviewed 206 studies where strangers judged both lies and truths and made judgements of veracity. They only reviewed studies in English and those which used adults as participants (over 17 years) and where no artificial or technological aids for detecting deception were employed. The analyses were compared at the level of individual receiver accuracy. They also examined associated factors including judgement medium, level of interactivity of senders and receivers, receiver expertise, motivation and whether or not senders had the opportunity to plan their lies in advance. In 292 samples where receivers judged messages as lies or truthful, they founded a weighted mean of 53% correct classifications which was significantly greater than that expected by chance. In a subset of 207 samples, they found a weighted mean of 55% correct judgements, again significantly greater than that expected by chance. This consisted of 61% of truthful messages and 48% of deceptive messages which were correctly classified. The findings from reviews of detection accuracy (Vrij, 2008; Bond & DePaulo, 2006) indicate that for a majority of studies, classification accuracy for honest and deceptive statements is poor, albeit better than chance.

DePaulo et al. (2003) assessed evidence that might support the motivational impairment effect. Highly motivated senders might be expected to be more detectable than those with little or no motivation to avoid detection. Highly motivated liars may be expected to be undermined by their efforts to appear honest through the leaking of cues to deception. Looking at data from 20 studies where motivation of senders was manipulated, Bond and DePaulo (2006) found that highly motivated liars were more often detected than unmotivated liars. This difference in classification success was not found when comparing groups drawn from a larger sample of data from many studies. The messages told by motivated truth-tellers were significantly less likely to be correctly judged as honest. There were however, also significantly fewer judgements of honesty when messages were told by motivated liars. DePaulo et al. (2003) found that in studies where an incentive for succeeding was given (such as money), more nonverbal cues to deceit were apparent. It appears that there is evidence to suggest that the more motivated liars are to avoid getting caught, the more their behaviour will reveal their deception. Vrij (2008) suggests that stronger emotions and perhaps also a greater cognitive load may be experienced by motivated liars, and the consequence is a greater likelihood that cues to deception also occur.

It has been supposed in the past that people vary in their ability to detect deception. Buller and Burgoon (1996) suggest that detection abilities might vary as a function of social competences. Studies such as Zuckerman et al. (1981) have failed to find a relation between detection accuracy and a range of individual differences including, gender, Machiavellianism, age, education, expertise. Kraut and Poe (1980) suggest that people do not vary in their ability to detect deception. In a previous study, Kraut (1978) found no relationship between a receiver's accuracy in judging one person and that same person's accuracy in judging a second person. Kraut has asserted that people judged as truthful by one person tend to be judged in the same manner by others (Kraut, 1980). In an meta-analysis by Bond and DePaulo (2008) they found little evidence that individuals vary more than by chance in their ability to detect deception. They argue that some differences between individuals in detection accuracy may be accounted for by variation in the tendency to judge others' statements as truthful, that is, biases towards judging answers as true or false. However, their analyses indicate that the outcome of a deception judgement depends more on the liar's tendency to appear deceptive than any other individual difference. They analysed the results from 142 studies where 19,801 people judged the veracity of 2,945 senders. In all, they report a mean accuracy of 54% in discriminating lies from truths with a mean standard deviation of 12.8. Zuckerman et al. (1979) found that the detectability of deception tended to be negatively correlated with the believability of honesty, suggesting that senders are likely to portray a consistent demeanour. That is, there is a tendency for some senders to appear more honest than others regardless of whether they are delivering an honest or deceptive message. This also suggests that overall accuracy would not be affected by a demeanour bias; as more deceptive messages are detected, fewer honest messages are believed. Some research groups have studied lies that can be discriminated from truths: with 72% accuracy in one case (Vrij, Mann, Robbins & Robinson, 2006b). Edelstein et al. (2006, cited in Vrij, 2008) report that individuals' accuracy of detection was positively related between tests, suggesting that some stable variations in individual detection ability may be demonstrated.

The majority of detection studies have been conducted face-to-face or with audio-video recordings as stimuli. The number of studies which have systematically investigated the effects of communication media on detection is small (e.g. Mann et al., 2008) and sometimes poorly reported. This is unfortunate for a number of reasons. If detection accuracy is often at low levels, but sometimes much better than chance, and there are behavioural cues which can reveal deceivers, then control of communication media could conceivably produce predictable effects upon detection. It could be found for instance that classification success might be improved by the use of particular media where particular cues are more salient. The nature and features of communication media need to be assessed in terms of senders' and receivers' perceptions and behaviours in order to make these predictions.

In summary, the evidence from the literature suggests that in many laboratory based contexts lie detection accuracy is likely to be low, (Vrij, 2008). Studies where lay-persons judge a small selection of truthful or deceptive messages from actors or senders with little or no motivation to escape detection are unlikely to show impressive lie detection accuracy, and may often show worse performance than would be expected by tossing a coin. This is in part a consequence of experimental design, but also may result from a tendency for receivers to judging the majority of senders' messages as truthful, regardless of actual veracity (e.g. Levine et al, 2006). There is evidence that the stereotypical perceptions of liars and their behaviour also contribute to poor classification accuracy. Many receivers appear to judge the honesty of senders by looking for visual nonverbal signs of deception, whereas deception has been found to be more associated with verbal cues (e.g. Mann et al., 2002). In a number of studies, judgements of veracity are made of small sets of stimuli and as such comparisons between honest and deceptive behaviour of individual senders is hard or impossible. There is evidence that significantly accurate discrimination between lies and honesty can be achieved. Vrij et al. (2006b) has reported classification accuracy of 72%. Bond (2008) identified two individual receivers (professional law enforcement officers) who were able to correctly classify truthful and deceptive statements in the study at 80-90%. Lay-persons appear able to achieve greater classification accuracy when the stakes of senders are higher rather than lower; senders' messages are planned rather than spontaneous; receivers have some exposure to honest behaviour from senders as a baseline; and when receivers judge veracity not on how senders behave, but on what they say. The last of these factors may be most relevant to the investigations of media effects on lie detection reported here. Communication media vary in the cues which they are capable of transmitting. As an example, email does not transmit vocal cues, such as intonation and receivers cannot make veracity judgements of email messages using intonation. If receivers may achieve varying degrees of classification accuracy depending on the cues upon which they focus, all things being equal they might be expected to show varying accuracy depending on the communication media through which senders are observed.

2.3 Communication Media and Their Characteristics

The variety of available electronic written and spoken communication media has dramatically increased over recent years. These media can provide a large variety of affordances that define their functionality and use. There are many publications which describe these media and the affordances they support (e.g. Whittaker, 2003) so they will not be listed here. Affordances are the qualities of media which allow communicative acts to take place, such as visual media supporting mutual gaze. They include: visual affordances such as facial expressions, gestures and head nods, but also audio affordances such as prosodic aspects of speech, content of speech and other linguistic information. Individually and in combination, these visual and auditory affordances may function as conversational cues including (but not exclusively): turn-taking, which facilitates reference, attention and understanding, but also provides affective and attitudinal cues including interactivity/synchronicity and coordinated turn-taking. Communication media also allow varying degrees of feedback, recordability, temporal resolution and speed and convenience of message reciprocity.

A combination of these affordances is realised through a range of media in wide use and at the present time includes (in no particular order):

- Audio-only: standard telephony, Voice over IP (VoIP), hands free Audio-only
- Email
- Short Messaging Service (SMS)
- Combined audio and video conferencing
- Online chat: MSN messaging, Internet Relay Chat, Talkers, Facebook Chat; referring to one-to-one or group text based communication

- Face-to-Face interaction is also included here as a communication medium.

As these communication channels have become increasingly ubiquitous and used in many more of our daily interactions, a great deal of research has focused on the individual behaviour and interactions of users in cooperative tasks, negotiations and general social interactions. These media have been examined in a multitude of laboratory and field settings, and a range of tasks including negotiation, collaborative problem solving, interviewing, entertainment and of course, deception. Evidence that mediated communication differs from face-to-face communication has been extensively reported and reviewed (e.g. Whittaker, 2003). The following findings are by no means exhaustive but may be relevant to a discussion of mediated communication and deception in particular. Communication using textual media has been reported to be less intimate than face-to-face communication (Argyle & Dean, 1965). Krauss and Chiu (1997) cited in McGinn and Croson (2004) claim that "face-to-face conversation is an intrinsically cooperative endeavour" (p. 340) due to conventions of behaviour, resulting in interactions that are truthful, informative, relevant and clear. Frohlich and Oppenheimer (1998, cited in McGinn & Croson, 2004) "concluded that face-to-face communication "virtually compels" people to cooperate in dilemma games" (p. 340). Valley, Moag and Bazerman (1998) also asserted that "face-to-face communication impels negotiators to incorporate elements of honest information exchange, cooperation and trust" (p. 212). Visual interpersonal cues (e.g. smiles), which are missing in text or audio representations, have been identified as particularly powerful in evoking immediate affective responses (Winston et al., 2002). People communicating face-to-face have been found to judge each other more leniently and as more likely to be truthful than in mediated contexts (Burgoon et al., 2001). The content and structure of dialogue has been found to vary between face-to-face and audio-video mediated conditions, with mediated conditions showing more explicit turn-taking behaviour and more extensive interactions to achieve shared goals (Doherty-Sneddon et al., 1997).

There is evidence that the affordances of communication media may be used by receivers in their judgements of deception with varying degrees of success. For example, Mann et al. (2002) reported in a study of police officers' judgements of criminal interviews that successful and less successful lie detection was related to the cues attended to by receivers. They found that successful detection was identified in receivers who tended to mention aspects of suspects' stories. Least successful receivers tended to report that they had made judgements based upon popular stereotypical cues such as fidgeting and gaze aversion. Few if any studies have directly manipulated the affordances available and also discovered which cues receivers used. Mann et al. (2008) compared the tendencies to judge senders as truthful or deceptive, and the detection accuracy of receivers who judged under video-only, audio-video and audio-only media conditions. They reported that receivers exposed only to visual cues were more likely to judge senders as deceptive than in other media conditions. They also found that classification accuracy for lies and truthful statements was significantly lower in the video-only condition. This evidence suggests that some media affordances vary in their predictive value for detecting deception. Burgoon et al. (2008) argue that media which only afford access to senders' words both reduce the processing task for receivers and include many cues diagnostic of deceit and therefore detection is more likely under those media conditions.

2.4 Media Choice

Particular interest has been shown in the choices of media that people make for different tasks and the design of media to support various interactions and behaviours. The communication medium that is chosen for a particular task may depend upon a range of factors including; affordances, suitability for the task, availability, familiarity, convenience and cost.

An extensive body of psychological, social science and communication research has addressed media choice and there is a significant body of work that attempts to characterize media, the tasks they are used for and the choices that people make.

2.4.1.1 Theories of mediated communication and deception

The characteristics of communication media and task features have generated a number of theories which might predict the kinds of media that people will choose to accomplish particular tasks, in this case deception and detection. Senders may wish to choose particular media if they plan to deceive as they may perceive media to vary in ability to reveal cues to deception. People may also choose media in order to dissuade others from attempting deception if they assume that everyone shares expectancies that deception is more easily detected with nonverbal cues. They may also believe that they will achieve greater and lesser success at detection with different media. Most people engaged in deception appear to not wish to be discovered (DePaulo et al, 1996a) and if able to choose, may reasonably select media that they believe will, if not assist them in their deceptive act, at least not support their detection. Some assumptions have been made about media which may not prove to be correct. For example Keyes (2004, p. 198) argues that "Electronic mail is a godsend. With email we needn't worry about so much as a quiver in our voice or a tremor in our pinkie when telling a lie. Email is a first rate deception-enabler." (cited by Hancock, 2007).

2.4.1.1.1 Media Richness Theory

Media richness theory (Daft & Lengel, 1986; Daft, Lengel & Trevino, 1987) proposes that media may be characterised in terms of "richness" where richness is dependent upon a medium's support for feedback, multiple cues, language variety and personal focus. Face-to-face is regarded as the richest medium, with written communication as the least rich. Media richness theory predicts that richer media should be preferred for tasks that are high in equivocality or low in uncertainty and less rich media for tasks low in equivocality or high in uncertainty. That a medium is high in richness does not necessarily mean that it will reduce the equivocality of a task. According to Daft and Lengel (1986), uncertainty is reduced by the exchange of large amounts of accurate, objective or quantitative data. Equivocality is ambiguity in the communication partner's frames of reference, resulting in a need for negotiation or persuasion. The richness of a medium is defined as a combination of four factors; feedback capability, cues, personalisation and language variety. Media richness is an example of a bandwidth model of communication media, where information is transmitted from sender to receiver through channels of varying capacity or bandwidth. According to Hancock et al. (2004) media richness theory suggests that deceivers will prefer to use the richest media available, as deceiving is a complex, equivocal task (although this assertion may be open to conjecture given the ease which some people have been reported to lie and the lack of guilt they often appear to feel, e.g. DePaulo et al., 1996a). It appears likely that the nature and seriousness of the deception, familiarity with the target of the lie and numerous other factors may influence the equivocality of lying.

2.4.1.1.2 Social Presence theory

Media vary in their capacity to transmit visual non-verbal cues such as facial expressions, the awareness of gaze direction that is possible, the apparent distance and "realness" of others, and the degree of interactivity and feedback that is supported. This collection of affordances has been variously termed Social Presence, (Short, Williams &

Christie, 1976) and Telepresence (Mühlbach, Böcker & Prussog, 1995). According to Short et al. (1976) media vary in their degree of social presence and this affects the nature of perceptions and relationships between interacting parties. Short et al. (1976) argues that users are aware of the social presence of a medium and will tend to behave accordingly, choosing behaviours that are appropriate for the media and media that are appropriate for the communication task. The complex interaction of these factors is argued by Short et al. (1976) to be determined by the user and is therefore a subjective not objective feature of the communication media or technology. Lombard and Ditton (1997) define presence as "the perceptual illusion of nonmediation" (p. 1) where perceptual means the real-time responses of human sensory, cognitive and affective processing systems to objects and entities in a person's environment. They suggest that the illusion of nonmediation can occur when the communication medium can appear to be invisible or transparent with the user and content sharing the same physical environment. The causes of a sense of presence can be divided into those that are features of the system such as visual and audio delivery, the obtrusiveness of the technology and the interactivity it affords, and those related to the experience, for instance, the kind of task a user is engaged in (Lombard & Ditton, 1997).

The overall ratings of media richness and social presence are likely to be similar for a number of media types, however the variety of new communication media make these classifications increasingly difficult.

2.4.1.2 Social awareness

McGinn and Croson (2004) suggest that social awareness is the key factor that influences media choice and use. They discuss Sally's sympathy theory of media choice, a product of physical and psychological proximity (Sally, 2000 cited in McGinn & Croson, 2004). McGinn and Croson (2004) suggest that sympathy and social presence are similar, allowing consciousness and attention towards the other. This social awareness is not a property of the medium, but also influenced by cultural factors, attitudes and interpersonal perceptions.

2.4.1.2.1 Feature-based theories

More recent work has suggested other characteristics and constructs in order to predict and explain media choices and task effects (e.g. Carlson and George, 2004). The feature-based theory breaks communication media down into more specific and testable features which are presumed to have influence on media choice and effects upon task outcomes. These features include synchronicity, symbol variety, cue multiplicity, tailorability, reprocessability (the ability to review messages) and rehearsability (Burgoon, Stoner, Bonito & Dunbar, 2003). The approach is more practical and given the variability of currently available media appears to provide a means by which technologies may be more effectively compared and contrasted in use.

Carlson and George (2004) propose that along with media richness, synchronicity is an important feature that influences media choice for deceivers. Synchronicity is characterised as a product of the speed of interaction, rehearsability and reprocessability. The speed of interaction is influenced by media delays and asynchronous media are typically used when participants are not physically co-present. With greater asynchronies, users have a chance to plan, edit and rehearse their answers. Carlson and George (2004) argue that all things being equal, senders will prefer media with high synchronicity in part because they can respond quickly to senders to maintain and manage honest impressions and deceptions are more likely to emerge spontaneously from conversation rather than pre-planned. Carlson and George (2004) also argue that when a task has low impact, senders should prefer asynchronous media. When a message has high impact, senders should prefer synchronous media.

Hancock et al. (2004) proposed a three-factor model that will influence media choice by deceivers. The factors being; the distributed nature of the media (distributed or not), synchronicity (synchronous or not) and recordless (recorded or not). The physical distribution of participants in a conversation has been demonstrated to have effects on their readiness to deceive. A study by Bradner and Mark (2002) found that people were more likely to deceive their partners if they were in a distant city compared to when they were co-located in the same city. Hancock, Toma and Ellison (2007) suggest that being physically co-located reduces the opportunity to lie about objects and events in the same shared environment. It may be harder, for instance, to lie about being ill if you are engaged in face-to-face conversation compared to composing an email. According to Hancock et al. (2007) the synchronicity of the medium impacts upon deception because the majority of lies are unplanned (citing DePaulo et al., 1996a) and tend to emerge spontaneously from conversation. They suggest that spontaneous conversation is likely to take place while using synchronous media such as face-to-face, telephone and instant messaging. The recordability of a medium is likely to impact upon deception; the more recordable media such as email and short messaging service (SMS) are less tempting to the deceiver compared to media that tend not to be recorded such as face-to-face and the telephone. A recorded interaction gives more opportunity for the sender to be detected, as messages may be reviewed by the receiver, but also if the deception is detected by any means, the recorded message is available as evidence. Thus, Hancock et al. (2004) suggest that people are more likely to attempt to deceive when using media that are distributed, synchronous and lacking records. However, they seem to confuse spontaneous lies with those that are planned, and a medium is subsequently chosen with which to transmit the deceitful message.

We may speculate that if some senders are believe that they're adept at appearing to be honest, they may prefer rich media in order to portray as many convincing cues as possible. In contrast, those who feel they are prone to reveal their deceptions are likely to choose media which are capable of communicating fewer cues. The key may perhaps be how people believe they will be detected and the consequences of discovery.

Carlson and George (2004) found no media differences for a group presented with a number of different deceptive scenarios who had to choose their preferred medium with which to lie (no-one chose videoconferencing as none of the participants had experience with it). However when media were grouped, it appeared that synchronous media were preferred. Those that chose asynchronous media for a high risk task were more likely to think they would be caught. They found some support for the hypothesis that people preferred asynchronous media for low risk lies.

The three-factor model proposed by Hancock et al. (2004) was tested in a diary study conducted over seven days. They asked participants to record the lies told and the media used (participants had access to face-to-face, telephone, text-chat and e-mail). They found support for their model from the measure of the proportion of interactions with each medium in which a lie was told. Phone conversations had the highest proportion of lies, greater than face-to-face and text-chat which both had higher proportions of lies than e-mail. However, according to George and Carlson (2005) Hancock et al.'s (2004) results can be interpreted in alternative ways than the proportion of interactions in which a deception was told. Both the total number of lies told per medium and the mean number of lies per day for each media type match the predictions made by media richness theory. That is, the highest rate of deception was found for face-to-face; the media with the highest interaction speed, simultaneous information channels, the largest set of informational cues and highest ability to tailor the information communicated to specific needs. The correct interpretations of the results may depend on whether participants chose media with which to lie, or lied or not depending on the medium that they were using at any given time.

The classification of video conferencing by George and Carlson (2005) is itself open to interpretation as they suggest that the cue multiplicity (or "parallelism") is more similar to phone than face-to-face.

2.5 Media Choice and Detection

In technology mediated communication there has been a small but limited body of research investigating the detection of deceptive behaviour (e.g. Horn, 2001) and the development of trust (e.g. Purdy, Nye & Balakrishnan, 2000). Carlson, George, Burgoon, Adkins and White (2004) predict that confidence in the veracity judgements that receivers make will be higher in rich, synchronous media as they know there is limited capacity for senders to rehearse and they believe that that is a greater opportunity to see the cues presumed to be associated with deception. A number of studies have shown that people appear to trust each more when face-to-face than when using other media to communicate (e.g., Valley et al., 1998; Burgoon et al., 2003). This truth bias would suggest deceivers are more likely to get away with deception when face-to-face, even though more cues are available for lie detection. Burgoon et al. (2005) suggest that visual media assist deceivers because immediacy and involvement can be capitalised on by deceivers. There are more opportunities to foster trust with friendly nonverbal cues. In audio modalities, there are fewer cues for the receiver to focus upon and fewer channels for deceivers to manipulate. Zuckerman, Driver and Koestner (1982b, cited in Heinrich & Borkenau, 1998) suggest that cross-modal inconsistencies may reveal deception. Cross-modal inconsistencies are instances where for example, facial expressions suggest positive affect but the sender is using negative terms to describe something. This would suggest that face-to-face and audio-visual modes should be better for detecting deception as more modalities are available. The hypothesis is that some cues are easier than others to monitor and control which can lead to inconsistencies. Bem (1972, cited in Heinrich & Borkenau, 1998) suggests that verbal responses are easier to control than expressive behaviours and physiological responses. Ekman also proposes that there is a hierarchy of controllability of expressive behaviours; with verbal responses easiest, facial expressions harder and non-facial gestures even harder to control and tone of voice the hardest of all to control. Some research indicates that detection should be better when visual cues are available. Zuckerman et al. (1981) point out that the voluntary attempt of deceivers to control behaviour may actually reveal their deception; they can try too hard to convey an honest appearance. This may result in overdoing some behaviours or appearing stiff and unnatural.

Other studies have indicated that the availability of visual cues may result in less accurate detection. Monitoring dependent lies are those where it is useful for the sender to see receiver's reactions to the attempted deception. Some work has reported that if deceivers tell monitoring dependent lies then visual cues can harm receivers' ability to detect the deception (Schweitzer et al., 2002). Notwithstanding Zuckerman et al.'s (1981) suggestion, taking these findings into account, deception detection should be reduced when receivers are visible. Fewer communication channels results in a lower requirement for senders to control their behaviour (if lying is cognitively more demanding), less demanding management of channels and fewer opportunities for channel discrepancies which may lead to suspicion and higher rates of lie guesses. Lie detection might conceivably be less accurate when face-to-face if the lies are undemanding for senders to produce, and more accurate if deceptions take many cognitive resources to produce.

Heinrich and Borkenau (1998) found deception detection was less accurate under video-only communication conditions compared to audio-video and audio-only conditions, but no differences were found between audio-only and audio-video. They also found evidence that judgements of deception were related to cross-modal discrepancies in receivers' impressions of the agreeableness of senders (they measured other personality traits and found little relation between discrepancies and deception ratings). However the numbers of participants was very small as they only had four receivers in each media condition. A number of studies reported by Zuckerman et al. (1982b, cited in Heinrich & Borkenau, 1998) where the influence of facial cues was investigated, produced inconsistent results. Littlepage and Pineault (1978) removed facial cues from stimuli and found the accuracy of detection was not affected, whereas Maier and Thurber (1968) removed facial cues and reported that detection was improved. Krauss, Geller and Olson (1976, cited in Zuckerman et al., 1979) found facial expression gave away senders' deception, but only when senders were not aware of being watched. Mann, Vrij, Fisher and Robinson (2008) investigated the classification of lies and honest statements presented as audio-video, audio-only and video-only. They found that detection accuracy was significantly lower under the video-only condition but no differences were identified between audio-only and audio-video conditions.

Some research has also attempted to determine the effect of vocal cues on detection. DePaulo, Lassiter and Stone (1982), and Zuckerman et al. (Zuckerman, Amidon, Bishop & Pomerantz, 1982a) report evidence that classification of lies and truths is most successful when using tone of voice. Although, in the work by DePaulo et al. (1982), only the identification of honest answers, but not the lies, was improved by instructing people to pay attention to verbal cues. Littlepage and Pineault (1978, cited in Zuckerman 1979) replaced senders' voices with new voices (i.e. they removed vocal cues) and found that detection accuracy was not reduced. Kassin et al. (2005) found that judgements of truthful and false confessions were more accurate in an audio-only condition (greater than chance levels) than in an audio-video condition (chance levels). Their study used a single sender for each often recorded confessions, five truthful and five false. Their study compared a student receiver population with police officers and found the student receivers to be more accurate in veracity classification than the professionals. In all the studies from the literature reported here, when detection of deception was investigated under varying conditions, audio-video, video-only, and so forth, the truthful and deceptive materials were all produced under audio-visual conditions and subsequently modified to remove video or to remove audio. In a unique study, Burgoon et al. (2005) compared the accuracy of veracity judgements of statements both produced and received under audio-only, audio-video and text conditions. They reported no significant differences in detection of deception between media conditions, but did note that participants tended to judge more answers as truthful under audio-video conditions than audio-only. Burgoon et al. (2005) also compared face-to-face to audio-video (low quality), audio-only and text-chat conditions on measures of trust, truthfulness and involvement (a measure of social presence). There was some evidence that during face-to-face interactions, users reported more involvement in the interaction than in other conditions. Both face-to-face and audio-video appeared to show little variation in measures of trust between truth-tellers and deceivers, however while using audio-only there was greater discrimination between the deceptive and honest sender conditions. In a text-only condition, deceivers were rated as more trustworthy than truth-tellers. All overall measures of truthfulness were above the midpoint of the scales (i.e. biased towards judgements of honesty) so accuracy at detecting deception was poor. The judgements of trustworthiness and truthfulness were also made of the participants, not of individual messages so results are hard to assess.

Some studies have looked at deception with different media, but few have varied both production conditions *and* reception conditions. The vast majority of studies have used recorded stimuli which have been replayed to groups of receivers; very few studies have used live interactions. The majority of studies have given participants a very limited number of messages to make judgements upon, in some cases a single interview or confession from a sender, making comparisons between honest and deceptive statements from the same person difficult if not impossible. The next section discusses how this work attempts to investigate some of the issues this large body of research raises and builds upon many interesting and impressive studies completed over recent decades.

3. Current Approach and Methodology – The Processes of Deceptive and Truthful Communication

The information transmission model of communication consists of the elements listed below. The simplistic model in which messages are constructed and transmitted by senders through some communication channel(s) and are picked up by receivers reveals its origins in communication technology. The model does however provide a useful starting point with which to study deceptive communication. Interactions may be further unpacked into some constituent parts which indicate the decision making processes involved in communications where senders may engage in deception, and receivers may also attempt detection. The process suggests a structure for this thesis.

- Sender may consider deception in order to achieve communicative goal, influenced by:
    - Morality
    - Interpersonal perceptions of receiver (+ve/-ve)
    - Risk of detection (cost)
    - Benefit of achieving goal.
- Sender assesses available media for their fitness for purpose (deception or honesty).
- Concurrently, prior and current perceptions of communication media and sender are assessed by receiver.
- Sender determines to lie with current media or chooses a medium with which to tell planned deception.
- Sender constructs verbal and non-verbal message with more or less control.
- Message is transmitted via a communication medium with more or less loss of fidelity.
- Verbal and non-verbal constituents of message are received and assessed for veracity, process is influenced by:
    - Communicative goals
    - Cost/benefits of veracity judgement
    - Judgement biases
    - Content of verbal behaviour

- Content of non-verbal behaviour

Therefore using this process model, the main steps of analysis in this thesis are distinguished as:

- **Perceptions of senders** about their deceptive behaviour and about communication media which influences their decisions to deceive or not, and their choice of media. Senders also have perceptions about their messages and communication partners which may influence an ongoing interaction during and after deception.
- **Behaviour of senders** Which is realised by the choices senders make to deceive or be honest when faced with the opportunity under different media conditions.
- **Perceptions of receivers** about deceptive behaviour in general, the messages they have received and about communication media.
- **Behaviour of receivers** when attempting to distinguish between deceptive and truthful communication, realised as veracity judgements.

There is no intention to imply that these steps for analysis are independent, clearly the perceptions and behaviours of people engaged in processes of communication and interaction are deeply intertwined.

A number of questions arise from the previous work on deception, communication media and the interaction between them which this thesis attempts to address.

- Are lies and truthful statements classified by receivers more or less successfully under different media conditions? We identified significant evidence that the media condition under which receivers judge senders influenced the accuracy of lie detection. There was some evidence that detection was most accurate under audio-only media conditions, least accurate with video-only, and significant detection accuracy was identified in both text-only and audio-video conditions.
- Do people perceive some communication media as "easier" to lie with, that is, less likely to be detected? We found evidence that senders perceive their detectability to vary in different media. Senders judged their detectability to be greater in visual media, less in audio-visual media and least in textual media.
- Are the communication media that are chosen for deception the ones perceived to be "easiest" to lie with? The media with which senders were most likely to lie were

typically the media with which they use most frequently. There was some evidence that media used infrequently in daily life are more likely to be chosen for deception than general use might imply.

- Do the general perceptions about deception and communication media impact on the behaviour of senders, that is, does the frequency of deception change with the mode of communication? If so, how and why? We found significant evidence that the frequency of deception was affected by communication media. Deception was most frequent in audio-only conditions.
- Are receivers trusted to varying degrees when they are communicating under different media conditions? We found little consistent evidence that the tendency to judge senders as truthful or deceptive was related to media condition.

3.1 The Perceptions and Beliefs of Senders about Deception and Communication Media

There have been a number of parallel strands of work published in the deception literature. This work has investigated the verbal and non-verbal behaviours that *actually* vary between deceivers and non-deceivers but also the *beliefs* that people hold about the characteristics and motivations that deceivers have and the behaviours which they display. There has been a smaller but significant body of work that has investigated deception from the point of view of the sender. Typically this effort has looked at the frequency and characteristics of lies, and the motivations and perceptions of deceivers through diary and questionnaire studies. Some research has also focused on the perceived characteristics of communication media and how they impact upon media choice.

Although there are various motivations that people have to lie; in order to protect oneself, to protect others or merely to amuse the sender, clearly they range in content, type and importance from perhaps inconsequential "white lies" to deceptions which have serious consequences.

Work by DePaulo (e.g. Kashy & DePaulo, 1996; DePaulo et al., 2003) has argued that people are motivated to present a positive impression to others in communicative acts, be they deceptive or non-deceptive. They suggest that deception is not an unusual part of our daily lives and the majority of deceptions are regarded as trivial; people do not report significant regret, they do not put much effort into planning the lies and in the majority of cases they believe they will go undetected. However, some instances of deception are assumed to be detectable. These deceptions are likely to be the most serious, anxiety-inducing lies. They are generally regarded as detectable through a range of cues, most of which are signs of guilt and nervousness which liars are presumed to be feeling. These cues are primarily visual, often located in the face, but also consist of some verbal cues, both in content and in prosodic aspects of speech.

A limited body of research has investigated senders and their choice of communication media which they use to engage in deception. Some of these studies have specifically investigated both deception and detection under different communication media conditions (e.g. Hancock et al., 2004; Carlson & George, 2004; George & Carlson, 2005). Theories have been based on the idea that media vary in their characteristics and affordances; their capacity to transmit information such as behavioural, social and affective cues. Users are aware of a communication media's ability to transmit the information that makes their emotions, intentions and behaviour apparently transparent, as measured by social presence, media richness, interactivity, synchrony and a host of other possible factors. Therefore, if people believe that their deceptions are obvious to others mostly through non-verbal cues when they're communicating, then how detectable they feel they are when lying will vary with the characteristics of different media that support the transmission of these cues. Media which are interactive and have multiple information-carrying channels are said to be richer than those that are asynchronous, lacking feedback and support few informational channels. Media richness theory (Daft & Lengel, 1986) and interpersonal deception theory (Buller & Burgoon, 1996) both suggest that deceivers would choose media that are richer and more interactive because deception is a complex task and deceivers are assisted by the opportunity to use cues to persuade and observe the receivers' reactions. Social distance theory as described by Hancock et al. (2004) suggests that senders would try to minimise the transmission of cues that might lead to their detection and so would choose leaner media (text, email) with which to deceive. If deception is inferred from violation of non-verbal norms (Bond et al., 1992) then these are most likely to be revealed with visual media. Whether senders would consider this is unclear.

How detectable people feel that they are is also likely to vary with the kinds of lies told, because as discussed earlier, some deceptions are regarded as trivial and relatively unimportant, whereas some are obviously serious and may be accompanied by anxiety in the deceiver. Deceivers may therefore be quite comfortable choosing to communicate face-to-face when telling "white", trivial lies. People may believe under these conditions that the most likely route to detection is after the fact, so media which record interactions such as email and other textual media may be less preferred. When deceivers believe that they are likely to be anxious, for the majority of people if they were to tell a lie with serious consequences if discovered, then they may be more hesitant of using a medium which reveal their nonverbal behaviours and/or other perceived cues to deception.

Other work (e.g. George & Carlson, 2005; Burgoon et al., 2003) proposes that synchronicity is the most salient feature that influences media choice for deceivers. Carlson and George (2004) suggest that all things being equal, deceivers will prefer highly synchronous media but when the task has a low impact, deceivers should prefer asynchronous media. They claim that their results support media richness theory as lying is an equivocal task. If, however, some people appear to find it easy to lie, and some lies appear easy for many people to tell (the high frequency of lies in diary studies would suggest that it is) then perhaps deceiving is not always such an equivocal task.

Both Carlson & George (2004), and Hancock et al. (2004; Hancock, Woodworth & Goorha, 2010) point out that uni-dimensional characterisations of media are inappropriate and it is the multidimensional interplay of features that predict which media senders choose for deception. In the majority of media choice studies, it has been hard to distinguish between when people have pre-planned deception and choose a particular media, and when they choose to deceive while already using a communication media. The perceptions people hold about both deception and communication media will interact and influence these choices.

The previous work has found it difficult to assess videoconferencing as many people have little or no experience of this medium. The studies reported here address that point.

3.2 The Behaviour of Senders When Faced With the Opportunity to Deceive

The behaviour of deceivers in terms of their verbal and non-verbal behaviour may conceivably influence the perceptions of receivers and their abilities to detect any deception. This section does not address this behaviour, instead, it investigates sender behaviour in terms of how likely they are to engage in deception, and which communication media they actually choose when they are doing so.

Some previous research suggests that people will feel that their deceptions are more detectable when they can be seen (Gilovich et al., 1998). This prediction fits with social presence and social distance theories and the illusion of transparency, in that, people will feel more uncomfortable and detectable with lying if there are channels that appear to them (whether true or not) to transmit their deception cues. These channels would seem to be those related to social presence, visibility of non-verbal signals, interactivity, "realness", spatial cues and a host of other factors. This finding was supported by DePaulo (DePaulo, et al., 1996a) who found the interactions during which lies were told were significantly more likely to be phone conversations than when face-to-face. However, this result can be explained in two ways, people either chose the phone when they wanted to lie, or they were already using the phone, and lies came more easily. Hancock et al. (2004) found in a diary study that participants lied most on the telephone, least via email and at comparable levels for face-to-face and instant text-chat. They suggested that the interactivity, recordability (whether a record of the interaction is likely to exist) and co-presence were all important factors. Some diary studies have reported that people lie frequently and that they often feel little anxiety or guilt over these deceptions. It is necessary to investigate whether this ease of deception is expressed in the behaviour demonstrated in experimental studies.

3.3 Receiver Perceptions of Deception and Media

The judgements of veracity that receivers make of senders' statements may be in part related to the actual deception or honesty of senders. However, these judgements may also be based upon perceptions that receivers have of individual senders, the content of messages and the behaviours which accompany their delivery. The judgements may also be influenced by the questions asked and the communication media employed. All of these factors are conceivably subject to biases, preconceptions and misattributions which influence judgements.

DePaulo et al., (2003) have proposed that there is a double standard invoked when people think about deception. Receivers expect liars to feel anxious and look for signs of nervousness and guilt to indicate deception. In contrast, most deceivers are in fact not very anxious and therefore may not show those signs. Some of the time, they are likely to be nervous and may display some behavioural indications but these signs are hard to make sense of, and of course people can also be nervous when telling the truth. There are a range of cues which people tend to believe are indicative of deception. These are predominantly nonverbal; visual, facial and gestural cues. There are also some verbal behaviours which people appear to associate with deception including hesitations and errors in speech, higher pitch and longer replies to answers. There is also some suggestion from the literature that it is the discrepancies between behavioural norms and also the inconsistencies in channels which lead people towards judgements of deception.

The evidence indicates that in order to cope with the complex task of judging veracity, receivers tend to make use of heuristics. According to Bond and DePaulo (2008), variation in judgement accuracy can be accounted for by variation in individual tendencies to judge others' statements as truthful and on senders' credibility. Bond and DePaulo (2006) suggest that the double standard theory of deception means that people are unwilling to label others as liars and this partly results in over-estimating the truthfulness of senders. There is evidence for a number of biases which will impact differentially depending on the medium of communication. There appears to be a general tendency to judge people as truthful and this bias is most evident when communicating with more interactive, visual media such as face-to-face. There appears to be a bias towards visual information at the expense of verbal information, the visual bias. This bias can influence judgements in various ways. If a sender regularly displays cues associated with deception through the verbal channel but looks honest, they may be judged more leniently than the same sender who is only listened to. The appearance of honestly or not has been labelled the demeanour bias and some research has found that some people are consistently judged as honest and others as dishonest (Zuckerman et al., 1979). These judgements can often be unrelated to the actual honesty of the senders. This demeanour bias would seem likely to be related to the social skills and appearance of the sender, and the context and congruity of behavioural cues. Some workers have found evidence for a lie bias, a heightened suspiciousness found especially in trained investigators. Millar and Millar (1997) posit that under conditions of high cognitive demand, highly suspicious people may rely on a lie bias. It is not unreasonable to suppose that videoconferencing might be the most demanding of media as it requires attendance towards multiple channels (sometimes of varying quality) but does not have the easy familiarity of face-to-face. Interpersonal deception theory predicts that in more interactive contexts receivers will judge senders as more credible because interaction fosters a sense of relational connectedness that leads to increased feelings of rapport and similarity. This increased rapport can be observed as responsive, coordinated and synchronous communication (Burgoon & Buller, 1996).

There is a large body of evidence that receivers are more likely to be trusting and rate participants as truthful rather than deceptive when communicating face-to-face (e.g. Buller, Strzyzewski & Hunsaker, 1991). How these biases impact with other media is not so clear. Burgoon et al. (2003) compared text-only, audio-video, audio-only and face-to-face media conditions. They found that deceivers were less trusted in an audio-only condition compared to audio-video. Bond and DePaulo (2006) reviewed eleven studies where the degree of interactivity of senders and receivers was experimentally manipulated. They found evidence that receivers who were directly interacting with senders (compared to third party observers) were more likely to judge them as truthful. Research on deception has found that people have a tendency to be overconfident in their judgements and there is only a very weak relationship between confidence and lie detection accuracy (DePaulo, Charlton, Cooper, Lindsay & Muhlenbruck, 1997, cited in Hartwig, Granhag, Strömwall and Vrij 2002).

3.4 Receiver Behaviour – Discrimination of Honesty and Deception

The existing literature indicates that detecting deception is difficult, but a small and reliable capability appears to exist. Bond and DePaulo (2006) reviewed 206 studies where strangers judged the veracity of both lies and truthful statements. The analyses were compared at the level of individual receiver accuracy. In 292 samples where receivers judged messages as lies or truthful, they founded a weighted mean of 53% correct classification which is reported to be significantly greater than that expected by chance.

It has been supposed in the past that individuals might vary in their ability to detect deception, and some studies have searched for people who might show consistent detection expertise. Buller and Burgoon (1996) suggest that detection abilities might vary as a function of social competences. Studies such as Zuckerman, DePaulo and Rosenthal (1981) among others have failed to find a relation between detection accuracy and a range of individual differences including age, education and expertise. In a meta-analysis by Bond and DePaulo (2008), they found little evidence that individuals vary more than by chance in their ability to detect deception. They suggest that the outcome of a deception judgement depends more on the liar's tendency to appear deceptive than on any other individual difference.

3.4.1 *Media differences in detecting deception*

Regardless of the particular theoretical perspective, any significant ability to detect deception suggests that senders must reveal their attempts at deception through verbal and/or nonverbal behaviour. Given that communication media vary in their ability to transmit verbal and nonverbal behaviour, it might be expected that detection of deception will systematically vary under different media conditions.

Some research suggests that detection should be better when visual cues are available. For example, DePaulo and Rosenthal (1979) point out that the voluntary control of behaviour that deceivers attempt may actually reveal their deception, they can too hard to convey an honest appearance. This may result in overdoing some behaviours or appearing stiff and unnatural.

Other studies have indicated that the availability of visual cues may result in less accurate detection. Monitoring dependant lies are those where it is useful for the sender to see the receiver's reactions to the attempted deception. Some work has reported that if deceivers tell monitoring dependent lies then visual cues can harm receivers' ability to detect the deception (Schweitzer et al., 2002). According to interpersonal deception theory, the more interactive a communication media is, the greater the opportunity for deceivers to modify their behaviour and avoid detection. Face-to-face is generally regarded as the most interactive media, with audio-video, audio-only and textual media progressively less interactive. There is some limited experimental support for this perspective.

Burgoon et al. (2003) claimed that deceivers are less prone to monitor their vocal behaviours than their visual behaviours. In conclusion, detection should be better in an audio-only modality than when visual cues are available.

Bond and DePaulo (2006) reported significant differences in detection accuracy under various media conditions. Classification accuracy was found to be significantly lower in a video-only condition compared to both audio-only and audio-video. They did not report differences in classification accuracy between audio-video and audio-only, or between face-to-face and other media. In a small subset, video-only was found to result in lower classification accuracy than written transcripts. There are a limited number of studies which have reported significant differences in detection accuracy under varying media conditions.

It is clear that behaviour, beliefs and perceptions influence one another in complex ways and the separation in this thesis is an attempt at clarity of analysis, not to suggest a functional separation. As such, the behaviour of receivers is defined as their judgements of message veracity. That is whether a message is judged to be true or false. The accuracy of these judgements is dependent upon a number of factors which may include:

- The ability of receivers to discriminate between truthful and deceitful answers. This may vary as a product of:
    - Individual receiver expertise and motivation
    - The context of communication, in this case media conditions
    - The nature of the questions asked (for instance, the level of seriousness of the context)
    - The motivation of the deceiver to avoid detection
    - The content and plausibility of the answers
- Their tendency to judge answers as true or false. This may also vary as a product of:
    - Individual receivers' biases, mood, personality
    - Individual senders' demeanour, social skills

- The context of communication
- The nature and seriousness of the questions asked

3.5 Thesis Structure

The experimental work reported in this thesis consists of two questionnaire studies, two interactive experimental studies and five further experimental studies which used recordings from the first interactive experimental study as stimuli.

The perceptions of senders (and to an extent) receivers was investigated through two questionnaire studies reported in Chapters 4 and 5 (Media Questionnaire Studies 1 and 2).

The perceptions of senders was also investigated by their assessments of how believable they were when communicating in two interactive experimental studies where people asked and answered questions and attempted to correctly judge when people were deceiving or being honest. These findings are reported in Chapters 6 and 7 (Experimental Studies 1 and 2).

The behaviour of senders was investigated by giving them the opportunity to lie or tell the truth when communicating with a range of media in an interactive experimental study, reported in Chapter 6 (Experimental Study 1).

The perceptions of receivers was assessed by their tendency to judge messages communicated in the two interactive experimental studies as truthful or deceptive, reported in Chapters 6-8.

The behaviour of receivers was investigated though their success at classifying messages as truthful or not in the experimental studies.

Perceptions and behaviour of receivers was also investigated through a number of studies (Experimental Studies 3-7) which used media recordings from Experimental Study 1 and presented them to new participants and were reported in Chapters 9-12.

4. Sender Perceptions of Discomfort and Detectability: Questionnaire Study 1

4.1 Introduction

This chapter reports a questionnaire study which investigated the perceptions that people have regarding communication media and deception. The study focuses upon the beliefs that people hold regarding deception and communication media as they relate to telling lies, that is, as potential senders. The study presented participants with a number of deceptive scenarios as narratives and they were required to rate the narrative on a number of scales designed to assess their perceptions of believability while using a range of communication media. The aim of this study was to describe some realistic contexts to people in which they might imagine themselves engaging in deception and to discover: whether they feel some lies are more serious than others; whether it matters if they get caught or not; and whether they would feel comfortable and/or believable to different degrees if telling these hypothetical lies through a range of communication media. The media being: email, telephone, live test-chat, face-to-face, videoconferencing and phone text (SMS). A number of studies have investigated the perceptions that people hold about their own and others' deceptions (e.g. DePaulo et al., 1996a, 2004) and the communication media choices which people make when planning, or engaging in deception (Hancock et al., 2004; George & Carlson, 2005). We aimed to bring together and extend the previous research that has investigated the beliefs people have hold about deception with work on communication media. Before describing the study design and results, we first review some relevant previous research.

The perceptions of people telling lies

As part of their diary study, DePaulo et al. (1996a), for each instance of a recorded lie, participants were asked to judge their deceptions on a number of scales designed to assess various factors. These factors included how important they thought it was not to be caught, how serious they thought the deception was and how likely they thought they were to be believed. The majority of lies told in the sample's daily life were not reported to be serious, participants did not feel it was important to avoid being caught and in general they felt they were believed. DePaulo, Ansfield, Kirkendol and Boden (2004) reported a study which asked participants to relate serious lies which they had told and judge them on a range of scales. Unlike the lies told in daily life reported in the previous study, participants judged themselves to have typically felt high levels of distress whether or not the deceptions were discovered. In fact, approximately half the lies that senders reported were never discovered. In contrast to the study of everyday lies, serious lies were more likely to be told to close romantic partners, but also included attempts to deceive family members, co-workers and strangers.

Media preferences for deception

Researchers have also become interested in whether individuals are more likely to lie using some communication media types than others. DePaulo et al. (1996a) reported results from diary studies that revealed that the majority of lies were told face-to-face, but there were a higher proportion of deceptions in the interactions which took place on the telephone. They argued that the choice of media with which to deceive was driven by the degree of social distance felt by senders. They assert that there is a preference to use media for deception which offer the greatest "distance" in order to avoid the discomfort deception brings about. Hancock et al. (2004) undertook a diary study which investigated the lies a student sample told with various communication media. Participants had access to four media types: face-to-face, telephone, test-chat and email. In common with DePaulo et al. (1996a) they found that the highest number of lies was told face-to-face vs. the telephone. They argue that the proportions of interactions which included lies were the important finding. They report that telephone conversations had the highest proportions of deceptions, greater than face-to-face and test-chat, and email showed lowest proportions of lies. There have been a number of explanations put forward for why the frequency of deception may vary between communication media. Hancock et al. (2004) claim that the results support the three-factor model which contends that the distributed nature of the interaction (distributed or not), the recordability (recordless or recorded) and synchronicity (synchronous or asynchronous) are the most important factors. They argue that deceivers prefer media which are distributed, synchronous and lacking records. George and Carlson (2005) suggested that the Hancock et al. (2004) results can be better explained by their model (Carlson & George, 2004) which extends media richness theory (Daft & Lengel, 1986). Richness is dependent upon a medium's support for: feedback, variety of social cues, language variety and personal focus. Face-to-face is the richest medium and written communication the least rich or leanest. Carlson and George (2004) also suggest that reprocessability (or recordability: the ability of the message to be recorded or not) and rehearsability (the degree to which a medium gives people time to plan and edit their messages) are also important factors. They predict that deceivers should prefer media that offer higher levels of symbol (or language) variety, tailorability (or personal focus) and rehearsability. They also predict that deceivers should also prefer media which offer lower cue multiplicity (or variety) and reprocessability. According to the model, people should prefer to communicate face-to-face if they are deceiving. Carlson and George (2004) report a survey study where participants were presented with a number of deceptive scenarios and had to choose their preferred medium with which to lie. They found no media differences, however when grouped into synchronous and asynchronous media it appeared that the synchronous media were preferred. Whitty and Carville (2008) asked participants to respond to hypothetical scenarios depicting self-serving and other-oriented deception and rate how likely they were to tell the lie face-to-face, via email or using the phone. For self-serving deception, they found the highest likelihood of lying with email, least likely with face-to-face and an intermediate likelihood of using the phone. For other-oriented deception to people close to them, there were no communication media differences. The results reported by Whitty and Carville (2008) for self-serving lies support the social distance theory (DePaulo et al., 1996a).

How people may be detected

There appears to be a general expectation in the general population, in professional lie detectors and occasionally in the research community that deception can be revealed through visual non-verbal behaviour (e.g. Bond & DePaulo, 2006; Akehurst et al. 1996; Lewis, 2009; Masip et al., 2005). These findings suggest that senders may feel that their deceptions will be revealed through visual channels to a greater extent than through non-visual channels. It might therefore be expected that people will feel more vulnerable to detection when they are using communication media which support visual cues.

In the previous diary study research, theories about media choice for deception have been generated from the frequencies of lies reported under various communication media conditions. In some other studies, participants have chosen the media conditions under which they would be expected to lie given hypothetical deceptive scenarios. To our knowledge, only DePaulo et al. (1996a) asked participants to report the media condition with which they lied and also to judge the lie on various measures of discomfort and believability. However they did not report how the media condition related to believability or discomfort. Their study also only investigated the everyday lies people told over a fairly short period of time and as such did not investigate a significant number of serious lies. The study of serious lies reported (DePaulo, 2004) did not investigate communication media. This previous research prompts the first research question:

Is the degree of comfort people feel telling lies related to how believable they feel they are?

If the discomfort people expect to feel while deceiving is directly related to how detectable they believe themselves to be, then we may expect to see a direct correlation between the measures. The second research question is therefore:

Does the discomfort and detectability that people expect to feel when telling lies relate to the features of communication media?

If the social distance theory is correct, we will expect to find that the discomfort people anticipate feeling while deceiving will be related to the apparent distance of the medium. Although DePaulo et al. (1996a) do not define the media characteristics which impart a perception of social distance; they indicate that distance is least for face-to-face, medium for the telephone and most for written communication. We surmise that cue multiplicity, synchronicity and the other features which are related to media richness and social presence are also related to social distance. Richer media, which facilitate greater social presence may show the least social distance. The feature-based theories (Hancock et al., 2004; Carlson & George, 2005) suggest that people choose media with which to deceive on the basis of their specific features. The theories do not make it clear whether media chosen for deception are those in which senders feel most comfortable and/or believable. If this is the case then we may find that expectations of discomfort and/or how believable people believe themselves to be will differ between media due to particular features of the communication media and not on the dimensions of richness or social distance. Hancock et al. (2004) argues that synchronicity is important for media choice in part because the majority of lies are unplanned, and therefore may be less likely to arise in email and other media in which message planning can take place. For planned lies, this feature may not have the same impact as for spontaneous deceptions. The recordability and the distributed nature of a medium is agued by Hancock et al. (2004) to be important features which may impact on planned lies. The more distributed and least recordable media are those preferred. If Hancock et al. (2004) are correct, then we may find that telephone should be preferred over all other media as it is less likely to be recorded than SMS, text-chat and email, but is more distributed than face-to-face and videoconferencing. If the discomfort people expect to feel is related to detectability and people believe deception to be detected through visual non-verbal cues, then we would expect to find the discomfort and detectability highest for face-to-face and videoconferencing and lower in all other media conditions. The third research question is:

Does the greater discomfort that is expected to be felt by people telling serious lies result in different perceptions of believability in the range of communication media?

If the media choice which people make for deception is directly related to how uncomfortable they feel, then we might expect to find media differences in believability for serious lies, but not for the trivial lies which have been found to not be accompanied by significant distress (e.g. DePaulo. et al., 1996a).

Some research has investigated the behaviour of people telling self-serving and other-oriented lies. Self-oriented or self-serving lies are those told to benefit the sender, such as "I did not break the window" when in fact you did break the window. Other-oriented lies are those such as "Yes, you are really pretty" when you do not find the target of the lie attractive at all. Whitty and Carville (2008) reported results indicating that the likelihood of telling self-serving deception was related to social distance, with a greater likelihood of lying in more distant email. They found little evidence of communication media differences for the likelihood of telling other-oriented lies. The results reported by Whitty and Carville (2008) for self-serving lies support the social distance theory (DePaulo et al., 1996a). We will also ask the fourth research question:

Does the discomfort felt by people telling self and other-oriented lies differ between media types?

If the results of this study support the findings of Whitty and Carville (2008), we will expect to find the discomfort felt by people telling self-serving lies to be related to the social distance afforded by media. We expect to find greater discomfort felt for "close" media and less discomfort for more "distant" media types. For other-oriented lies, we may expect to find smaller differences in discomfort between media types.

A number of studies have found variations in the preferences people have for communication media in general and specifically when telling lies. Some of this research appears to confuse the perceptions people have for which media they would prefer to lie with and/or think they would use in a particular scenario, and which media they actually use. This study is concerned only with the perceptions and expectations people have. The study was designed to build upon previous studies by extending the range of communication media which are assessed to include media types which are in fairly common usage. To our knowledge no single study has compared six communication media in use today. Many experimental studies of deception are as naturalistic as possible, but lies tend to be self-serving and relatively trivial. For ethical considerations, questions and answers in most experimental studies are fairly trivial to ensure there are minimal consequences if discovered lying. This study allows an investigation into more serious deceptions which people may direct to a range of targets. They address people's perceptions about self-serving and other-oriented lies with greater and lesser consequences through the use of narratives which describe hypothetical deceptions. This study used hypothetical scenarios in common with previous work which has argued that this methodology "can reveal greater truths, especially when considering socially undesirable behaviours" (p. 1030, Whitty & Carville, 2008).

4.2 Method

4.2.1 *Participants*

51 participants of approximately equal numbers of international and British, men and women were recruited from staff and students at the University of Nottingham via email and poster advertisements. The advertisement briefly explained that a study investigating deception and truth telling were taking place, excellent spoken and written English was required and that participants would be paid a small inconvenience allowance. People who expressed an interest in participating were met face-to-face to ensure their spoken English was fluent.

4.2.2 *Materials*

A set of eight short narratives of approximately 50-100 words each were constructed to illustrate a range of lies that might realistically told in everyday life (see below). They were designed such that it was feasible that they could be told by any gender, age, nationality, religious persuasion or ethnicity. They varied with the seriousness of the lie, with four narratives describing fairly trivial lies with minimal consequences and four major deceptions with serious consequences to both the target and/or the person deceiving. The second dimension was whether the deception was self-serving or other-oriented, four narrative depicted self-serving deceptions, and four described other-oriented lies. The targets of the depicted lies were work colleagues, employer, friends and romantic partner.

4.2.2.1 The narratives

1. Trivial, self-serving deception: You have just had a fairly boring weekend, you had planned to go out with friends but they cancelled at the last minute. You have a work colleague who always asks you on Monday morning if you have had a good week-end. You can't be bothered to explain what happened so you'll say that you had met up with some friends and had a fun time.

2. Serious, self-serving deception: Everyone at work has been told not to take drinks into the company computer room. You're on your own in there one day, have brought in a coffee and manage to spill it all over the machine, which stops working. No-one has seen you, so you leave the room and don't mention it to anyone. Next day, the damage is discovered and your boss is very annoyed, he knows you were working in the room and asks if you know anything about it, instead of admitting that you were at fault you pretend to be completely unaware of the incident.

3. Trivial, self-serving deception: Your partner is extremely untidy, hasn't done any housework for ages and it's getting on your nerves. They're spending the day at home, so you lie and say that your parents are coming for the weekend and ask your partner to tidy up before they arrive.

4. Serious, self-serving deception: You're in a long-term relationship, are mostly very happy, and you certainly don't want it to end. However, you went out with your friends to a nightclub, had a few drinks, and ended up getting physically intimate with someone you met there. Unknown to you, a friend of your partner was there too and has told them that you were with this person. Your partner is very suspicious and asks

you what has happened. You tell them that you were just chatting with this person and nothing went on.

5. Trivial, other-oriented deception: Your friend has just had a new haircut, you avoid saying anything when you first see her as you don't really like it. Later on in the day she asks what you think of it and you say that you think it's lovely and makes her look younger.

6. Serious, other-oriented deception: You see one of your work colleagues stealing some stationery from the company office and you know that she's been doing this on many occasions. Your boss suspects her and asks you if you have seen her stealing anything, you say that you haven't.

7. Trivial, other-oriented deception: Your friend has been annoyed by someone at work who keeps asking them if they'd like to go out on a date. Your friend isn't interested at all but this person won't take no for an answer. They ask you why your friend isn't interested and you lie saying that you think they are married even though they don't wear a ring.

8. Serious, other-oriented deception: You're working as a nurse and one of your best friends and colleague on the ward has made a mistake and given a drug overdose to a patient, making them quite ill. Your friend had been out the night before and was very drunk, not for the first time. In fact when you saw them in the morning they smelt strongly of drink. An investigation is being conducted by the hospital and you are asked whether you have any knowledge of drink or drug abuse by your friend. You are told that if you don't tell the truth you could be disciplined or dismissed. You say that you have never seen them drunk and that they seemed fine on the day of the incident.

Participants were told that research had indicated that most people do not tell the truth all the time and that some examples of the kinds of lies that people tell are contained in the document they were given. They were asked to carefully read each example of a lie, try and imagine they were telling this falsehood and rate how would they would feel and behave if they had done so in real life.

It was made clear that the study was not concerned with the morality of telling the truth or not and no suggestion was being made that they would personally tell those lies.

After reading each narrative, participants were required to complete the following series of nine-point Likert-type scales which were modified versions of the rating scales used by DePaulo et al. (1996a). These scales were designed to assess:

- The **importance of not getting caught** telling this lie, ranging from *very unimportant* (1) to *very important* (9)

- The **seriousness** of the lie ranging from *very trivial unimportant lie* (1) to *serious important lie* (9)

The feelings participants thought they would have telling the lie was assessed with two questions for each of six communication media types.

- How **comfortable** would they be telling this lie with email, over the telephone, using test-chat, face-to-face, during a videoconference or using a phone text (SMS) ranging from *very comfortable* (1) to *very uncomfortable* (9)

- How **confident would they be of being believed** if they had told this lie using email, telephone, test-chat, face-to-face, videoconferencing or a phone text (SMS) ranging from *very confident I would be believed* (1) to *very confident I would not be believed* (9)

4.2.3 *Procedure*

Before giving participants the materials, it was ensured that they had experience with all the media types under study. They were asked whether they understood the terms face-to-face, email, test-chat, SMS, phone and videoconferencing and the media were described to them. Some participants were not familiar with videoconferencing equipment so they were shown a high-quality conferencing system with audio and video in operation, and used the equipment to have a brief conversation with other participants or the experimenter. Some participants had taken part in other studies using communication technology and so were experienced with using a high quality videoconferencing system. All participants were familiar with (and used) the other media types so demonstrations were unnecessary.

After any demonstrations, participants were given the materials, and instructed that they were to read through the narratives and complete the rating scales with the equipment in the experimental rooms as the example for the videoconferencing system. Any questions that the participants had were answered and they completed the materials in their own time.

4.3 Results of Media Questionnaire Study 1

To identify if there were perceived differences between communication media without taking any variation of narratives into account, the mean values for the measure of how uncomfortable, and also how detectable people would feel telling the lies with each media type was calculated.

4.3.1 *Media differences in perceptions of discomfort telling lies*

The descriptive statistics for how uncomfortable people believed they would feel telling the lies were averaged across all narratives and are shown in Table 1. A higher value indicates feeling more uncomfortable with telling the lie.

Table 1

Mean Degree of Discomfort Telling Lies in Different Media Types

Media Type (*N=52)*	Email	SMS	Text-chat	Phone	Video	Face-to-face
M	**4.20**	**3.94**	**3.81**	**5.01**	**5.79**	**5.93**
SD	1.67	1.59	1.70	1.44	1.40	1.53
Skewness	0.76	0.52	0.77	0.23	0.21	-0.22

The results are also shown graphically in Figure 1[1].

Repeated measures ANOVA indicated significant differences between media types in how comfortable people would feel telling the lies $F(2.56, 130.33) = 67.96$, $p < .001$.

[1] Throughout this work, all error bars in graphs are standard deviations

(Greenhouse-Geisser adjusted for a significant result from Mauchly's test of sphericity). Post hoc tests were conducted to identify significant media differences and results are shown in Table 2. Bonferonni adjusted values for alpha of .003 were used (.05/15).

Table 2

Probability Values for Post-hoc Comparisons of Media Types in Discomfort

Media Type (N=52)	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
df = 51	t	p	t	p	t	p	t	p	t	p	t	p
email			2.22	= .031	3.48	= .001	-4.91	< .001	-9.05	< .001	-8.79	< .001
SMS	2.22	= .031			-1.83	= .073	6.36	< .001	10.09	< .001	10.06	< .001
Text-chat	3.48	= .001	-1.83	= .073			7.30	< .001	-10.35	< .001	-10.50	< .001
Phone	-4.91	< .001	6.36	< .001	7.30	< .001			-5.55	< .001	-8.78	< .001
Video	-9.05	< .001	10.09	< .001	-10.35	< .001	-5.55	< .001			0.92	= .364
Face-to-face	-8.79	< .001	10.06	< .001	-10.50	< .001	-8.78	< .001	0.92	= .364		

Post hoc tests indicate that participants feel most comfortable telling lies using email, text-chat or SMS and there were no significant differences between these text-based media, except for one comparison. Participants judged that they felt more uncomfortable deceiving with text-chat than email. They feel least comfortable using video or when face-to-face and there no significant difference was identified between these audio-visual media. The telephone was significantly different to all the other media, and is intermediate in the perceptions of discomfort.

4.3.2 *Media differences in perceptions of believability when telling lies*

A higher value indicates less confidence that they would be believed telling the lie, that is higher perceived detectability. Descriptive statistics for each media type are shown in Table 3.

Table 3

Perceived Detectability of Lies

Media type (*N=52*)	Email	SMS	Text-chat	Phone	Video	Face-to-face
M	**3.72**	**3.72**	**3.68**	**4.44**	**5.08**	**5.02**
SD	1.22	1.20	1.27	1.24	1.29	1.42
Skewness	0.38	0.26	0.47	0.13	0.06	-0.20

The results are also shown graphically in Figure 1.

A repeated measures ANOVA indicated highly significant differences between the media types, $F(2.17, 110.42) = 42.01$, $p < .001$ (Greenhouse-Geisser adjusted for a significant result from Mauchly's test of sphericity). Results from post hoc paired sample t-tests are tabulated in Table 4. Bonferonni adjusted values for alpha of .003 were used (.05/15).

Table 4

Probability Values for Post-hoc Comparisons of Detectability in Media Types

Media Type (*N*=52)	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
df = 51	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*
email			-0.03	= .980	0.60	= .555	-5.50	< .001	-8.24	< .001	-6.65	< .001
SMS	-0.03	= .980			-0.65	= .520	5.47	< .001	8.48	< .001	7.00	< .001
Text-chat	0.60	= .555	-0.65	= .520			5.38	< .001	-8.35	< .001	-6.60	< .001
Phone	-5.50	< .001	5.47	< .001	5.38	< .001			-5.00	< .001	-4.68	< .001
Video	-8.24	< .001	8.48	< .001	-8.35	< .001	-5.00	< .001			-0.53	= .596
Face-to-face	-6.65	< .001	7.00	< .001	-6.60	< .001	-4.68	< .001	-0.53	= .596		

Analyses indicate that participants feel least detectable telling lies using email, text-chat or SMS and there are no significant differences between these media. They feel most detectable using videoconferencing or when communicating face-to-face and there is no significant difference identified between these media. Phone was intermediate in the perceptions of detectability and was judged as significantly different from all other media types.

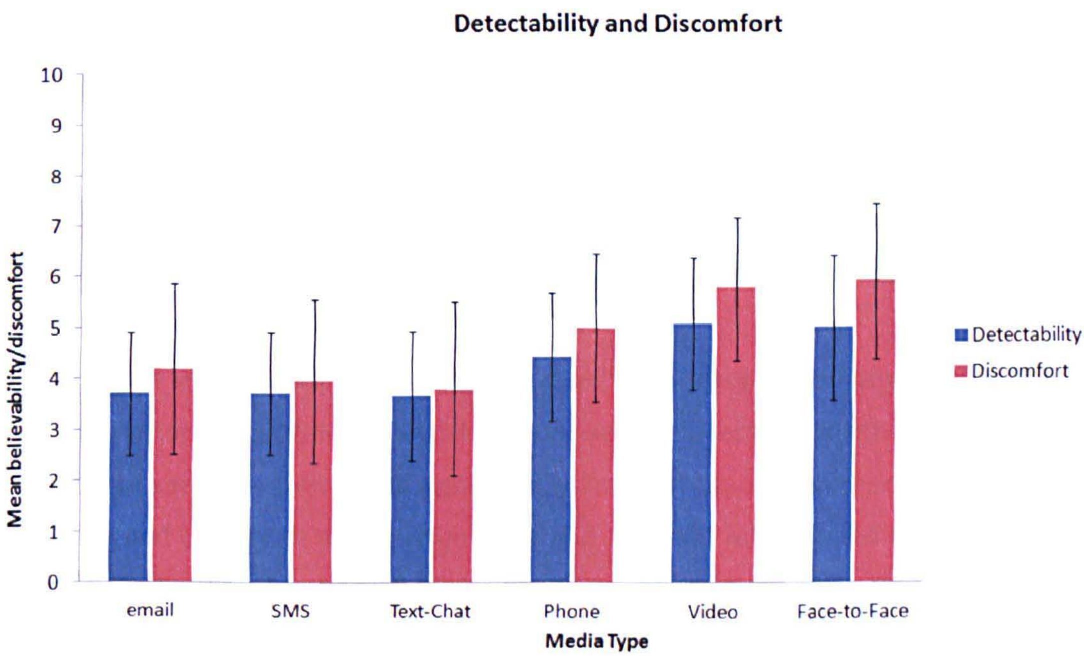


Figure 1 **Mean Detectability and Discomfort for each Media Type**

We asked **whether the degree of discomfort people feel telling lies relates to how believable they feel they are.** Pearson correlations were conducted to determine if the level of discomfort felt by participants in each media condition was related to the perceived detectability. The average values for all narratives were used to compare the measures of discomfort and detectability for each media type. Significant correlations were identified between discomfort and detectability for email, $r = .76$, $p < .001$; for SMS, $r = .65$, $p < .001$; for text-chat, $r = .73$, $p < .001$; for the phone, $r = .83$, $p < .001$; for videoconferencing, $r = .59$, $p < .001$; and for face-to-face, $r = .82$, $p < .001$. Results indicate that there were significant relationships between the level of discomfort people felt telling the lies and the expected detectability for each media type.

The results suggested there was a strong relationship between the expected discomfort felt by participants and detectability. The relationship was highly significant for all media types. If participants felt uncomfortable telling a lie while using a particular media, the results suggested that they would also feel highly detectable. The pattern of differences between media types was similar between the degree of discomfort participants felt and the degree to which their lies would be detected. The media clustered into three distinct groups within which for the majority of tests media were judged the same as each other: the text-based media of email, SMS and text-chat; the visual media of videoconferencing and face-to-face and the telephone on its own. Only one analysis differed between two measures, the discomfort felt by people using text-chat was significantly greater than email.

4.3.3 *Differences between narratives in their seriousness and the importance not to be discovered lying*

To investigate whether there are differences between media depending on the importance and seriousness of lies and whether the lie is self-serving or other-oriented, it is necessary to see if the narratives significantly varied from one another. The narratives were designed to vary in their seriousness and it would be expected that they would also vary in the degree to which participants would want to avoid discovery of their deception. Narratives 1, 3, 5 and 7 were intended to be trivial, relatively unimportant lies, 2, 4, 6 and 8 were serious, important lies. Descriptive statistics for the judgement of deceptions' seriousness are shown in Table 5.

Table 5

Seriousness of the Lie Depicted in each Narrative

Narrative (N=52)	1	2	3	4	5	6	7	8
M	**2.69**	**7.42**	**3.44**	**8.12**	**3.33**	**6.35**	**3.65**	**8.63**
SD	1.83	1.39	1.64	1.06	1.97	2.12	2.25	1.17

A repeated measures ANOVA indicated that the perceived seriousness of narratives was significantly different, $F(4.69, 239.32) = 62.40$, $p < .001$. A repeated measures ANOVA identified a significant difference between the mean seriousness of narratives 1, 3, 5, and 7 with narratives 2, 4, 6 and 8, $F(1, 51) = 493.86$, $p < .001$. The results indicated that the lies as described differed in their perceived seriousness with narratives 1, 3, 5 and 7 regarded as more trivial and less serious than narratives 2, 4, 6 and 8. The narratives were designed such that participants would regard some lies as serious, others as more trivial and the results appear to support the intention.

For the measure of *importance not to be discovered lying*, descriptive statistics for each narrative are shown in Table 6.

Table 6

Importance Not to Be Discovered

Narrative (N=52)	1	2	3	4	5	6	7	8
M	**4.12**	**7.67**	**3.79**	**8.00**	**4.23**	**6.42**	**3.96**	**8.60**
SD	2.30	1.80	1.72	1.53	2.31	2.07	2.53	1.26

A repeated measures ANOVA indicated that the differences between narratives was significant, $F(4.69, 239.32) = 62.40, p < .001$.

Judgements of the seriousness of the deception and the importance not to be caught lying for each narrative are shown in Figure 2.

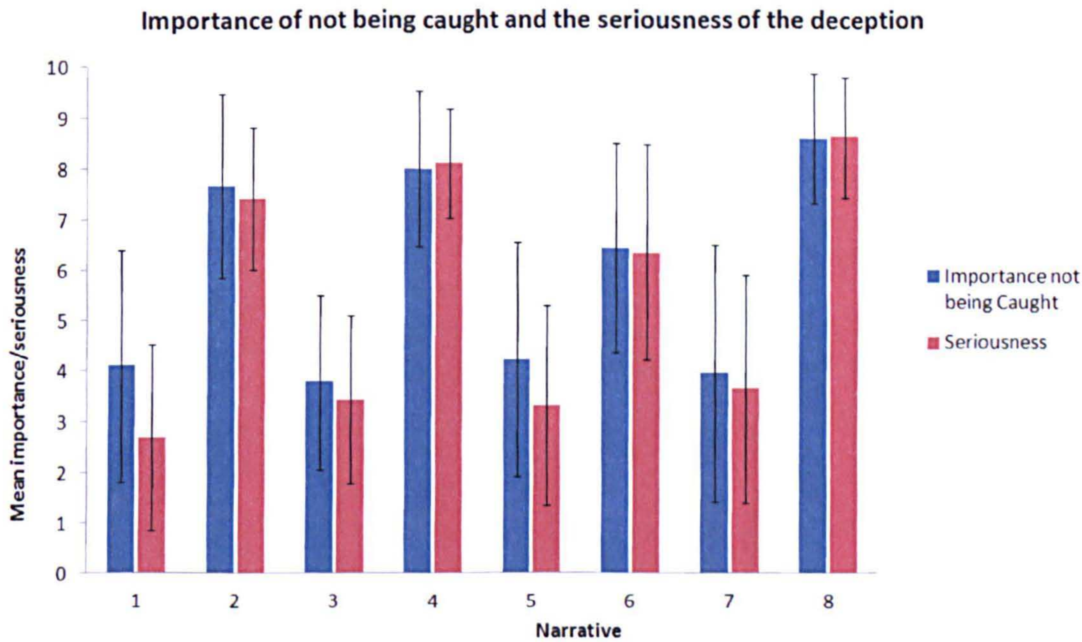


Figure 2 **Importance of Not Being Discovered and Seriousness of the Deception**

Pearson correlations were conducted to determine if the seriousness of the lie in each narrative was related to the perceived importance of not being caught. Significant correlations were identified between seriousness and importance to avoid detection for all the narratives. Narrative 1, $r = .49, p < .001$; narrative 2, $r = .63, p < .001$; narrative 3, $r = .64, p < .001$; narrative 4, $r = .72, p < .001$; for narrative 5, $r = .49, p < .001$; for narrative 6, $r = .82, p < .001$; for narrative 7, $r = .74, p < .001$; and narrative 8, $r = .86, p < .001$. The results indicate that the more serious a lie is judged to be, the more important it is not to be detected.

4.3.4 *Interaction of narrative and media perceptions*

Figure 3 displays the values of mean discomfort in telling the lie for each media type for each narrative. A higher value indicates a higher degree of discomfort.

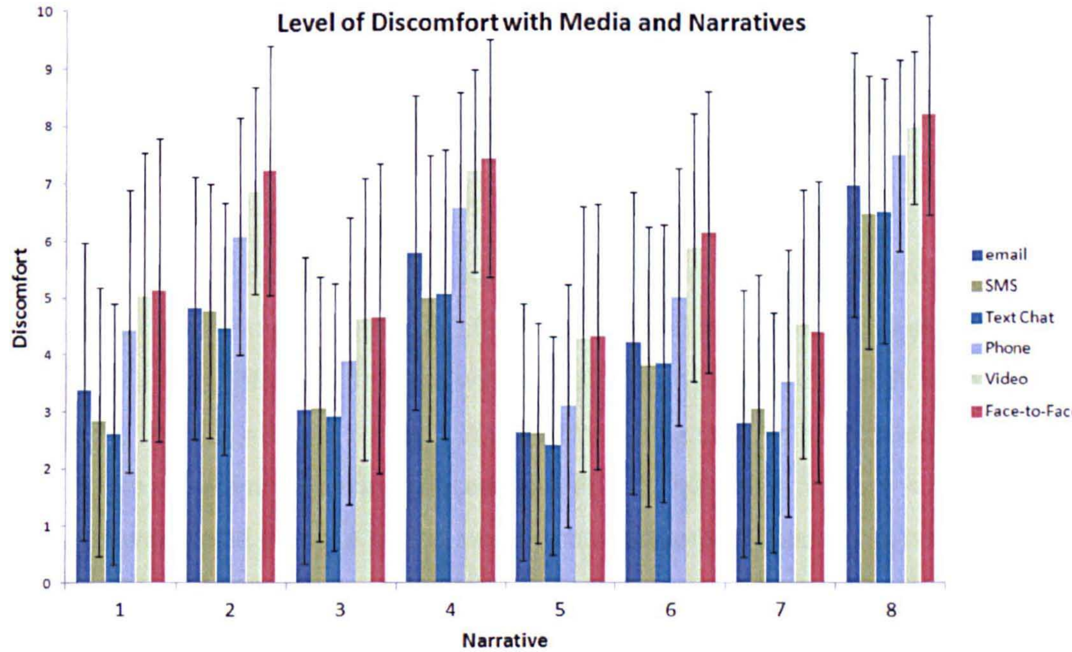


***Figure 3* The Discomfort telling lies for each narrative and media type**

The Seriousness of Deceptions and the Degree of Discomfort Felt

We asked whether differences in the degree of discomfort felt telling lies with different media types would vary between serious and trivial lies. For instance people may believe that for serious lies their higher levels of discomfort might make them more detectable in some media conditions, but for trivial lies they may feel fairly undetectable in any media condition. There are other potential differences between media which might become more salient when lies are more serious. Descriptive statistics for the discomfort felt telling serious and trivial lies are shown in Table 7.

Table 7

Mean Discomfort for Serious and Trivial Lies

Media type (*N=52*)		Email	SMS	Text-chat	Phone	Video	Face-to-face
Serious Lies	*M*	**5.44**	**5.00**	**4.97**	**6.29**	**6.98**	**7.25**
	SD	1.93	1.85	1.93	1.42	1.36	1.58
Trivial Lies	*M*	**2.96**	**2.88**	**2.64**	**3.73**	**4.61**	**4.62**
	SD	1.94	1.76	1.75	1.81	1.76	1.93

A repeated measures ANOVA was performed to compare the mean discomfort felt for all media types between serious ($M = 5.99$, $SD = 1.46$) and trivial ($M = 3.57$, $SD = 1.61$) lies. A significantly greater discomfort was identified for serious lies, $F(1, 51) = 154.25$, $p < .001$.

A pair of repeated measures ANOVA were performed to identify any differences in discomfort felt between media types. Bonferroni corrected values for alpha of .25 were used (.05/2). A significant difference was identified between media types for the trivial lies, $F(2.81, 143.43) = 44.98$, $p < .001$. A significant difference was also identified between media types for the serious deceptions, $F(2.79, 142.29) = 58.46$, $p < .001$. Post hoc t-tests were used to make paired sample comparisons. A Bonferroni corrected value for alpha of .003 was used (.05/15). Results for the trivial lies are shown in Table 8, results for the serious lies in Table 9.

Table 8

Probability Values for Post-hoc Comparisons of Discomfort forTrivial Lies in Media Types

Media Type (*N*=52)	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
df = 51	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*
email			0.50	= .621	2.34	= .023	-3.45	= .001	-7.10	< .001	-6.87	< .001
SMS	0.50	= .621			3.32	= .002	-4.33	< .001	-9.20	< .001	-8.19	< .001
Text-chat	2.34	= .023	3.32	= .002			-6.03	< .001	-10.28	< .001	-9.08	< .001
Phone	-3.45	= .001	-4.33	< .001	-6.03	< .001			-5.35	< .001	-5.91	< .001
Video	-7.10	< .001	-9.20	< .001	-10.28	< .001	-5.35	< .001			-0.06	= .956
Face-to-face	-6.87	< .001	-8.19	< .001	-9.08	< .001	-5.91	< .001	-0.06	= .956		

Table 9

Probability Values for Post-hoc Comparisons of Discomfort for Serious Lies in Media Types

Media Type (*N*=52)	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
df = 51	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*	*t*	*p*
email			2.67	= .010	2.96	= .005	-4.86	< .001	-8.44	< .001	-8.93	< .001
SMS	2.67	= .010			0.28	= .783	-6.66	< .001	-8.77	< .001	-9.67	< .001
Text-chat	2.96	= .005	0.28	= .783			-6.95	< .001	-8.94	< .001	-10.00	< .001
Phone	-4.86	< .001	-6.66	< .001	-6.95	< .001			-4.62	< .001	-8.49	< .001
Video	-8.44	< .001	-8.77	< .001	-8.94	< .001	-4.62	< .001			-1.74	= .088
Face-to-face	-8.93	< .001	-9.67	< .001	-10.00	< .001	-8.49	< .001	-1.74	= .088		

The only difference between serious and trivial lies in the paired comparisons is that the degree of discomfort for trivial lies was judged to be significantly less than for SMS; the difference was not significant for serious lies.

The results indicate although the degree of discomfort that participants judge themselves as likely to feel varies between the different narratives, and across the media types, the patterns are the same. That is, although, they may feel less comfortable telling a serious compared to a trivial lie, the relationships between the media do not change. That is, regardless of the seriousness of the deceptions, participants feel most comfortable telling the lies using text-based media, most uncomfortable with the visual media types and the phone is intermediate. Although there are some small variations between narratives, the media appear to cluster into these three groups with greater differences between, than within the groups.

Self-serving and other-oriented lies

The study also investigated whether the degree of discomfort felt while using various media types might vary according to whether lies were self-serving (such as "I did not steal the car") and other-oriented (such as, "I really like your new pink suit"). Narratives 1-4 depicted self-serving lies, narratives 5-8 described other-oriented deceptions. A research question asked whether the discomfort felt by people telling self-serving and other-oriented lies differed between media types. Table 10 shows levels of discomfort felt for self-serving and other-oriented deceptions for each media type.

Table 10

Mean Discomfort for Self-serving and Other-oriented Lies

Media type (N=52)		Email	SMS	Text-chat	Phone	Video	Face-to-face
Self-serving Lies	*M*	**4.25**	**3.91**	**3.76**	**5.24**	**5.93**	**6.10**
	SD	1.89	1.79	1.88	1.64	1.58	1.69
Other-oriented Lies	*M*	**4.14**	**3.98**	**3.85**	**4.77**	**5.66**	**5.76**
	SD	1.79	1.71	1.73	1.54	1.54	1.63

A repeated measures ANOVA was performed to compare the mean discomfort felt for all media types between self-serving (M = 4.86, SD = 1.50) and other-oriented (M = 4.69, SD = 1.46) lies. No significant difference was identified, $F(1, 51) = 1.19, p = .280$. A pair of repeated measures ANOVA were used to identify any differences in discomfort felt between media types. Bonferroni corrected values for alpha of .25 were used (.05/2). A significant difference was identified between media types for the self-serving lies, $F(2.87, 146.14) = 57.19, p < .001$. A significant difference was also identified between media types for the other-oriented deceptions, $F(2.87, 146.48) = 49.03, p < .001$. Post hoc t-tests were used to make paired sample comparisons. A Bonferroni corrected value for alpha of .003 was used (.05/15). We only report the other-oriented lies here as the results identified the same significant differences between media in all pairs for both self-serving and other-oriented lies. No significant differences were identified in email compared to SMS, $t(51) = 1.11, p = .274$; email compared to text-chat, $t(51) = 2.53, p = .015$; SMS compared to text-chat, $t(51) = 1.17, p = .249$; and videoconferencing compared to face-to-face, $t(51) = -0.66, p = .513$. Results indicated that the degree of discomfort was greater for the visual media than the phone, which was greater than the text-based media. There was no evidence that the media type affected the discomfort felt by telling self-serving lies compared to other-oriented lies. There was little evidence that the discomfort felt by telling self-serving lies was different to other-oriented lies.

4.4 Discussion

A questionnaire study was conducted to investigate the perceptions that people had about lying by presenting participants with a number of deceptive narratives which they might tell while using a range of communication media. The study extended previous research by expanding the variety of communication media under investigation, varying deceptive narratives by the seriousness and the target of lies and whether the lies were self-serving or other-oriented. Participants judged the seriousness of lies, how important it was not to be detected, and how believable and comfortable they would be telling the lies while using email; SMS; text-chat; telephone; videoconferencing ; and face-to-face.

We investigated **whether the degree of discomfort people feel telling lies related to how believable they feel they are.**

Correlations indicated that there was a strong relationship between the expected discomfort felt by participants and detectability for all media types. If participants felt uncomfortable telling a lie while using a particular media, they would also feel highly detectable. We also investigated **whether the comfort and believability that people expect to feel was related to the features of communication media.** There were significant differences between some media types and the pattern of differences was almost identical between the degree of discomfort participants felt and the degree to which their lies would be detected. The media types clustered into three groups within which the majority of tests showed media were not judged to be significantly different from each other. These three groups were: The text-based media of email, SMS and text-chat; the visual media of videoconferencing and face-to-face and the telephone on its own. Only one analysis identified a difference between two measures, the discomfort felt by people using text-chat was significantly greater than email. Participants felt less comfortable and believable with the visual and interactive face-to-face and videoconferencing media, and most comfortable and believable with text based media types. The telephone, an interactive but not visual media fell between the two other groups. The results broadly supported the predictions of the social distance theory (DePaulo et al., 1996a). The discomfort people expect to feel deceiving was related to the apparent distance of the medium. The more socially distant media were, the lower the discomfort felt while deceiving. We found little support for the feature-based theories (Hancock et al., 2004; Carlson & George, 2005) which suggest that people choose media with which to deceive on the basis of their specific features, such as synchronicity or recordability. If this was the case then we may have expected to find that discomfort and/or believable people perceive themselves to be will differ between media due to particular features of the communication media and not on the dimensions of richness or social distance. However, the theories do not make it predict whether media chosen for deception are also those in which senders feel most comfortable and/or believable so results must be treated with caution. Hancock et al. (2004) suggests that more distributed and least recordable media are preferred and the telephone would be preferred over all other media. Our results did not support this prediction. We also found little support for George and Carlson (2004) and their interpretation of media richness theory which predicts that people should prefer richer media for deception.

The seriousness of deception

Narratives were designed to vary in their seriousness and it was expected that that the more serious lies would also be those for which it would be most important not to be discovered. The narratives varied as designed, some deceptions were assessed as more serious than others and were rated as more important not to be discovered. Significant correlations were identified for all media types between the seriousness and the importance not to be detected. This would imply (not surprisingly) that people do care that their lies are not detected. We investigated whether **the greater discomfort that expected to be felt by people telling serious lies result in different perceptions of believability in the range of communication media.** We found little evidence that the patterns of detectability and discomfort felt lying with the different media types varied according to whether the lies were serious or trivial. Participants felt less comfortable and more detectable with the serious lies, but the relationships between media types remained comparable with visual media least comfortable, textual media most comfortable and the phone intermediate.

Self- and other-oriented deception

We also investigated whether the discomfort felt by people telling self-serving and other-oriented lies differed between media types. The study identified little evidence that the level of discomfort varied according to who was the perceived beneficiary of the lie. The relationships between media types also remained the same. Whitty and Carville (2008) found a difference in the likelihood of using particular media for telling self-serving lies, but not for other-oriented lies. Our results did not find this difference, but in this study, we investigated discomfort and detectability not likelihood of using a medium. The direct comparison of results may need to take this caveat into account.

4.5 Conclusions

The questionnaire study reported found evidence that media types varied in the degree of discomfort and believability which participants felt telling lies. Results indicated that discomfort and detectability were related and perhaps equivalent. Discomfort and detectability were greatest for visual media types, least for text-based media and was intermediate for the phone. If people prefer to lie with the media types where they feel most distance and least discomfort then results support the social distance hypothesis. We did not find evidence that media differences were affected by the seriousness of lies or whether they were self-serving or other-oriented. To address the question of whether the media that are preferred for deception are the same as those believed to be least detectable and most comfortable the same narratives were used in a further study. It is possible that some media where people feel more discomfort and feel a greater risk of detection could be preferred over media where the discomfort felt while deceiving might be lower and apparent detection less risky. These kind of counterintuitive preferences might exist where there are strong expectations of the target for a particular medium to be used and any change might arouse suspicion, or where certain characteristics of media mean that discovery in the future may be more likely. For example, a media characteristic such as recordability may make some media less tempting to use for deception even if immediate discovery is perceived to be less likely. The follow-on study also aims to investigate whether the general frequency which various media are used might affect the choices people make for deception.

5. Investigating Media Characteristics and the Likelihood of Choosing a Media Type to Deceive: Questionnaire Study 2

5.1 Introduction

Deception is a regular part of daily communicative interactions which people engage in with a range of media types (e.g. Hancock et al., 2004; Serota et al., 2010). Diary studies have reported people telling on average of 1-2 lies per day. DePaulo et al. (1996a) found that the overwhelming majority of interactions were face-to-face, but a higher proportion of interactions conducted on the telephone included deception. They concluded that the telephone was preferred for deception due to its apparent social distance. Hancock et al. (2004) also investigated deception and communication media and reported similar levels of deception. They also found that the majority of interactions were face-to-face but a higher proportion of telephone conversations involved deception than other media types (face-to-face, text-chat, and email). George and Carlson (2005) conducted a survey study and concluded that deceivers tended to prefer richer media for deception as face-to-face was the favoured medium. They did not assess the general (deceptive and non deceptive) frequency that people use the different media types. Media Questionnaire Study 2 aimed to build on these finding from the literature and findings from Questionnaire Study 1 reported in the previous chapter. Participants assessed narratives which described a range of deceptions in Questionnaire Study 1. The narratives described lies that were verified as either trivial, low impact lies or serious, important lies. Participants were asked how comfortable and believable they would be telling these lies with a range of different media: email, phone, text-chat, face to face, videoconferencing and SMS. It was found that media could be grouped into three functional categories. Participants rated themselves as most comfortable and believable using text-chat, SMS and email, least comfortable with face to face and videoconferencing and intermediate values were found for the telephone. Feelings of comfort and detectability were significantly related and may measure the same factor. Questionnaire 1 did not directly investigate the choice of media that people would make in order to deceive. Questionnaire 2 was designed to address this concern. The study also investigated the frequency of use that participants make of the range of media types included in Questionnaire 1. Before the study is described in detail, we review some previous research.

Hancock et al. (2004) and DePaulo et al. (1996a) both reported that face-to-face was the most frequently used media for communication, but a higher proportion of lies were told during telephone conversations. Hancock et al. (2004) reported the highest number of interactions was face-to-face, followed by phone, email and text-chat. They found that the lowest proportion of lies was told while using email. They proposed a three-factor model to explain their findings where media preferred for deception are synchronous, recordless and distributed. Whitty and Carville (2008) used a questionnaire study to investigate the likelihood of telling self-serving and other-oriented lies face-to-face, or by phone and email. They found the least likelihood of telling self-serving lies face-to-face, followed by the phone and least with email. Their results tended to support the social distance hypothesis (DePaulo et al., 1996a) where social distance is the important factor determining media choice for deception, media with the greatest social distance being preferred. George and Carlson (2005) investigated media choice for deception with a survey study. In addition to asking respondents to indicate their preferred choice of media for deception, they were also asked to rate the appropriateness of each medium for deception.

They suggested that the results of the diary study reported by Hancock et al. (2004) can be interpreted to be supportive of media richness theory (Daft & Lengel, 1986). Richer media are those which afford higher interaction speeds (synchronicity), offer more simultaneous information channels and a larger set of informational cues and permit tailoring of the information communicated (George & Carlson, 2005). According to their conceptualisation they expected face-to-face would be preferred to videoconferencing and the phone (regarded as equivalent to each other) and text-based media as least preferred. George and Carlson (2005) asked respondents to choose their preferred media to tell a single lie where they were asked by their boss to deal with a business problem by lying. Some of the participants were given a serious lie, others a more trivial lie, the target of the lie was either familiar to them or a stranger. Media were characterised by the researchers by media richness (lean/rich); synchronicity (asynchronous/synchronous); recordless (creating a record/not creating a record); and distributed or not. When the target of the lie was familiar, the preferred media was synchronous, made no record and was high in media richness. The severity of the deception had no influence on media choice. The distributed nature of the media also had no effect on media choice. When the target of the lie was a stranger, the preference was for leaner media.

The current study will investigate the frequency which people use various media types in their general life and the likelihood of using the media types to communicate with a number of social groups: friends, family, boss, romantic partner and work colleagues. In addition to investigating whether media use varies according to the social group membership of the communication partner, the likelihood of using media to communicate with various partners provides a baseline with which to correct the measure of likelihood of using that media with which to deceive. In previous diary studies (DePaulo et al., 1996a; Hancock et al., 2004) investigating media choice for deception, the majority of interactions were found to be face-to-face, fewer using the phone, less with instant messaging (text-chat) and least with email. Hancock et al. (2004) reported the highest proportion of deceptive conversations used the phone. The reported studies did not report the frequencies of general use and deception with reference to the targets of the deception. Diary studies have reported that more lies per interaction are told to people they feel less emotionally close to (DePaulo & Kashy, 1998). It is possible therefore, that the variation in the frequencies of lying to different targets provides an explanation for media differences in deception frequencies if that there are differences in the media preferences for communicating with different groups of people. The first research question of the current study is:

Are there variations in the likelihood that each media type is used to communicate with different social groups?

Although, we may be safe in making the assumption that communication media vary from one another on a number of dimensions which are properties of the technology. For example, videoconferencing systems are able to transmit some visual cues which are missing from email communication. Some theoretical perspectives such as social presence theory (Short et al., 1976) argue that users' perceptions of the objective properties of media are important in defining the social presence of a medium. A number of theories have been developed to explain media choices which people make and the impact upon their deceptive behaviour including media richness theory (Daft & Lengel, 1986), Social Distance (e.g. DePaulo et al., 1996a) and Social presence. Typically, the properties of media types have been not been assessed by the research participants, but have been defined by investigators (e.g. George & Carlson, 2005). The second research question the current study investigates is:

Do respondents perceive differences between media on a range of characteristics?

In a characterisation of media, George and Carlson (2005) state that face-to-face, videoconferencing, phone and instant messaging (text-chat) are all high in terms of feedback, with email moderate and voice-mail, letter and memos low. Face-to-face, phone, instant messaging and videoconferencing are regarded to be synchronous, with email, letter and memo asynchronous. Face-to-face and videoconferencing are regarded as not distributed and recordless unlike all other media types investigated in the study. If perceptions of media characteristics support the categorisation of George and Carlson (2005) and Hancock et al. (2004) and are objective properties of the media then we may expect to find no difference between face-to-face and videoconferencing in measures of feedback, recordability and synchrony and apparent closeness.

Some research has suggested that unitary perspectives such as social distance and media richness are too simplistic to explain media choices for deception (e.g. Hancock et al., 2004, George & Carlson, 2005) and that the specific characteristics of communication media are important. A number of media characteristics have been investigated including synchronicity, the ability of media to be routinely recorded and whether participants are distributed or not. The study was also designed to investigate the third research question:

Is the likelihood of choosing a medium with which to lie related to the specific characteristics of communication media?

The social distance hypothesis, three-factor model and media richness theory would all predict that the likelihood of choosing communication media with which to deceive is at least influenced by the characteristics of the media type. Social distance hypothesis (DePaulo et al., 1996a) would predict that media are more likely to be used for deception when they afford greater distance from the target of the lie. The three-factor model (Hancock et al., 2004) suggests that media most likely to be chosen for deception are synchronous, recordless and distributed. If media are chosen according to the predictions of media richness theory, richer media will be preferred over leaner media, so we might expect to find synchronous, visual media types preferred over text-based, asynchronous media types. If media differences in the preferences for deception are identified which do not fit the models reported in the literature, we may speculate that some specific characteristics are important. If media are chosen for deception on the basis of their general use, then we may expect to find little difference in frequency of general use and when chosen for deception.

George and Carlson (2005) reported results which suggested that the target of deception had an effect on media choice. Richer media were preferred for deceptions to people familiar to them and leaner media for lying to strangers. We do not specifically manipulate target familiarity in this study; however, we are investigating media choice and the targets of lies. The study investigates the use of media types to communicate in general daily life to various social groups. The fourth research question is:

Is the likelihood of choosing a media type to deceive affected by the social group membership of the deception target?

In the previous study, we found that the measure of the degree of discomfort felt by people telling the lies was related to the measure of the likelihood of detection. In the current study we can ask a final research question:

Is the likelihood of choosing a medium with which to lie influenced by how comfortable people feel?

If the media preferences people reveal are related to the discomfort they feel when telling the lie, then we may expect to find that the likelihood to use a particular media type for deception will be related to the social distance afforded. We will find that people will be more likely to lie using the visual media types, followed by the phone and least likely to lie using text-based media.

The current study extends the previous work by gathering data on the frequencies which participants use each of the media types to communicate with various targets. Participants are also asked to characterise a range of features of the communication media, assess how comfortable they would feel engaging in various acts of deception and make choices as to which media they would use if they were attempting to tell each lie.

5.2 Method

5.2.1 *Participants*

100 participants took part in the study and were recruited through emailing staff and students at the University of Nottingham and asking them to pass on details of the study to other people who might be interested through social networking sites, email and some popular science discussion forums. The participants were approximately 2/3 female with an age range of 16-58 (mean age 28). The majority of the participants were students (60%), but there were also artists, technicians and teachers amongst other professional occupations. 65% of the participants were British. Only one participant did not provide age and occupation.

5.2.2 *Materials and procedure*

The questionnaire was presented using an online survey service and consisted of three parts. Actual questionnaire items are shown in the results section.

Part 1: Personal information asking for information on gender, age, nationality and occupation

Part 2: Questions probing the frequency with which people use six communication media types: email, Short Messaging Service (SMS), live text-chat services (Text-chat), telephone, audio-video conferencing (video) and face-to-face. Questions measured the frequencies that media were typically used to communicate with people in different social groups. Participants had to rate the likelihood that they would use the six communication media listed earlier, when communicating with: their boss, romantic partner, friend, work colleague and a member of their family. These items were designed to generate a metric of general usage levels for each medium and for a range of social interactions.

Participants were also asked to characterise features of the media on a range of scales. The following five questions aimed to assess the impressions participants have of the characteristics of communication media which might impact upon deception. The characteristics identified from the communication media literature were synchronicity, recordability, message planning, social distance and feedback. Participants had to rate the six different media using a seven-point Likert-type scale. The purpose of these items was to identify which media characteristics might predict both the expected media use if planning the different lies and also how comfortable participants anticipate feeling whilst telling the lies. Where convenient for interpretation, results were reversed such that a higher value indicated a greater intensity of the characteristic.

1. Some means of communicating are live, interactive, and synchronous and messages are received immediately after they are sent. Other communication media are asynchronous: there is a delay between saying something and the other person seeing or hearing your message (perhaps seconds, minutes or days). How synchronous or asynchronous would you say that these communication media are? 1 = completely synchronous and 7 = completely asynchronous

2. Although almost anything can be recorded, some communication media naturally leave a trace, messages can be reviewed as many times as you want and don't disappear unless they are erased. How reviewable do you feel that these communication media are in normal use? 1 = completely reviewable and 7 = completely unreviewable

3. Some communication media give you time to plan messages, perhaps rehearse what you want to say. Some other media do not give you that opportunity; you have to think on your feet. How much time do you feel these media give you to plan? 1 = no time to plan and 7 = as much time as you want to plan

4. Communication media may sometimes make you feel like you are with the other person, even in the same room, whilst other media don't give that sense of closeness. How close to the person you're communicating with do these media make you feel? 1 = in the same room and 7 = a very long distance

5. Feedback from the person you are communicating with is sometimes important. This feedback could be for instance, acknowledgment that they have understood, or an indication that they don't agree what you're saying. Communication media may vary in the degree of feedback they offer. How much feedback do you feel these communication media allow you to get from the other person? 1 = very little and 7 = a great deal

Finally, participants were asked to note any other characteristics of communication media that were particularly important to them and which might affect their decision of which one to use when they had a choice.

Part 3: Media choice and lying. The same eight narratives from Study 1 were used.

After reading each narrative, participants were asked to rate how likely they would be to use each of the six communication media if they were planning to tell the lie. The rating was on a seven-point Likert-type scale ranging from 1=very likely to use, to 7=very unlikely to use. The function of this item was to gauge how likely participants thought they were to use each medium and enable this measure to be compared with the general usage measures in the second part of the questionnaire. They also had to rate each medium according to how comfortable they would feel telling the lie if they were already engaged in a conversation. They used a seven-point scale ranging from 1 = *very comfortable,* to 7 = *very uncomfortable.* This item allows a comparison with the results from Questionnaire Study 1 which had an almost identical measure.

Finally they were asked to note any reasons why they might choose a particular communication media if they were planning to tell any of these lies (or others).

5.3 Results from Questionnaire Study 2

It was expected that the results should indicate which characteristics of the communication process participants think are supported by various media types and whether those characteristics are relate to how likely people feel they would be to use them for deception. Results should also show whether variations in the media people are likely to choose for lying varies according to the seriousness of the lie and/or who is the target of the lie.

For ease of interpretation, rating scores were reversed where appropriate, such that a high score means a greater value of the measure. That is, for example, 1 = less likely, 7 = more likely; 1 = less synchronous, 7 = more synchronous and so forth.

5.3.1 *General frequency of media use*

Participants were asked to assess their frequency of use of a list of communication media through the question "**How often do you use the following means to communicate?**" Participants were asked to check a box indicating how frequently that they use the media type:

1. Never
2. Very infrequently
3. Monthly
4. Weekly
5. Less than once a day
6. Once a day
7. More than once a day

A frequency histogram showing the frequency of general use that people make of the range of communication media is shown in Figure 4.

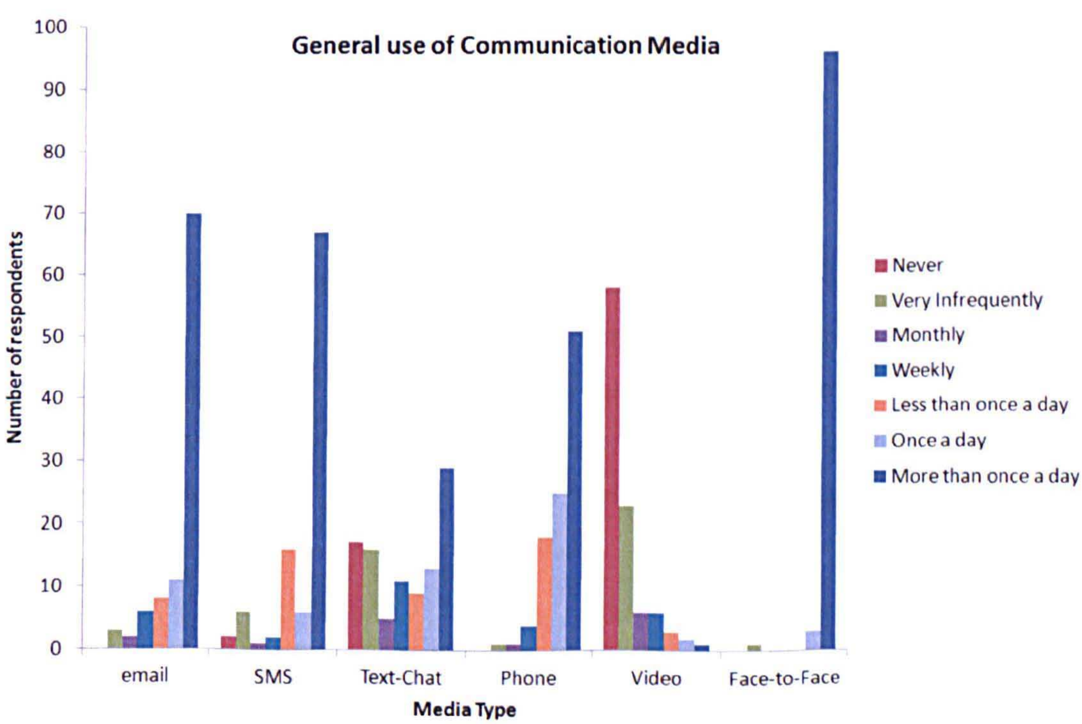


Figure 4 **General frequencies of Media Use**

The frequencies that people reported to use the communication media in their general daily life ranged from one or two to seven for all media types, with the majority of people stating that they used each media type more than once every day. The exception to this finding was videoconferencing where the majority of people never used it. However, there were people who did use videoconferencing at a high frequency. A Friedman comparing the frequencies of use indicated that there was a significant difference between media types, $X^2(5, N = 100) = 299.11, p < .001$. The results indicate that there are variations in the general use that people make of different media types. Fifteen Paired Wilcoxon tests were conducted to compare each media type with each other. A Bonferroni corrected value for alpha of .003 was used (.05/15). The test results reported here are those which illustrate the overall media type ranking for frequency of use. Ranking according to mean frequency of use was: face-to-face ($M = 6.92$, $SD = 0.53$, $N = 100$): email ($M = 6.32$, $SD = 1.26$, $N = 100$): phone ($M = 6.18$, $SD = 1.04$): SMS ($N = 6.10$, $SD = 1.57$, $N = 100$): text-chat ($M = 4.34$, $SD = 2.32$, $N = 100$) and videoconferencing ($M = 1.82$, $SD = 1.31$, $N = 99$). Face-to-face was used significantly more frequently than email, $Z = 4.64$, $p < .001$. There was no significant difference identified between email and phone, $Z = -1.15$, $p = .252$ or between phone and SMS, $Z = -0.01$, $p = .991$. SMS was used significantly more than text-chat, $Z = -5.75$, $p < .001$. Videoconferencing was used less than text-chat, $Z = -7.30$, $p < .001$. Results indicate that face to face is used more than email, SMS and the phone which do not differ from each other. Text-chat is used less than the other media types except videoconferencing which was used infrequently or not at all by most respondents.

5.3.2 *Likelihood of media use with different targets*

To investigate whether media preferences vary for deception, we wished to investigate how much people use media in their general interactions with the different targets described in the narratives. This was in order to investigate whether media selected for deceptive purposes are different to those chosen for daily use. The study measures were designed to assess usage levels for each medium and for a range of social interactions.

Participants had to rate the likelihood that they would use the six communication media listed earlier, when communicating with their boss, romantic partner, friend, work colleague and member of their family. Questions were in the following format;

"If you were planning to speak to your boss, please rate the following communication media according to how likely you are to use them"

The scores were reversed for analyses so that 1 = very unlikely to use, 7 = very likely to use. Table 11 shows descriptive statistics for the likelihood of media use for various social groups.

Table 11

Likelihood of General Media Use with Social Groups

		Email	SMS	Text-chat	Phone	Video	Face-to-face
Boss	*N*	99	99	99	99	99	99
	M	**5.87**	**2.61**	**1.57**	**5.75**	**1.65**	**6.62**
	SD	1.83	1.98	1.20	1.64	1.48	1.03
Partner	*N*	99	98	98	98	98	98
	M	**4.70**	**6.08**	**4.17**	**6.52**	**1.97**	**6.85**
	SD	2.14	1.70	2.53	1.06	1.84	0.88
Friend	*N*	100	100	100	100	99	100
	M	**5.75**	**6.04**	**4.38**	**6.30**	**1.90**	**6.75**
	SD	1.75	1.71	2.54	1.22	1.78	0.74
Colleague	*N*	98	98	98	98	98	98
	M	**6.12**	**4.13**	**2.66**	**5.76**	**1.65**	**6.63**
	SD	1.69	2.27	2.01	1.65	1.39	0.95
Family	*N*	100	100	100	99	98	99
	M	**4.89**	**5.19**	**3.19**	**6.77**	**1.97**	**6.30**
	SD	1.99	2.02	2.44	0.68	1.85	1.44

Figure 5 shows mean values for the likelihood of using particular communication media with various social groups.

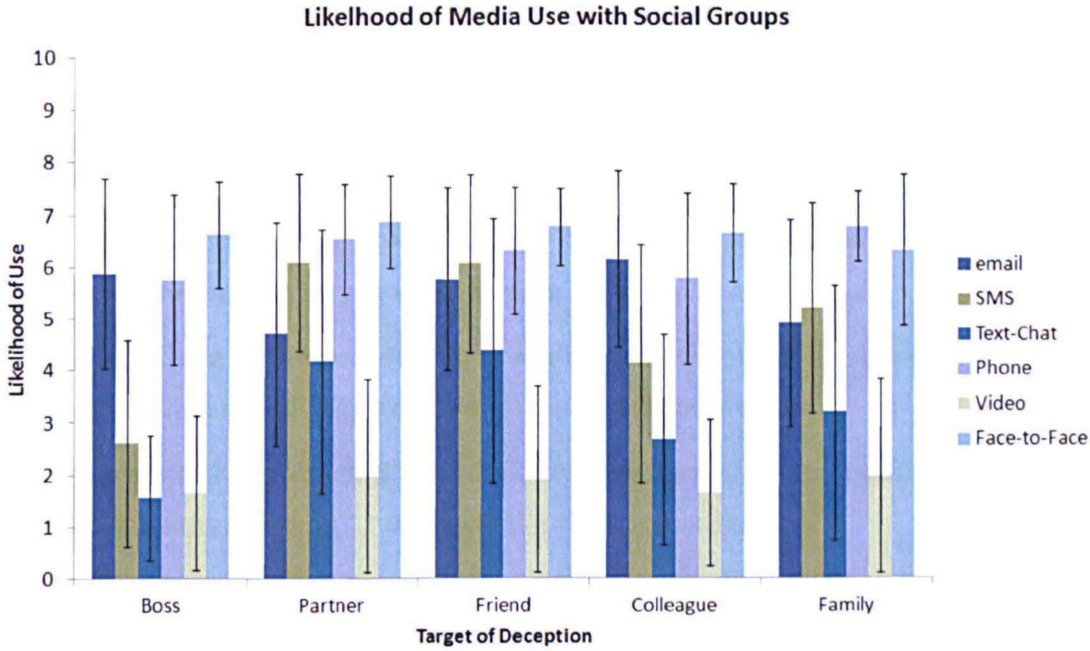


Figure 5 **Likelihood of General Media Use with Social Groups**

Five repeated measures ANOVA with Greenhouse-Geisser correction were conducted comparing the likelihood of use for each of the six media types for each of the five target groups. Levels for alpha were Bonferroni corrected to .01 (.05/5). Results indicate that there are significant differences in the likelihood of using email to different targets, $F(3.21, 311.20) = 21.58$, $p < .001$. There was also significant differences in the use of SMS with different targets, $F(3.04, 291.45) = 96.89$, $p < .001$; Text-chat, $F(2.89, 277.74) = 51.85$, $p < .001$); telephone, $F(2.99, 286.79) = 18.64$, $p <.001$ and face to face, $F(2.58, 245.16) = 6.53$, $p = .001$ There were no significant differences found with videoconferencing, $F(2.81, 260.92) = 1.15$, $p = .329$, which is infrequently used by most participants. The results provide a baseline of frequencies of media use for later analyses and reveal that almost all communication media are used to communicate at different frequencies to various communication partners. This result is not entirely surprising, however, the result provides little insight into what influences people's media choices.

5.3.3 *The Characteristics of communication media*

Communication media have certain characteristics which may affect their selection and use across the range of social groups with which people interact. A number of those characteristics were assessed with the following questions:

1. How synchronous or asynchronous would you say that these communication media are? 1 = completely asynchronous: 7 = completely synchronous

2. How reviewable do you feel that these communication media are in normal use? 1 = completely unreviewable: 7 = completely reviewable

3. How much time do you feel these media give you to plan? 1 = no time to plan: 7 = as much time as you want to plan

4. How close to the person you're communicating with do these media make you feel? 1 = a very long distance away: 7 = in the same room

5. How much feedback do you feel these communication media allow you to get from the other person? 1 = very little: 7 = a great deal

Table 12 shows the descriptive statistics for the characteristics of each media condition. Figure 6 shows the descriptive statistics in graphical form.

Table 12

Characteristics of Media Types

		Email	SMS	Text-chat	Phone	Video	Face-to-face
Synchronous	*N*	100	100	98	100	96	99
	M	**3.67**	**4.61**	**5.64**	**6.53**	**5.74**	**7.00**
	SD	1.74	1.33	1.15	0.85	1.13	0.00
Recordable	*N*	100	100	96	100	94	100
	M	**6.87**	**6.40**	**5.45**	**2.53**	**3.51**	**2.04**
	SD	0.56	1.03	1.75	1.64	2.07	1.39
Planning	*N*	97	97	96	97	93	97
	M	**6.81**	**6.11**	**4.52**	**2.39**	**2.70**	**2.06**
	SD	0.78	1.18	1.54	1.12	1.41	1.18
Closeness	*N*	100	99	97	100	93	100
	M	**2.50**	**3.20**	**3.71**	**4.84**	**4.82**	**6.88**
	SD	1.62	1.44	1.44	1.34	1.72	0.84
Feedback	*N*	98	98	96	98	92	98
	M	**3.71**	**3.40**	**3.84**	**5.03**	**4.97**	**5.81**
	SD	1.97	1.76	1.70	1.65	1.78	2.20

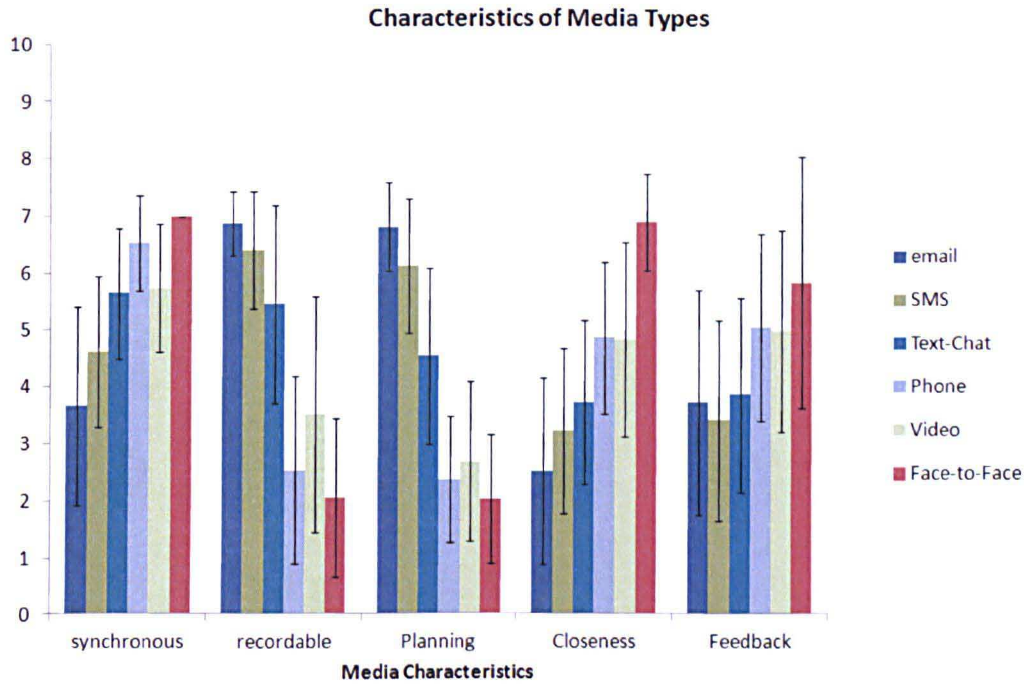


Figure 6 **Characteristics of Communication Media**

Five repeated measures ANOVA (with Greenhouse-Geisser correction) were conducted to compare media in the values for each characteristic. A corrected value for alpha of .01 was used (.05/5). Tests indicated that the communication media are significantly different from each other in synchronicity of the media, $F(2.76, 256.68) = 131.40, p < .001$; recordability, $F(3.00, 272.50) = 209.12, p < .001$; ability to plan messages, $F(2.73, 248.38) = 319.32, p < .001$, perceived distance from partner, $F(3.87, 344.10) = 126.79, p < .001$ and the ability to provide feedback, $F(2.00, 180.01) = 37.25, p < .001$.

For each of the five characteristics, fifteen post hoc paired sample t-tests were used to compare each media type with one another. A Bonferroni corrected value for alpha of .003 was used (.05/15). Full results are shown in Tables 13-17.

Table 13

Probability Values for Post-hoc Comparisons of Synchronicity in Media Types

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(99)-5.99	< .001	(97)-10.15	< .001	(99)-15.08	< .001	(95)-9.83	< .001	(98)- 19.49	< .001
SMS	(99)-5.99	< .001			(97)-6.60	< .001	(99)-12.56	< .001	(95)-6.43	< .001	(98)-18.18	< .001
Text-chat	(97)-10.15	< .001	(97)-6.60	< .001			(97)-8.75	< .001	(94)-0.98	= .332	(96)-11.53	< .001
Phone	(99)-15.08	< .001	(99)-12.56	< .001	(97)-8.75	< .001			(95)8.03	< .001	(98)-5.56	< .001
Video	(95)-9.83	< .001	(95)-6.43	< .001	(94)-0.98	= .332	(95)8.03	< .001			(94)-11.04	< .001
Face-to-face	(98)- 19.49	< .001	(98)-18.18	< .001	(96)-11.53	< .001	(98)-5.56	< .001	(94)-11.04	< .001		

Table 14

Probability Values for Post-hoc Comparisons of Recordability in Media Types

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(99)5.08	< .001	(95)8.21	< .001	(99)24.05	< .001	(93)14.65	< .001	(99)29.91	< .001
SMS	(99)5.08	< .001			(95)5.86	< .001	(99)20.66	< .001	(93)11.86	< .001	(99)25.34	< .001
Text-chat	(95)8.21	< .001	(95)5.86	< .001			(95)11.91	< .001	(91)6.99	< .001	(95)15.25	< .001
Phone	(99)24.05	< .001	(99)20.66	< .001	(95)11.91	< .001			(93)-4.77	< .001	(99)4.00	< .001
Video	(93)14.65	< .001	(93)11.86	< .001	(91)6.99	< .001	(93)-4.77	< .001			(93)7.55	< .001
Face-to-face	(99)29.91	< .001	(99)25.34	< .001	(95)15.25	< .001	(99)4.00	< .001	(93)7.55	< .001		

Table 15

Probability Values for Post-hoc Comparisons of Ability to Plan in Media Types

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(96)7.04	< .001	(95)14.76	< .001	(96)32.96	< .001	(91)25.37	< .001	(96)33.44	< .001
SMS	(96)7.04	< .001			(95)9.46	< .001	(96)24.13	< .001	(91)18.83	< .001	(96)24.69	< .001
Text-chat	(95)14.76	< .001	(95)9.46	< .001			(95)10.82	< .001	(91)8.44	< .001	(95)11.83	< .001
Phone	(96)32.96	< .001	(96)24.13	< .001	(95)10.82	< .001			(91)-2.57	= .012	(96)4.00	< .001
Video	(91)25.37	< .001	(91)18.83	< .001	(91)8.44	< .001	(91)-2.57	= .012			(91)5.31	< .001
Face-to-face	(96)33.44	< .001	(96)24.69	< .001	(95)11.83	< .001	(96)4.00	< .001	(91)5.31	< .001		

Table 16

Probability Values for Post-hoc Comparisons of Closeness in Media Types

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(98)-4.52	< .001	(96)-7.14	< .001	(99)-12.89	< .001	(92)-10.08	< .001	(99)-22.08	< .001
SMS	(98)-4.52	< .001			(95)-3.12	= .002	(98)-9.36	< .001	(91)-6.56	< .001	(98)-21.13	< .001
Text-chat	(96)-7.14	< .001	(95)-3.12	= .002			(96)-6.46	< .001	(92)-5.02	< .001	(96)-18.41	< .001
Phone	(99)-12.89	< .001	(98)-9.36	< .001	(96)-6.46	< .001			(92)-0.19	= .854	(99)-14.66	< .001
Video	(92)-10.08	< .001	(91)-6.56	< .001	(92)-5.02	< .001	(92)-0.19	= .854			(92)-10.99	< .001
Face-to-face	(99)-22.08	< .001	(98)-21.13	< .001	(96)-18.41	< .001	(99)-14.66	< .001	(92)-10.99	< .001		

Table 17

Probability Values for Post-hoc Comparisons of Feedback in Media Types

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(97)2.12	= .036	(95)-0.77	= .443	(97)-5.00	< .001	(91)-4.43	< .001	(97)-6.08	< .001
SMS	(97)2.12	= .036			(95)-2.91	= .005	(97)-6.72	< .001	(91)-5.80	< .001	(97)-7.56	< .001
Text-chat	(95)-0.77	= .443	(95)-2.91	= .005			(95)-5.88	< .001	(90)-4.83	< .001	(95)-7.34	< .001
Phone	(97)-5.00	< .001	(97)-6.72	< .001	(95)-5.88	< .001			(91)1.06	= .291	(97)-5.75	< .001
Video	(91)-4.43	< .001	(91)-5.80	< .001	(90)-4.83	< .001	(91)1.06	= .291			(91)-6.42	< .001
Face-to-face	(97)-6.08	< .001	(97)-7.56	< .001	(95)-7.34	< .001	(97)-5.75	< .001	(91)-6.42	< .001		

Each paired comparison was significant at the .003 level apart from in synchronicity where text-chat was not significantly different from video, $t(94) = -0.98$, $p = .332$. The test indicated no significant difference in the ability to plan when using the phone compared to videoconferencing, $t(91) = -2.57$, $p = .012$. There was no significant difference revealed in closeness between the phone and videoconferencing, $t(92) = -0.19$, $p = .854$. Significant differences were not indicated between email and SMS in perceived feedback, $t(97)2.12$, $p = .036$, or between email and text-chat, $t(95) = -0.77$, $p = .443$ or between SMS and text-chat, $t(95) = -2.91$, $p = .005$. No significant difference was indicated between phone and videoconferencing in feedback, $t(91) = 1.06$, $p = .291$.

Although there is a risk of type 2 errors in interpreting non-significant comparisons, the analyses suggest that videoconferencing was perceived to be more similar to the telephone than face-to-face in the support for message planning, closeness and feedback. Face-to-face was regarded as different to all other media conditions for all characteristics. The three text based media did not significantly differ from each other in perceived support for feedback.

5.3.4 *How comfortable would people feel telling the lies and which media would they prefer to use?*

Participants were presented with the same eight narratives describing the deceptive scenarios in which they might attempt to deceive a particular target, be that a friend, colleague, boss or romantic partner. After each narrative, they were asked to indicate how comfortable they would be telling that deception with each media type, and which media they would most likely choose to communicate the lie. The rating scale for the degree of comfort telling the lie while using a particular media was a seven-point scale ranging from 1 = very comfortable, to 7 = very uncomfortable.

The measures of degree of comfort people would feel telling the lies in the narratives are shown in Table 18 and Figure 7. All results reported are mean values of the narratives which refer to particular target groups (rather than showing results for each narrative). The values for target group "Colleague" is mean of narratives #1 and #7. Values for target group "Boss" is mean of narratives #2, #6 and #8. Values for target group "Friend" is the single narratives #5. Values for target group "Partner" is mean of narratives #3 and #4.

Table 18

Discomfort Felt Telling Lies to Target Groups

		Email	SMS	Text-chat	Phone	Video	Face-to-face
Colleague	*N*	100	97	98	99	93	100
	M	**2.67**	**2.67**	**2.83**	**3.60**	**4.25**	**4.21**
	SD	1.64	1.58	1.59	1.62	1.91	1.81
Boss	*N*	100	98	97	100	95	100
	M	**3.96**	**4.01**	**4.19**	**4.59**	**5.02**	**5.07**
	SD	1.42	1.75	1.73	1.62	1.62	1.75
Partner	*N*	97	96	94	97	92	98
	M	**3.45**	**3.34**	**3.66**	**4.13**	**4.88**	**4.68**
	SD	1.90	1.80	1.87	1.68	1.56	1.75
Friend	*N*	98	97	97	99	93	99
	M	**2.70**	**2.59**	**2.84**	**3.27**	**3.85**	**3.61**
	SD	2.05	1.94	2.05	1.94	2.16	2.15

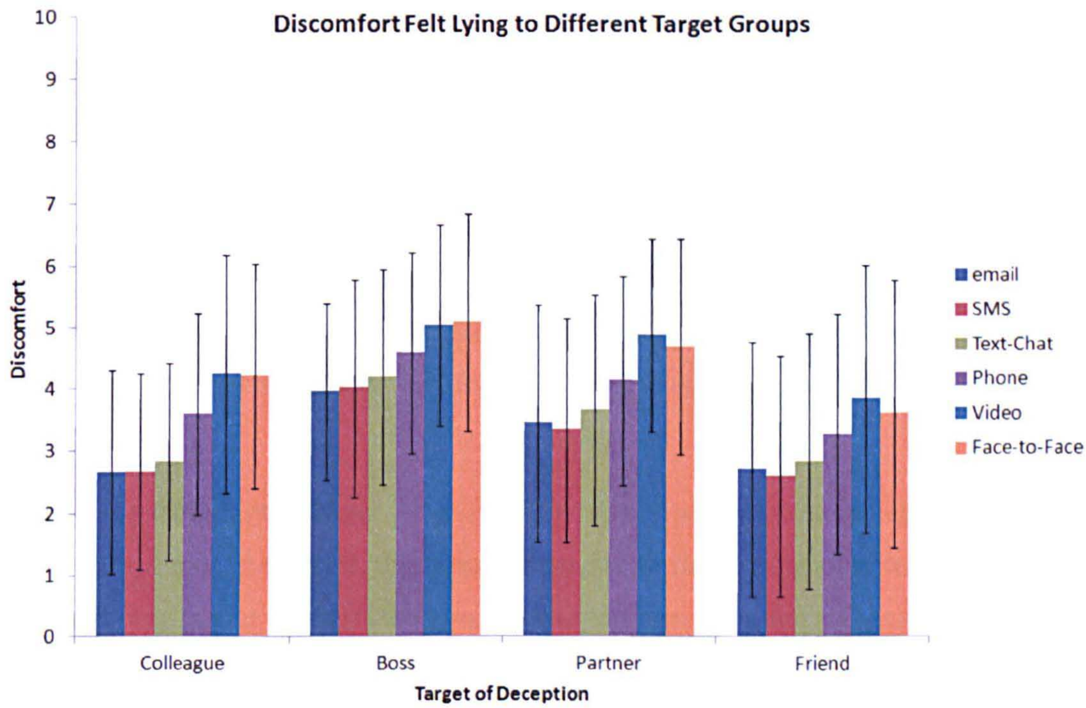


***Figure7* Discomfort Telling Lies to Different Targets**

In order to compare studies, results from the measure used in Questionnaire Study 1 was converted from a 9-point to a 7-point scale by dividing by a simple scale factor of 1.2859. This method is only suitable as an approximate comparison. Results from Questionnaire Studies 1 and 2 are shown in Table 19.

Table 19

Discomfort Felt Telling Lies with Media Types in Studies 1 and 2

		Email	SMS	Text-chat	Phone	Video	Face-to-face
Study 1	*N*	52	52	52	52	52	52
	M	**3.26**	**3.07**	**2.96**	**3.89**	**4.50**	**4.61**
	SD	1.30	1.24	1.32	1.12	1.09	1.19
Study 2	*N*	100	99	99	100	97	100
	M	**3.34**	**3.57**	**3.57**	**4.05**	**4.66**	**4.56**
	SD	1.56	1.57	1.57	1.37	1.49	1.50

Six one-way ANOVA were conducted to compare the mean level of discomfort for each media type between the studies. A Bonferroni corrected level for alpha of .008 was used (.05/6). No significant difference was identified between mean discomfort for email, $F(1, 150) = 0.08$, $p = .776$; for SMS $F(1, 149) = 4.07$, $p = .046$; for text-chat, $F(1, 149) = 5.80$, $p = .017$; for the phone, $F(1, 150) = 0.478$, $p = .490$; for videoconferencing, $F(1, 147) = 0.43$, $p = .512$; for face-to-face, $F(1, 150) = 0.06$, $p = .814$. The results indicate that the discomfort which participants would feel telling the lies in each media type in Study 2 is not significantly different to that found in Study 1.

In Study 1, participants did not judge how likely they would be to use each media type for the deceptions. In Study 2, this was assessed with the seven-point scale: Which media would they prefer to use if they were planning to tell the lie; ranging from 1 = very unlikely to use, to 7 = very likely to use.

The descriptive statistics for the likelihood of using each medium for the deceptions with each of the four target groups are shown in Table 20 and Figure 8.

Table 20 ***Mean Likelihood of Using Media to Deceive Different Targets***

		email	SMS	Text-chat	Phone	Video	Face-to-Face
Colleague	N	100	100	99	100	96	100
	M	**4.38**	**4.20**	**3.68**	**4.23**	**2.28**	**4.97**
	SD	1.90	1.96	2.03	1.60	1.47	1.84
Boss	N	100	100	100	100	99	100
	M	**3.97**	**3.37**	**2.64**	**3.64**	**3.00**	**4.19**
	SD	1.82	1.67	1.57	1.33	1.52	1.39
Partner	N	98	98	96	98	94	98
	M	**2.99**	**4.15**	**2.91**	**4.67**	**1.95**	**5.69**
	SD	1.89	2.00	1.90	1.84	1.39	1.68
Friend	N	100	100	99	100	97	100
	M	**3.76**	**4.71**	**3.68**	**4.84**	**2.28**	**5.79**
	SD	2.22	2.13	2.24	2.02	1.91	1.72

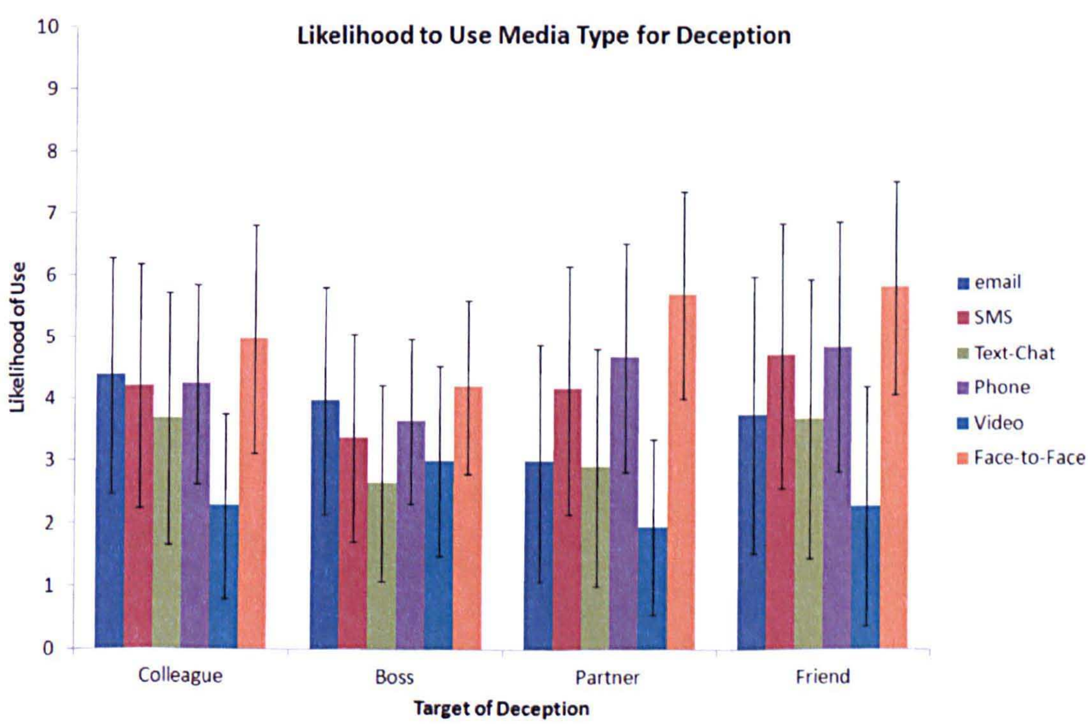


Figure 8 **Likelihood of Using Media to Deceive Targets**

Four repeated measures ANOVA (with Greenhouse-Geisser correction) were conducted to investigate whether there were significant differences in the likelihood of using each medium to tell the lies to the four target groups. A Bonferroni corrected value for alpha of .0125 was used (.05/4). A significant difference was identified in the likelihood of using each medium for the deceptions aimed at the boss, $F(2.79, 273.09) = 25.31$, $p < .001$; aimed at colleagues, $F(3.30, 309.89) = 34.51$, $p < .001$; aimed at a friend, $F(3.88, 368.70) = 49.91$, $p < .001$; aimed at one's romantic partner, $F(3.30, 304.01) = 79.04$, $p < .001$. The results indicate that there is significant variation in the likelihood that people will use a particular media type to tell deceptions.

One possible explanation for the differences in the likelihood of using a media type for deception is that it is related to the discomfort people feel when telling the lie (and the results from Questionnaire study 1 suggested that discomfort is related to the expectation of being detected). An alternative explanation may be that the likelihood of using a media type for deception is related to how likely they will use that media type in general daily life. To separate these two possible factors, for each participant we divided the likelihood of using a media type to tell each of the eight lies by the likelihood of using the media type in daily life. If the likelihood of using the media type to tell that lie to the target was the same as the likelihood of using the media type in daily life, then the transformed likelihood measure would equal 1. A positive value would indicate that the likelihood for using a media type for telling the lie was greater than expected in daily life. The mean values for likelihood of using a medium to tell lies to the target groups corrected for the frequency of daily use are shown in Table 21 and Figure 9.

Table 21 ***Corrected Likelihood of Using Media to Deceive Different Targets***

		email	SMS	Text-chat	Phone	Video	Face-to-Face
Colleague	N	98	98	97	98	94	98
	M	**0.77**	**1.45**	**1.91**	**0.84**	**1.71**	**0.78**
	SD	0.40	1.25	1.48	0.57	1.14	0.43
Boss	N	100	99	99	99	98	99
	M	**0.84**	**1.93**	**2.04**	**0.74**	**1.12**	**0.78**
	SD	0.89	1.41	1.37	0.57	0.91	0.54
Partner	N	97	96	94	97	92	96
	M	**0.81**	**0.76**	**1.00**	**0.73**	**1.35**	**0.86**
	SD	0.78	0.64	1.03	0.32	0.99	0.40
Friend	N	100	100	99	100	96	100
	M	**0.72**	**0.87**	**1.20**	**0.81**	**1.67**	**0.86**
	SD	0.55	0.63	1.29	0.46	1.62	0.26

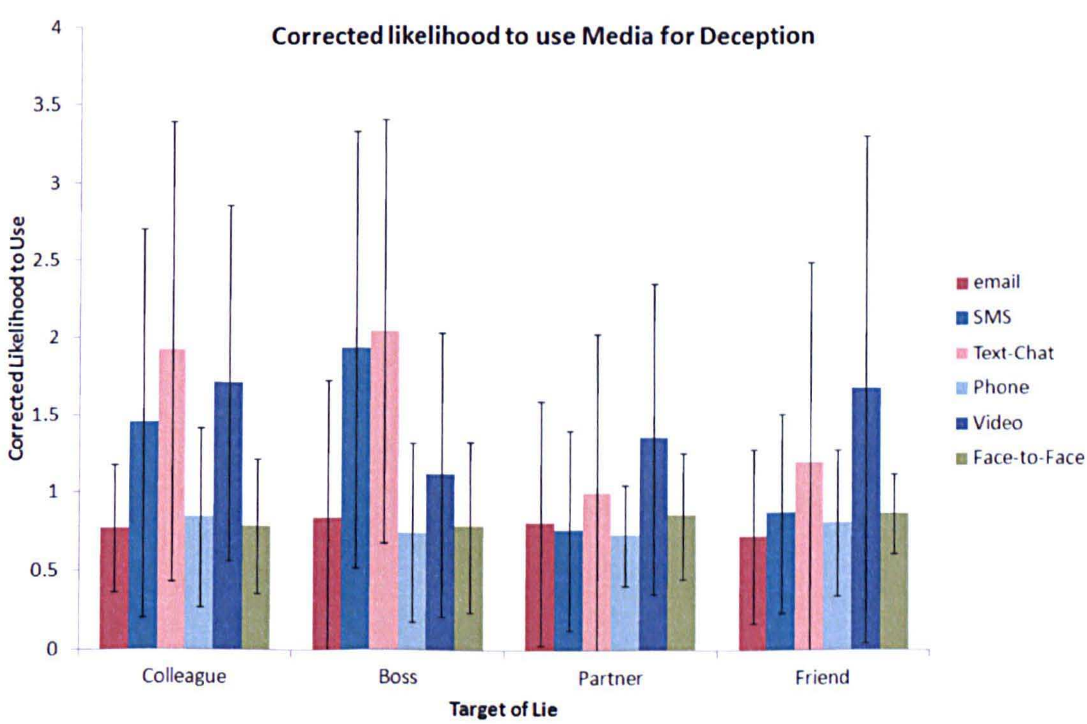


Figure 9 **Corrected Mean Likelihood to Use Media Types to Deceive Different Targets**

Four repeated measures ANOVA (with Greenhouse-Geisser correction) were conducted to compare the corrected measure for the likelihood of using a particular media type for each of the four deception target groups. A Bonferroni corrected value for alpha of .0125 was used (.05/4). Significant differences were identified between media types for deceiving all targets: Colleagues, $F(3.07, 282.21) = 29.52$, $p < .001$; Boss, $F(3.04, 294.77) = 38.59$, $p < .001$; Partner, $F(3.42, 308.19) = 10.05$, $p < .001$; Friend, $F(2.46, 230.78) = 16.91$, $p < .001$.

For each of the four deception targets, fifteen post hoc paired sample t-tests were conducted to compare each media type with one another. A Bonferroni corrected value for alpha of .003 was used (.05/15). Full results are tabulated in Tables 22-25.

Table 22

Probability Values for Post-hoc Comparisons of Corrected Likelihood to Use Media Types to Deceive a Colleague

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(97)-5.29	< .001	(96)-7.78	< .001	(97)-1.04	= .299	(93)-7.77	< .001	(97)-0.23	= .821
SMS	(97)-5.29	< .001			(96)-2.94	= .004	(97)5.31	< .001	(93)-1.46	= .148	(97)4.83	< .001
Text-chat	(96)-7.78	< .001	(96)-2.94	= .004			(96)6.98	< .001	(92)0.76	= .452	(96)7.45	< .001
Phone	(97)-1.04	= .299	(97)5.31	< .001	(96)6.98	< .001			(93)-7.54	< .001	(97)-0.81	= .423
Video	(93)-7.77	< .001	(93)-1.46	= .148	(92)0.76	= .452	(93)-7.54	< .001			(93)7.97	< .001
Face-to-face	(97)-0.23	= .821	(97)4.83	< .001	(96)7.45	< .001	(97)-0.81	= .423	(93)7.97	< .001		

Table 23

Probability Values for Post-hoc Comparisons of Corrected Likelihood to Use Media Types to Deceive a Boss

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(98)-6.69	< .001	(98)-7.92	< .001	(98)0.97	= .336	(97)-2.19	= .031	(98)0.57	= .571
SMS	(98)-6.69	< .001			(98)-0.77	= .445	(98)7.94	< .001	(97)5.02	< .001	(98)7.22	< .001
Text-chat	(98)-7.92	< .001	(98)-0.77	= .445			(98)8.90	< .001	(97)5.99	< .001	(98)8.09	< .001
Phone	(98)0.97	= .336	(98)7.94	< .001	(98)8.90	< .001			(97)-6.36	< .001	(98)-1.10	= .273
Video	(97)-2.19	= .031	(97)5.02	< .001	(97)5.99	< .001	(97)-6.36	< .001			(97)4.56	< .001
Face-to-face	(98)0.57	= .571	(98)7.22	< .001	(98)8.09	< .001	(98)-1.10	= .273	(97)4.56	< .001		

Table 24

Probability Values for Post-hoc Comparisons of Corrected Likelihood to Use Media Types to Deceive a Romantic Partner

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email			(95)0.51	= .611	(93)-1.71	= .090	(96)0.95	= .344	(91)-4.36	< .001	(95)-0.52	= .602
SMS	(95)0.51	= .611			(93)-2.66	= .009	(95)0.46	= .648	(91)-4.84	< .001	(95)-1.15	= .254
Text-chat	(93)-1.71	= .090	(93)-2.66	= .009			(93)2.46	= .016	(90)-2.85	= .005	(93)1.11	= .269
Phone	(96)0.95	= .344	(95)0.46	= .648	(93)2.46	= .016			(91)-6.21	< .001	(95)-3.13	= .002
Video	(91)-4.36	< .001	(91)-4.84	< .001	(90)-2.85	= .005	(91)-6.21	< .001			(91) 4.63	< .001
Face-to-face	(95)-0.52	= .602	(95)-1.15	= .254	(93)1.11	= .269	(95)-3.13	= .002	(91) 4.63	< .001		

Table 25

Probability Values for Post-hoc Comparisons of Corrected Likelihood to Use Media Types to Deceive a Friend

Media Type	Email		SMS		Text-chat		Phone		Videoconferencing		Face-to-face	
	(df)t	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*	*(df)t*	*p*
email	.		(99)-2.02	= .046	(98)-3.46	= .001	(99)-1.34	= .182	(95)-5.85	< .001	(99)-2.11	= .038
SMS	(99)-2.02	= .046			(98)-2.61	= .010	(99)0.92	= .359	(95)-4.58	< .001	(99)0.14	= .886
Text-chat	(98)-3.46	= .001	(98)-2.61	= .010			(98)3.15	= .002	(94)-3.07	= .003	(98)2.52	= .013
Phone	(99)-1.34	= .182	(99)0.92	= .359	(98)3.15	= .002			(95)-5.56	< .001	(99)-1.19	= .238
Video	(95)-5.85	< .001	(95)-4.58	< .001	(94)-3.07	= .003	(95)-5.56	< .001			(95) 4.83	< .001
Face-to-face	(99)-2.11	= .038	(99)0.14	= .886	(98)2.52	= .013	(99)-1.19	= .238	(95) 4.83	< .001		

For deception of work colleagues, results indicated that the corrected likelihood of using a media type was not significantly different between a group consisting of email, the phone and face-to-face. The corrected likelihood of using a media type was also not significantly different between a group consisting of SMS, text-chat and videoconferencing. There were significant differences in all comparisons of media types between the groups. Six single sample t-tests investigated whether the corrected likelihood of using each media type was significantly greater or less than a value of 1, which would indicate that using the media type for deception was no more likely than general frequency. A Bonferroni corrected value for alpha of .008 was used (.05/6). Results indicated that one group of media types were significantly less likely to be used for deception than in daily life: email, $t(97) = -5.61, p < .001$; phone, $t(97) = -2.77, p = .007$; face-to-face, $t(97) = -4.98, p < .001$. Media types in the other group were significantly more likely to be used for deception than in daily life: SMS, $t(97) = 3.57, p = .001$; text-chat, $t(96) = 6.08, p < .001$; videoconferencing, $t(93) = 6.02, p < .001$.

For deception of the boss, results indicated that the corrected likelihood of using a media type was not significantly different between a group consisting of email, the phone and face-to-face. The corrected likelihood of using a media type was also not significantly different between a group consisting of SMS and text-chat. Videoconferencing was significantly different to all media types except email. There were significant differences in all comparisons of media types between the two media type groups (excluding videoconferencing). Six single sample t-tests investigated whether the corrected likelihood of using each media type was significantly greater or less than a value of 1, which would indicate that using the media type for deception was no more likely than general frequency. A Bonferroni corrected value for alpha of .008 was used (.05/6). Results indicated that one group of media types were significantly less likely to be used for deception than in daily life: phone, $t(98) = -4.50, p < .001$; face-to-face, $t(98) = -3.97, p < .001$. Media types in the other group were significantly more likely to be used for deception than in general: SMS, $t(98) = 6.55, p < .001$; text-chat, $t(98) = 7.59, p < .001$; There was no significantly difference from the frequency used in daily life in videoconferencing, $t(97) = 1.31, p = .195$ or email, $t(97) = -1.84, p = .068$.

For deception of a romantic partner, results indicated that there were few significant differences between media types in the corrected likelihood to use them for that target.

The corrected likelihood of using videoconferencing was significantly greater than all other media types and face-to-face was greater than the phone. Six single sample t-tests investigated whether the corrected likelihood of using each media type was significantly greater or less than a value of 1 which would indicate that using the media type for deception was no more likely than general frequency. A Bonferroni corrected value for alpha of .008 was used (.05/6). Results indicated that a group of media types were significantly less likely to be used for deception than in daily life: SMS, $t(95) = -3.66$, $p < .001$; phone, $t(96) = -8.31$, $p < .001$; face-to-face, $t(95) = -3.54$, $p = .001$. Only videoconferencing was significantly more likely to be used for deception than in daily life; $t(91) = 3.41$, $p = .001$. There was no significantly difference from the frequency used in daily life for email, $t(96) = 2.41$, $p = .018$ and text-chat, $t(93) = -0.04$, $p = .968$.

For deception of friends, results indicated that there were few significant differences between media types in the corrected likelihood to use them for deceiving a partner. Again, the corrected likelihood of using videoconferencing was significantly greater than all other media types and text-chat was greater than the phone and email. Six single sample t-tests investigated whether the corrected likelihood of using each media type was significantly greater or less than a value of 1, which would indicate that using the media type for deception was no more likely than general frequency. A Bonferroni corrected value for alpha of .008 was used (.05/6). There was no significantly difference from the frequency used in daily life for SMS, $t(99) = -1.97$, $p = .051$ and text-chat, $t(98) = 1.52$, $p = .131$. Three media types were less likely to be used than in daily life: email, $t(99) = -5.00$, $p < .001$; phone, $t(99) = -4.12$, $p < .001$; and face-to-face, $t(99) = -5.29$, $p < .001$. Only videoconferencing was more likely to be used for deception than in daily life, $t(95) = 4.06$, $p < .001$.

The results suggest that even when corrected for the frequency of general use, there are differences in the use of media types for deceiving different people. As suggested, a possible explanation for the differences in the likelihood of using a media type for deception is that it is related to the discomfort people feel when telling the lie.

A multi-factorial repeated measures ANOVA was conducted to investigate the effect of media type and target of the deception on the corrected likelihood to use a medium for the lie and the level of discomfort felt.

Significant main effects (with Greenhouse-Geisser correction) were identified for media types in the level of discomfort, $F(2.01, 173.04) = 42.93$, $p < .001$ and the likelihood to use each media type for deception, $F(3.29, 283.24) = 34.91$, $p < .001$.

Significant main effects were identified between targets of the lie on the level of discomfort (with Greenhouse-Geisser correction), $F(2.35, 201.69) = 38.26$, $p < .001$, and on the likelihood to use media types for deception, $F(3, 258) = 15.45$, $p < .001$. Significant interactions were also identified (with Greenhouse-Geisser correction) between the media type and target of the lie, in the discomfort felt, $F(6.79, 584.28) = 2.73$, $p < .001$ and also the likelihood to use the media to lie, $F(7.64, 656.66) = 14.65$, $p < .001$.

Results from analyses are shown graphically in Figures 10 and 11. Note: for axis and legend labels, media 1-6 denote #1: email; #2: SMS; #3: text-chat; #4: phone; #5: videoconferencing; #6: face-to-face. Horizontal axis: targets 1-4 denotes the target of deception: #1: Colleague; #2: Boss; #3: Partner; #4: Friend.

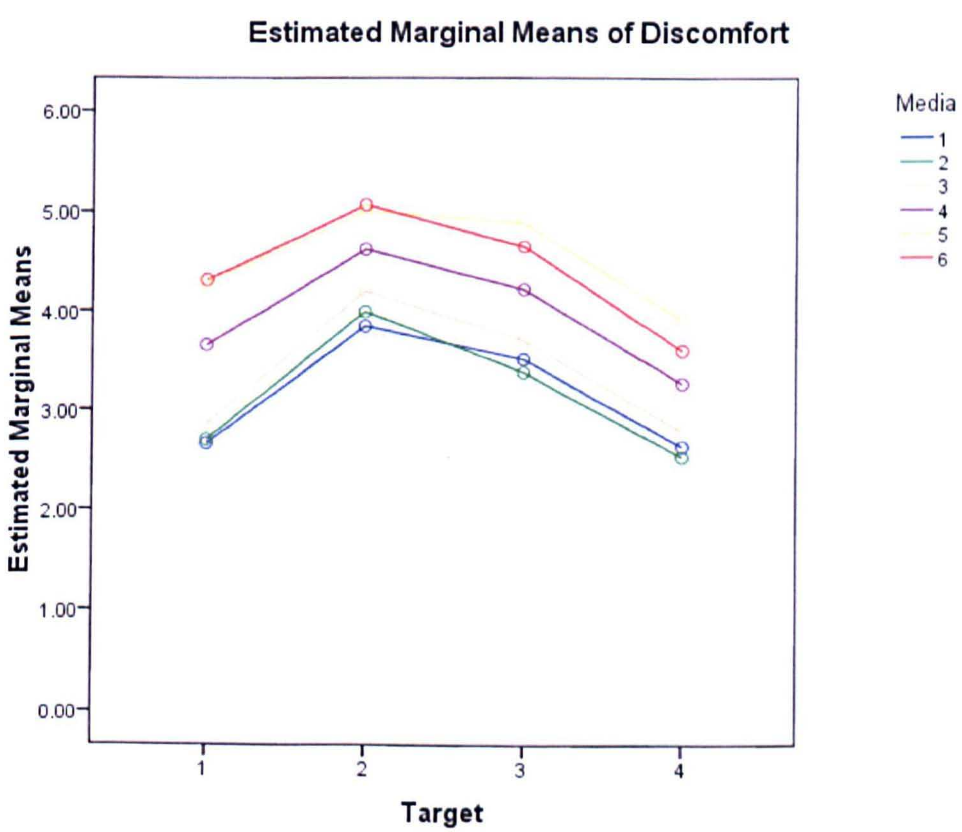


Figure 10 **Discomfort for Media Types and Targets of Deception**

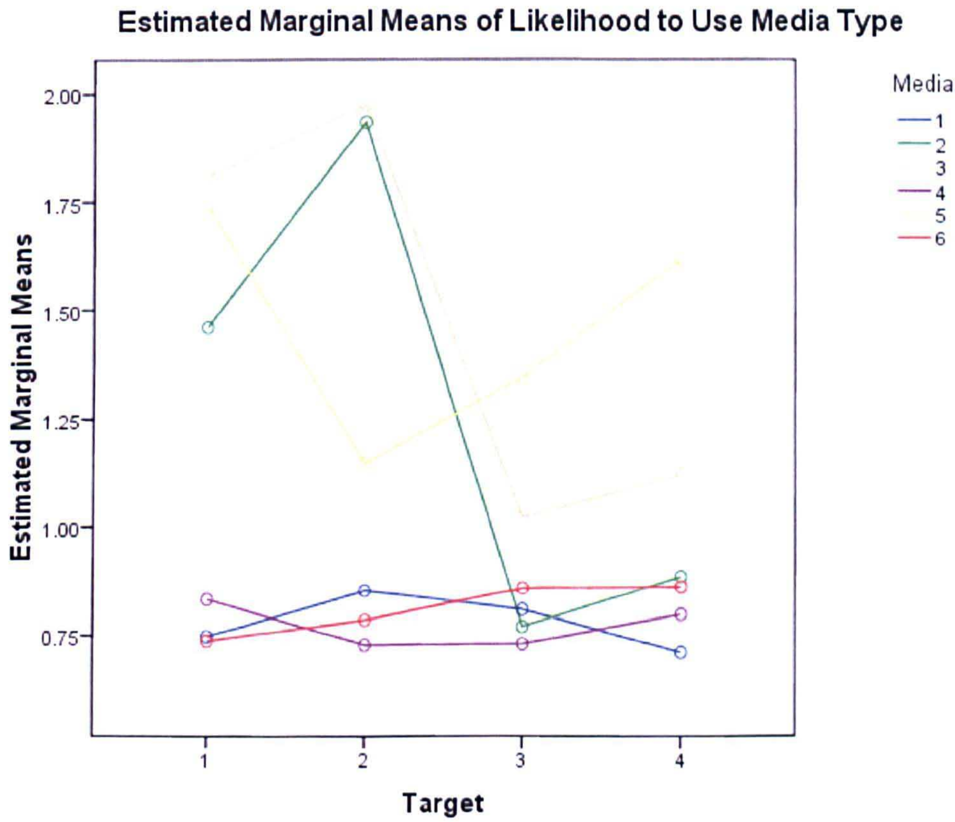


Figure 11 **Likelihood to Use Each Media Type to Deceive Targets**

The analyses indicate that the target of the deception, the degree of discomfort they feel telling a lie and the frequency which people use media for both deceptive and non-deceptive purposes influences their choice of media type with which to deceive. Further analyses may be useful to unpack the relative influence of factors. A speculative visual analysis of the graphs may indicate that when deceiving the boss, participants are more likely to use SMS, text-chat and videoconferencing than in their general interactions. When deceiving colleagues again, SMS and text-chat may be more likely to be used than in general interactions. For friends and partners, there is little evidence to suggest that the likelihood to use any particular media type may increase for deception from the frequency of regular use.

5.3.5 *Comments by participants*

Participants were given the opportunity to comment on why they might choose a particular media with which to deceive and to offer any other thoughts they may have on the study. Many comments were provided and although an extensive analysis is beyond the scope of this study, we argue that some themes emerged. Participants frequently described their choice of media for deception with one of two approaches, one group being those who would wish to avoid rich media for fear that facial expressions and other cues commonly associated with deception would be revealed. Typical comments were:

For more important lies would probably prefer communication media which don't give anything away e.g. non-verbal communication where someone may spot the lie. That is, not face-to-face or telephone communication

and from a different person:

With all the forms of communication except videoconferencing and face-to-face conversations, one does not have to deal with the emotions or expressions from the other person, or have to worry about one's own emotions or expressions whilst telling the lie

However, another theme of comments suggested that face-to-face is a particularly convincing media because of its ubiquity. For example, three different participants stated that:

Face-to-face is always more convincing. It may look suspicious if I choose to hide behind the medium of email or text.

I think in certain situations for a lie to be believable you have to do it face to face or by one of your usually methods of communication even if that method makes you feel more uncomfortable or uneasy.

If I am telling a lie to a person close to me. It feels more important to confront them face to face or over the phone. Which is probably even more deceitful because you want it to have the ring of truth by personal contact

These comments support the notion that changing the means of communication from the expected is likely to arouse suspicion. Face-to-face appears to be viewed as facilitating convincing communication. Perhaps due to its ease and familiarity, it is somehow easier to be believable with.

There were a large number of comments which indicated that not leaving a record is a significant factor in media choice:

I would use text messaging if it was to tell a lie that wasn't important as then it is easy to not respond and choose how much you say. If it was an important lie that

would have consequences I would say it face to face so that there was no record and I could change my story later!

and:

sometimes it would be better to use face-to-face or telephone as there would be no record/"evidence" of the lie - thus everything could be denied in case things go wrong... - in some cases it is better to use direct feedback communication (i.e. face-to-face)

5.4 Discussion

An online questionnaire study was conducted in order to extend the findings from Questionnaire study 1 by investigating not only the discomfort which deceivers may feel under varying media conditions, but also the likelihood that they would use each medium for the deception. The study also investigated some of the characteristics of media types which may impact upon media choices and whether the target of lies impacted upon media choices. The media types investigated were: email, SMS (mobile phone texting), text-chat (MSN, Facebook chat and so on); phone: videoconferencing and face-to-face.

The study first investigated the frequencies which different media types are used for all interactions, with any group of communication partner. Results showed the fairly unsurprising result that there were significant differences between media types. Communication with email, SMS and face-to-face was frequent and reported as occurring daily or more often by all participants. Approximately 30% of respondents used text-chat once a day or more, however approximately 20% of respondents never used it. Only for videoconferencing did the majority of people report that they had never used it. Results indicated that face-to-face was the most common media for interactions followed by the phone, email and SMS which were used at similar frequencies. Less used was text-chat, but it was used more often than videoconferencing. The results were similar to those reported by Hancock et al. (2004) and DePaulo et al. (1996a) who found that face-to-face was used most frequently and more than the phone. However, our results showed that email, telephone and SMS were used at similar frequencies, perhaps reflecting a growth in the ubiquity of these media types. Text-chat was used by a significant proportion of people, unlike videoconferencing which was very infrequently used by the majority of respondents. This may of course change in future surveys.

The study investigated the likelihood that respondents felt that they would use each media type to communicate with a range of targets: Boss (employer); work colleagues; friends; romantic partner and family. Results showed significant differences in the likelihood of use of each media type for all social groups of communication partners. The only exception was found for videoconferencing which was rated as unlikely to be used for all communication partners.

Media characteristics

We investigated whether respondents would perceive differences between media on a range of characteristics. The media characteristics were: how synchronous media are; the reviewability of messages; the degree to which messages could be planned; how close people felt to their communication partner and the degree of feedback a medium offered. Significant differences were identified between all the media in each of the characteristics. Paired tests of differences were almost all significantly different. However a small number of comparisons did not identify significant differences. Although there is a risk of type 2 errors in interpreting non-significant comparisons, the analyses suggested that videoconferencing was perceived to be more similar to the telephone than face-to-face in the support for message planning, closeness and feedback. Face-to-face was regarded as different to all other media conditions for all of the characteristics we investigated.

To characterise each media type: face to face showed the highest or lowest values for each characteristic. It was regarded as highest in synchrony, closeness and feedback (higher than videoconferencing). It was low in recordability and ability to plan messages (lower than phone and videoconferencing). Face-to-face was opposite to email on most measures.

Videoconferencing was regarded as more recordable than both face-to-face and the phone, but was judged to be not significantly different to the phone with low ability to plan messages, closeness and feedback were less than face-to-face but greater than the textual media types.

The phone was regarded as having low recordability and planning compared to the textual media and more synchronous than any other media apart from face-to-face.

Text-chat tended to be between the media conditions supporting auditory information (phone, video, face-to-face) and the other textual media. Text-chat was judged to be the only media type which is both synchronous (not significantly different to videoconferencing) and more recordable than any of the auditory media types.

SMS was judged to be different to email for all measures apart from support for feedback, but we speculate that it was more similar to email than any other media type.

Email was found to be extreme on most measures: it showed the lowest value for synchrony, most for recordability, highest for planning, and it was the most distant media type.

George and Carlson (2005) argued that face-to-face, videoconferencing, phone and instant messaging (text-chat) are all high in terms of feedback, with email moderate and voice-mail, letter and memos low. We found that feedback was judged to be greater face-to-face than the phone and videoconferencing which were both greater than text-chat. Hancock et al. (2004) suggest that face-to-face, phone, instant messaging and videoconferencing are regarded as synchronous, with email, letter and memo asynchronous. We found that all media differed from one other apart from text-chat and videoconferencing. According to Hancock et al. (2004), face-to-face and videoconferencing are regarded as not distributed and recordless. However, we found that videoconferencing was judged to be more distant than face-to-face and not different to the phone. Videoconferencing was also regarded as more recordable than both the phone and face-to-face. We did find difference between face-to-face and videoconferencing in measures of feedback, recordability and synchrony and apparent closeness. Perhaps the binary and ternary categorisations of media characterisations do not capture the subtleties of the perceptions which people have regarding media types.

Choice of media for deception according to target groups

We investigated whether the likelihood of choosing a media type to deceive was affected by the social group membership of the deception target. Results indicated that the likelihood to lie with each medium was significantly different between media types for each target group. We had identified significant differences in the likelihood to use each media type to communicate with the different targets. In order to investigate whether the use of media changed when attempting to deceive, we used the general likelihood to use a medium as a baseline measure. After correcting for baseline likelihood of use, we still found significant differences in the likelihood of using media for deceiving each target group.

Post hoc comparisons indicated that for all deception targets; email, phone and face-to-face were reduced in likelihood from the baseline use and were not different in likelihood from each other. For all targets, text-chat and videoconferencing were judged to be more likely to be used than other media types. For the target groups of work colleagues and the boss, SMS was also more likely to be used than general use suggested.

Media Choice and discomfort (and detectability)

A possible explanation for media choice for deception is an attempt to reduce the discomfort felt while lying. DePaulo et al. (1996a) argue that people use media with higher social distance when deceiving in an attempt to reduce discomfort. In Questionnaire Study 1 we found that discomfort and detectability were correlated. In the current study we investigated whether the likelihood of choosing a medium with which to lie is influenced by how comfortable people feel. Discomfort felt appeared to fall into three groups, visual media, phone and textual media types which do not appear to follow the pattern revealed by the corrected likelihood to use media types for deception. We identified text-chat, videoconferencing and SMS to increase in the likelihood of use. The corrected likelihood to use media did not appear to follow either social distance or media richness dimensions. A multi-factorial analysis indicated that both the target of the lie and the media type had an effect on both the discomfort telling the lie and corrected likelihood to use a medium. The analysis suggests a complex relationship between choice of media, the target of the lie, the general frequency of use and the discomfort telling the lie (which varies between media). Results indicated that respondents are likely to change the media type for deceiving colleagues and the boss, but less evidence that they will change their general media use patterns for friends and partners. The use of videoconferencing appeared more likely for all targets.

We asked whether the likelihood of choosing a medium with which to lie related to the specific characteristics of communication media. From our results we might specify the question as why might text-chat and video conferencing be more likely to be used for deception than for other communication. The investigation into the perceived characteristics of each media type indicated that text-chat was not regarded as significantly different to videoconferencing in terms of synchronicity, but both were higher than the highly recordable, textual media and lower than phone and face-to-face. Synchrony was identified as an important media characteristic by George and Carlson (2005), suggesting that under some circumstance people would prefer synchronous media for deception. Perhaps our results indicate that a certain level of apparent synchrony is preferred. This is speculation and requires further investigation. Media types which showed a higher likelihood of use for deception were also the media types that were judged to have a low frequency of general use. There are a number of possible explanations for this finding. It is speculation to suggest that perhaps people may prefer unusual media with which to deceive as they believe targets are also unfamiliar and cues to deception will be harder to assess. We did not find evidence that media richness could predict the likelihood of using a particular medium for deception. We also did not find evidence to support Hancock et al. (2004) three-factor model that the phone would be preferred for deception. A number of the studies with which we are comparing findings collected diary data of actual use; however, our data are from a survey asking people to judge descriptions of lies. Our findings suggest that perhaps when looking for deception, the use of an uncommon media type may be a warning.

5.5 Conclusions

We reported a second questionnaire study which investigated the perceptions which senders have about the characteristics of communication media, the degree of discomfort they would feel telling lies to different targets and the likelihood that media types would be used for the deceptions described in a series of narratives. Results suggested that media vary over a range of characteristics. The results suggested that there may be subtle variations in media characteristics which have not been identified by previous research. With some characteristics, differences were identified between face-to-face and video conferencing and the phone and videoconferencing appeared more similar. Videoconferencing was perceived to be more similar to the phone than face-to-face in the support for message planning, closeness and feedback. Face-to-face was regarded as different to all other media conditions for all of the characteristics we investigated. We reported results which indicate that media show differences in the likelihood that they will be used to communicate with different groups of people for all interactions. Variation was identified between media types in the likelihood that they would be used to lie to different targets. The results were complex and the discomfort felt lying, the target of the lies and the general frequency of media use all appeared to impact upon media choice for deception. There was some evidence that the media types used at low general frequency: SMS, text-chat and videoconferencing may be more likely to be used for deceiving than would be expected by their low general frequency of use. There was some evidence that deception to work colleagues might take place via the more uncommon media types.

This chapter was primarily concerned with how people believe they will behave, under particular social situations and also how they perceive communication media in a fairly abstract, considered manner. The next chapter addresses how senders actually behave when given the opportunity to deceive in an experimental context.

6. Deception and Detection in a Laboratory Context: Effects of Media Condition on the Propensity to Deceive and the Likelihood of Detection. Experimental Study 1

6.1 Introduction

The previous chapters reported two questionnaire studies which addressed the perceptions that senders have about deception and communication media. Participants were given hypothetical scenarios in which they might attempt to deceive another person. They judged how comfortable they would be lying with various communication media, and also judged how detectable they thought they would be. Results varied according to the seriousness of the deceptions and who was the target of the lie, but a strong finding was that detectability and the discomfort felt lying, broadly varied with media richness. That is, in rich media (face-to-face, audio-video), participants felt more uncomfortable and detectable than in the leaner textual and audio-only media.

A potential limitation of questionnaire studies is their ecological validity. However realistic the deceptive scenarios are, they and the media choices people made were hypothetical. This chapter reports an experimental study which intended to address this ecological limitation. A number of diary studies have suggested that some people may both regularly and frequently engage in deception (e.g. DePaulo et al., 1996a, Serota et al., 2010). Other work has also reported that the propensity to lie is not equal across media conditions (Hancock et al., 2004; George & Robb, 2008) and a number of theoretical frameworks have been developed in an attempt to explain the findings. Some of these frameworks (e.g. Carlson & George, 2004) have built upon media richness theory (Daft & Lengel, 1986) while others have taken a feature based approach (Hancock et al., 2004). To date it has not been possible to identify work that has investigated the propensity for real deception whilst controlling for irregular use of communication media. The study reported here addresses these issues. The study also investigates the perceptions that senders have of their believability, which may or may not be related to the propensity to lie.

There is considerable evidence that there are a number of processes that can result in biased judgements by receivers. A bias towards overestimating the truthfulness of senders is commonly reported (e.g. Levine et al., 2006; Burgoon et al., 2008). Levine et al. (2006) have detailed evidence for a truth bias in receivers even when relative frequencies of senders' truth and lies have been varied. A visual bias has also been reported where visual information is relied upon to make veracity judgments and tends to lead to more judgements of honesty (e.g. Stiff et al., 1989; Burgoon et al., 2003). The study reported here investigates whether there is evidence for truth and visual biases and if they vary according to communication media condition.

Along with the perceptions of receivers as revealed by their tendency to judge senders as truthful or deceptive, this study investigates whether receivers' accuracy at identifying deception varies with media condition. Deception detection studies have often reported low but sometimes significant abilities to detect deception (e.g. Vrij, 2008; Bond & DePaulo, 2006). A significant body of work has emerged suggesting that there can be media differences in detection (e.g. Bond & DePaulo, 2006; Kassin et al., 2005). Lower accuracy has been reported under video-only conditions compared to audio-only and audio-video conditions (Mann et al., 2008). The majority of these studies have assumed that audio-video is equivalent to face-to-face and so have not investigated the two conditions separately. This study also addresses that issue.

In this study, participants were both senders and receivers. They alternated role while communicating in real-time with each of three media conditions: face-to-face; audio-video; and audio-only. Participants as senders gave honest or deceitful answers to a set of personal questions and as receivers judged the veracity of their responses. Further information is provided later on the design and methodology, the next section reviews relevant literature and outlines the study research questions.

Frequency and likelihood of deception: Sender behaviour

A number of diary studies have found that people lie quite frequently in their daily lives. DePaulo et al. (1996a) reported that in a community sample on average, people told a lie a day and were deceptive in some 20% of their interactions. Hancock et al. (2004) reported that a student sample told two lies a day and were deceptive in one in three interactions. George and Robb (2008) reported two diary studies and found approximately 25% of interactions contained lies and participants reported telling 0.6-0.9 lies per day. However, other studies have suggested that people do not all deceive to the same degree. Serota et al. (2010) also found an average deception frequency of once or twice a day, although they reported a highly skewed distribution. They found that a few people told many lies, the majority told very few.

The propensity to lie with different media

Researchers have also become interested in whether individuals are more likely to lie in one medium than another. DePaulo et al.'s (1996a) study found that the majority of lies were told face-to-face, but there were a higher proportion of deceptions in the interactions which took place on the telephone. They argued that the choice of media with which to deceive was driven by the degree of social distance felt by senders. They assert that liars would prefer to use least rich media to avoid the discomfort deception brings about. Hancock et al.'s (2004) diary study recorded the lies that a student population told and the communication media with which they interacted. Participants had access to four media types: face-to-face, telephone, text-chat and email. In common with DePaulo et al. (1996a) they found that a higher frequency of lies were told face-to-face (65% of the total) vs. the telephone (22% of the total). They argue that the proportions of interactions which included lies were the important finding. They report that telephone conversations had the highest proportions of deceptions, greater than face-to-face and text-chat, and email showed lowest proportions of lies. Hancock et al. (2004) argue that results support their three-factor model which contends that the distributed nature of the interaction (distributed or not), the recordability (recordless or recorded) and synchronicity (synchronous or asynchronous) are the most important factors. They argue that deceivers prefer media which are distributed, synchronous and lacking records. George and Carlson (2005) suggested that Hancock et al.'s (2004) results can be better explained by their model (Carlson & George, 2004) which extends media richness theory (Daft & Lengel, 1986). Richness is dependent upon a media's support for: feedback, variety of social cues, language variety and personal focus. Face-to-face is the richest medium and written communication the least rich or leanest. Carlson and George (2004) also suggest that reprocessability (or recordability; the ability of the message to be recorded or not) and rehearsability (the degree to which a medium gives people time to plan and edit their messages) are also important factors. They predict that deceivers should prefer media that offer higher levels of symbol (or language) variety, tailorability (or personal focus) and rehearsability. Deceivers should also prefer media which offer lower cue multiplicity (or variety) and reprocessability. According to the model, people should most prefer face-to-face if they are deceiving. Carlson and George (2004) report a survey study where participants were presented with a number of deceptive scenarios and had to choose their preferred medium with which to lie. They found no media differences, however, when grouped into synchronous and asynchronous media, it appeared that the synchronous media were preferred. George and Robb (2008) in their diary studies collected data on the deceptive and non-deceptive interactions that participants had face-to-face, on the telephone and using instant messaging and email. They reported no significant differences in the proportions of interactions which contained lies between face-to-face and other media conditions. A problem with these studies has been that the base rate of media use is not consistent. People tend to use some communication media more than others regardless of whether they are deceiving or plan to deceive. It is not possible to determine if people are spontaneously lying while using a medium, or specifically choosing a medium with which to tell a planned lie. A study is reported here which will attempt to control for some of these potentially confounding factors and generates the first research question:

Is the propensity for deception affected by communication media when the frequency of interactions is controlled?

Hancock et al.'s model (2004) predicts that senders are likely to tell a higher proportion of lies in audio-only and audio-video compared to face-to-face as the media conditions are all synchronous, recordless and only vary on how distributed they are. Their model does not make a prediction regarding any difference between audio-video and audio-only. The Carlson and George (2004) model suggests that the highest proportion of lies should be found face-to-face, followed by audio-video and least deception in the audio-only condition. The social distance hypothesis (DePaulo et al., 1996a) would suggest that the most lies will be told in the audio-only condition, the least face-to-face and audio-video in between.

Sender perceptions

Gilovich et al. (1998) reported evidence that people overestimate the tendency by which other people can perceive their internal states. Their emotions are said to "leak out", this is the *illusion of transparency*. They propose that a precondition for the illusion of transparency is that there must be a route by which their internal states can leak out. They reported a study where participants were required to lie and make judgments of how detectable they felt. They found that senders believed that they would be discovered as a liar 49% of the time, when in fact only 26% were discovered. There appears to be a general expectation in the general population, in professional lie detectors and occasionally in the research community that deception can be revealed through visual non-verbal behaviour (e.g. Bond & DePaulo, 2006; Akehurst et al. 1996; Lewis, 2009; Masip et al., 2005). These findings suggest that senders may feel that their deceptions will be revealed through visual channels to a greater extent than through non-visual channels. This generates the second research question for this study:

Do senders feel less confident that they will escape detection of deception in visual media?

If participants feel that their deceptions are likely to be revealed through visual cues and the illusion of transparency has an effect on participants, then senders should feel less confident that they will escape detection in the visual media compared to an audio-only media condition.

Receiver perceptions

The judgements of veracity that receivers make of senders may well be in part a result of senders' honesty. However there is evidence from the literature that people also make judgements of people's honesty based on preconceptions and biases that they have about deceptive behaviour and also communication media. There are a number of judgement biases that may affect receivers' ability to accurately detect deception, including truth and visual biases. The truth bias is the tendency to assume that people are telling the truth regardless of their actual veracity. Truth biases have been reported in receivers' judgements of veracity even when the relative frequencies of truth and deception have been variable (Levine et al., 2006). Burgoon et al. (2005) have argued that the truth bias is a cognitive shortcut or heuristic, they state that "truth judgments must often rely on stereotypical knowledge that is detached from the assessment of authentic cues" (p. 2). A functional explanation is reported by Millar and Millar (1997) which proposes that truth biases facilitate communication and help to maintain relationships. Kraut and Higgins (1984, cited in Millar & Millar, 1997) proposed that the "assumption of truthfulness in a conversational partner is a fundamental part of most conversations" (p. 2). Truths may be expected to occur more frequently than deceptions, and a simple heuristic is easy to apply, especially in complex situations. Burgoon et al., (2008) reported evidence of a truth bias. In their study, where receivers judged the veracity of recorded interviews presented in three media conditions: textual, audio-only and audio-video. Compared to 53% of the stimuli which were actually truthful, receivers judged 67% to be true. They also report a communication media affect where the truth bias was intensified in the audio-only and audio-video conditions which gave receivers access to non-verbal cues. However, this truth bias was only evident when senders were deceptive in the audio-video condition. They claim that the intensified bias towards judging deceptive receivers as truthful in the audio-video condition is a result of a visual bias.

The visual bias is the tendency to assign primacy of visual information over other social information (Burgoon et al., 2008). Stiff et al. (1989) reported that receivers largely relied on visual cues with which to make veracity judgements. A number of studies have found that people appear to trust each other more when face-to-face than when using other media (e.g. Valley et al., 1998; Burgoon et al., 2003). Burgoon et al. (2005) argued that visual media assist deceivers because immediacy and involvement can be capitalised on. There are more opportunities to foster trust with friendly nonverbal cues. In contrast, non visual media afford fewer channels for deceivers to manipulate and fewer cues for receivers to focus upon. Burgoon et al. (2005) seem to regard face-to-face as equivalent to audio-video. This supposition may of course be unwarranted. These observations of receiver perceptions generate the third and fourth research questions for this study:

Are receivers biased towards judging senders as more honest than dishonest?

Are receiver judgements more biased towards honesty when the communication media are visual compared to when audio-only?

If there is a bias towards judging senders as truthful, then it would be expected to find significantly fewer judgements of deception than honesty in all media conditions. If there is a visual bias then we might expect to observe fewer judgements of deception in the face-to-face and audio-video conditions than in the audio-only condition.

Detection of deception

If receivers are biased towards judging senders as honest, and this bias is intensified with visual media, it might be supposed that the detection of deception will vary between media. A large number of studies have been reported which have investigated the detection of deception in laboratory contexts (for reviews see e.g. Vrij, 2008; Bond & DePaulo, 2006). The literature suggests that lie detection is poor, often no better than chance, but a significant capability can exist. Bond and DePaulo report an average of 53% correct lie-truth classifications, a small effect, but significantly better than chance. There are a number of possible explanations for the generally reported poor detection ability. These include receiver biases (such as the truth and visual biases), an over reliance on stereotypical and largely incorrect assumptions about deceptive behaviour and deceiver expertise. Burgoon et al. (2008) reported that a truth bias was evident for the judgement of deceptive senders when observed in an audio-video compared to audio-only and textual conditions. If people trust each other more in richer audio-video or face-to-face media conditions, they may be expected to show reduced deception detection. According to interpersonal deception theory, the more interactive a communication medium, the greater the opportunity there is for deceivers to modify their behaviour and avoid detection.

As discussed earlier, there is a general expectation that deception is revealed through visual cues. These cues are often those associated with nervousness (Taylor & Hick, 2007). Mann et al. (2002) reported that more than 25% of their police officer sample mentioned gaze aversion and body movements as cues to deception. In their study, the more body cues mentioned by receivers, the lower their detection accuracy. In contrast, those better at detection were more likely to mention aspects relating to the content of the lies (for example, inconsistencies and vague replies). Some research has found that classification of lies and truths is most successful when using tone of voice (Zuckerman et al., 1982a).

A number of studies have investigated detection accuracy with different communication media. Heinrich and Borkenau (1998) found deception detection was less accurate in a video-only condition compared to audio-video and audio-only. However, they found no differences in accuracy between the audio-video and audio-only conditions. Mann et al. (2008) also compared the veracity classification of honest and dishonest statements when presented as video-only, audio-video and audio-only. They found that overall lie detection accuracy was better than chance (mean of 58% correct classification). They also found that lie detection was significantly lower in the video-only condition compared to the other media conditions. They did not find a significant difference between audio-only and audio-video in detection accuracy. Kassin et al. (2005) reported that judgments of truthful and false confessions were more accurate in an audio-only condition compared to an audio-video condition. Burgoon et al. (2005) found no significant differences in lie detection accuracy between audio-only, audio-video and textual conditions. Bond and DePaulo's (2006) meta-analysis found accuracy in video-only conditions was significantly lower than audio-video and audio-only conditions. Again, they did not identify significant differences between audio-only and audio-video media conditions. Although the deception literature has a number of examples of studies comparing mediated conditions, there does not appear to be work which also investigates face-to-face as a media condition. This would appear to be an omission given that the majority of communication is face-to-face. The present study addresses this omission. These observations generate the fifth research question:

Is the classification accuracy of honest and dishonest messages influenced by media condition?

If there is a bias towards judging answers as truthful in visual and also more interactive media conditions, then we might expect to find reduced deception detection in the face-to-face and audio-video conditions compared to audio-only. We might also expect to find reduced detection in visual media conditions if visual cues tend to be used by receivers to make judgements of veracity as these cues are generally not diagnostic of deception.

Confidence in judgements of veracity

Some previous research has suggested that people may vary in the confidence that they have in their veracity judgements. Forensic professions such as Police Officers, for instance, have been reported as more confident in their judgements than lay members of the public (Vrij & Mann, 2005). Typically, confidence in judgements has not been found to be related to detection accuracy (Mann et al., 2002). The experimental study discussed in this chapter did not have professional detectors of deception taking part; however, there may be variations in judgement confidence of lay people that are influenced by the media conditions under which they assess veracity. The work by Buller, Burgoon and their colleagues (e.g. Burgoon, Buller, White, Afifi & Buslig, 1999) highlights the importance of interaction in veracity judgements. Confidence of receivers in their judgements of veracity may be expected to be higher in media which support richer interactions, so face-to-face being the greatest, audio-only being the least and audio-video falling somewhere in between. Also, if cues to deception are predominantly reported to be visual (Taylor & Hick, 2007) then people might be expected to feel more confident in their judgments if they are made in face-to-face or audio-video conditions. This generates the sixth research question:

Is the confidence receivers have in their veracity judgements greater in richer media conditions compared to lean media conditions?

In all media conditions, we expect to find that senders' confidence in their judgments will not be related to lie detection accuracy. If senders tend to use visual cues to make judgements of veracity and they also tend to be more confident in richer media conditions, then we expect to find confidence highest in the face-to-face condition, lowest in the audio-only condition and audio-video intermediate.

A laboratory based study was undertaken where participants acted as both senders and receivers. They communicated using three live, synchronous communication media; face to face; audio-video and audio-only. As senders, they had the opportunity to choose when to give honest or deceitful answers to a set of personal questions. As receivers, participants attempted to correctly judge whether they had been given honest or deceitful answers. The study addresses some limitations of previous research. Diary studies have not been able to control the frequency of media use which makes the interpretation of deception frequency problematic. This study controlled the frequency of interactions which people had with each medium. Many previous experimental studies have used recordings as stimuli, whereas the present study was fully interactive. Some previous studies have also used forced deceptions: that is participants were told when and sometimes what to lie about. The ecological validity of the study is high as participants were free to be honest or deceptive according to their own volition in each media condition and lies were both real and spontaneous. Also, in the majority of previous studies, receivers have judged only a single deceptive or truthful message from each sender. In this study, receivers made judgements of multiple messages in an extended interaction. Finally, few studies have been conducted with face-to-face as a media condition; audio-video is typically used as the most interactive media condition. In this study, we were able to compare face-to-face to other media conditions, again increasing the ecological validity of the study.

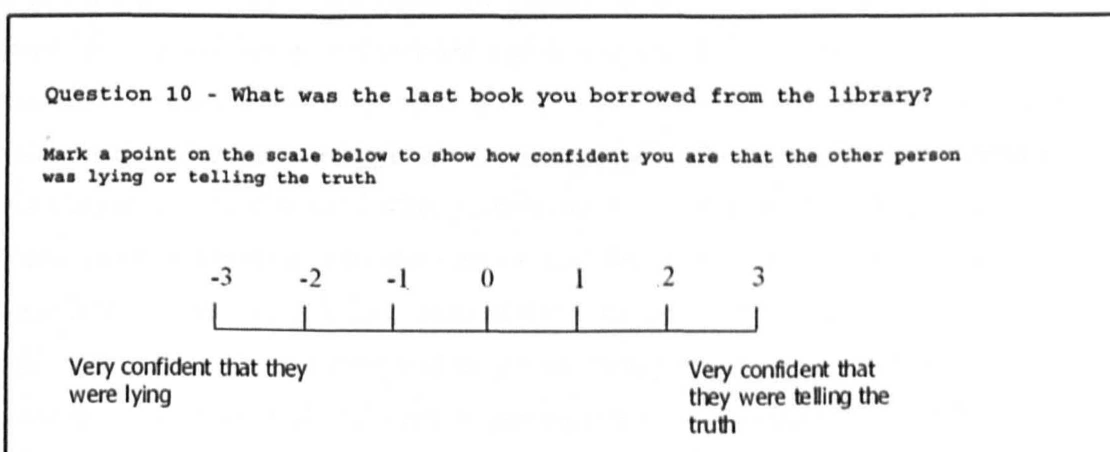
6.2 Method

6.2.1 *Participants*

42 participants were recruited from staff and students at the University of Nottingham via email and poster advertisements. The advertisements indicated that the study was investigating lying and truth telling and that the person performing best in the study would receive a prize of £100. Approximately equal numbers of men and women took part.

6.2.2 *Materials*

A bank of 60 questions was created which probed personal, factual information. Questions were designed to be open-ended but could be unambiguously answered truthfully or deceptively (for example, "What was the last movie that you went to see"). Questions were designed to be emotionally neutral to reduce the chance that participants would be reluctant to answer. Sixty Question sheets for receivers were constructed in the form shown in Figure 12 below.


Question 10 - What was the last book you borrowed from the library?

Mark a point on the scale below to show how confident you are that the other person was lying or telling the truth

-3 -2 -1 0 1 2 3

Very confident that they were lying

Very confident that they were telling the truth

Figure12 **Receiver Question and Answer Sheet**

60 sender answer sheets were also produced in the form shown in Figure 13, they asked senders to indicate whether they have lied or told the truth to the question asked. They are also asked to assess whether they would be believed or not and their confidence in that assessment.

Question ___

Did you answer with the truth or tell a lie? Lie ☐ Truth ☐

Please mark a point on the scale below to show how confident you are that the other person will guess that you were lying or believe that you were telling the truth.

1 2 3 4 5 6 7 8 9 10

Very confident that they will think I was lying — Very confident that they will believe me

Figure 13 **Sender Answer Sheet**

6.2.3 *Design and procedure*

Participants were told that their aim was to be believed at all times. While answering questions they would differentially achieve points if they were believed telling lies or truths and lose points differentially if they were not believed in either case. They were informed that as questioners they would gain points by correctly judging truthful and false answers and lose points if they were wrong in their judgements. The scoring system is explained below.

A 1x3 design was used, with media condition as the within-participants factor with three levels (audio-only, audio-video and face-to-face). Participants were paired and checked that they were unacquainted with each other. They were seated in separate test rooms and given identical written instructions. The instructions informed them that they were paired with another person and that in front of them they both had a set of ten question sheets and ten answer sheets. Their task was to take the first question sheet from the set and ask their partner the question written at the top. Their partner then will answer the question and they must judge whether they believe the answer given was either truthful or deceptive and complete the measure (Figure 12). After answering the question, their partner indicates on the answer sheet whether they lied or told the truth. They also had to assess whether they thought they were believed or not by marking a point on the scale (Figure 13).

Participants were instructed to take turns asking and answering questions and work through the set of sheets until all are completed. The participants were informed that the aim of the task was to score as many points as possible and were given the scoring system shown in Figure 14. A number of pilots were conducted to develop the scoring system. The aim was to have a scoring system where there was a clear benefit if they lied, but also a fairly high penalty for being discovered. The scoring strategy was developed in order that people would be encouraged to both lie and tell the truth (so that receivers would have both truthful and deceptive answers to judge), but to only lie when they were fairly confident that they would be believed. In the pilot studies, the cost of being caught lying was varied until participants told two to five lies over at least three trials.

Points are awarded when asking questions in the following way:

Tell the truth and be believed: 2 points
Tell the truth and not be believed: -2 points
Tell a lie and be believed: 3 points
Tell a lie and not be believed: -10 points

Points are awarded when answering questions in the following way:

Correctly believe the other person when they are telling the truth: **2** points
Incorrectly believe someone when they were lying: **-2** points
Incorrectly think the other person is lying when they are telling the truth: **-2** points
Correctly think the other person is lying: **2** points

	Points for questioner	Points for answerer	Points for questioner	Points for answerer
Guess answer is True	-2	3	2	2
Guess answer is Lie	2	-10	-2	-2
Answer given is a	Lie	Lie	Truth	Truth

***Figure14* Scoring System: Experimental Study 1**[2]

Participants were asked whether they understood the scoring system and any questions that they had were answered.

Participants were told that there would be three rounds of ten questions and answers. They were instructed that their task was to be a good lie and truth detector when listening to answers, and to try and make the other person believe them when answering, regardless of whether they told the truth or not. Pairs were then informed of the communication media they would use with each other in that round.

[2] In the scoring system information, the word "guess" was used where "judge or decide" might have been more appropriate. The author does not believe this slight semantic difference would have any impact upon participant behaviour. In future work the word "guess" will be replaced.

Participants were subsequently given a new set of question and answer sheets and explained with a description of the medium that they would use to communicate for that round. This procedure was repeated for each of three communication media conditions. The order of media condition was counterbalanced in the study. Participants did not know in advance what kind of communication medium they would be using, or in which order. The set of 60 questions was randomised for each experimental pair.

6.2.4 *Technical set-up*

The study was completed in two test rooms separated by a control room that had one-way glass in the walls adjoining the test rooms. Entry to each test room was via a single door situated off a small corridor space that was just in front of the control room. Doors in this access space also led to the control room and to an external corridor. The test rooms were equipped with diffuse artificial daylight lighting at a level of approximately 500 lux. In the audio-only and audio-video conditions, participants communicated using Tandberg 6000 video conferencing systems which were directly connected to ensure continuity of service. Both audio and video were fed to 29" Loewe CRT televisions in the audio-video condition. In the audio-only condition, the video feed was disconnected from the television. Participants were seated at a desk (80x160cm) in a standard adjustable office chair two meters from the monitor on which the camera was centrally placed. Participants field of view was from waist to top of head with the eyes of participants approximately at 1/3-2/3 horizontal division of the monitor. See Figure 15. The camera was standard to the Tandberg 6000 with automatic iris-control and auto focus. Audio protocol was G722. Video protocol was H263, with 25 frames per second and screen resolution of CIF.

Figure 15 **Technical Setup in Mediated Conditions**

In the face-to-face condition, participants sat opposite each other approximately 2.5 metres apart at desks equipped with lecterns. See Figure 16.

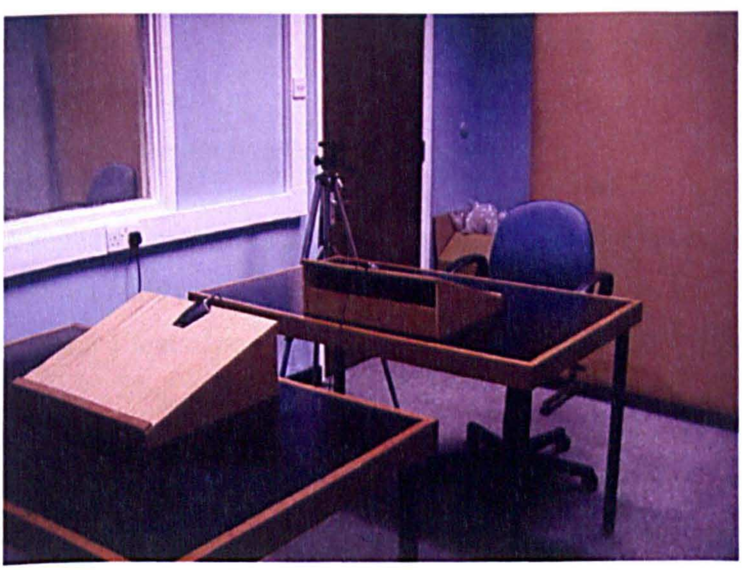


Figure 16 **Technical Setup in the Face-to-face Condition**

Audio and video recordings of participants were made during the study. A digital colour quad processor was used to combine the video feeds from both test rooms. A digital video cassette recorder was used to record the combined feeds to video tape. The digital VCR was also used to record the audio from each participant on separate audio channels.

6.3 Results

6.3.1 *Sender behaviour: The frequency and likelihood of deception:*

Research question one asked if the propensity for deception is affected by media condition when the frequency of interactions is controlled.

The percentage of deceptive answers senders gave under the different communication media conditions are shown in Table 26. Each sender answered ten questions in each media condition. The frequencies of honest and deceptive answers to each of the 60 individual questions was also investigated and discussed below.

We used an alpha level of .05 for all statistical tests.

Table 26

Mean Percentage of Deceptive Answers Given in Each Media Condition

Media Condition (N = 42)	Face-to-face	Audio-Video	Audio-Only
M	**40.47**	**38.81**	**47.14**
SD	23.78	23.29	24.72

A repeated measures ANOVA was conducted to compare the effect of type of communication media on the number of lies told in the three media conditions. There was a significant effect of communication media condition, $F(2, 82) = 3.83, p = .026$.

Three paired samples t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The first paired sample t-test showed that there were significantly more lies told in the audio-only media condition compared to the audio-video media condition, $t(41) = -2.62, p = .006$, 1-tailed. A second test indicated that there was no significant difference in the mean number of lies told face-to-face and in the audio-video condition, $t(41) = 0.58, p = .281$, 1-tailed. A third test indicated that there was no significant difference in the mean number of lies told face-to-face and in the audio-only condition, $t(41) = -1.90, p = .032$, 1-tailed.

The results indicate that when participants were not visible to their communication partner, they had a greater propensity to deceive. Specifically, when participants communicated in the audio-only condition they told significantly more lies than when they communicated with audio-video.

6.3.2 *Analyses of individual questions*

The main focus of this thesis is the variations in sender and receiver behaviour that may be due to characteristics and perceptions of various communication media; however it is quite possible that individual differences and the nature of the questions asked (and answered) also influence behaviour. Variations in the number of lies and truthful answers given by senders may vary according to the question asked. The question asked may also influence the likelihood of receivers' judgements of veracity. An interaction of these effects may also have an influence on discrimination accuracy by receivers.

Each individual trial consisted of a pair of participants who asked each other 60 questions in total. Each of the participants asked ten questions in each of three media conditions. The questions they asked were randomly assigned to individuals and communication media conditions from the total bank of 60 questions.

The 60 questions used in Experimental Studies 1 and 2 are listed in the appendix. The majority of questions were asked 20 times, however, some instances of questions were excluded from results as receivers did not decide whether they believed the answer given was truthful or not. The purpose of investigating individual questions was to determine whether there were differences between the frequencies of truthful answers given by senders to particular questions. A similar analysis of the judgements of veracity by receivers and/or discrimination accuracy for individual questions was conducted. The frequency analyses might indicate that individual questions were qualitatively different from one another and that further analyses of the question content would be useful.

6.3.2.1 *Frequencies of senders' honest and deceptive answers to individual questions*

The total number of deceptive and truthful answers given was 534 (42%) and 725 (58%) respectively[3]. Deceptive answers to individual questions ranged from five to thirteen. Truthful answers in contrast ranged from seven to 17 for individual questions. There was a clear tendency to answer questions truthfully.

Frequencies of deceptive answers above the upper quartile are shown in Tables 27-29.

Table 27

Face-to-Face Condition - Upper Quartile = 4

Question Number	10	23	24	41	20	16	28	15	51
Lies	5	5	5	5	6	7	7	10	11
Truths	2	3	3	2	2	2	2	7	1

Table 28

Audio-Video Condition - Upper Quartile = 4

Question Number	18	22	45	49	12	14	29	42	47
Lies	5	5	5	5	6	6	6	6	6
Truths	2	5	2	3	5	5	4	5	4

Table 29

Audio-Only Condition - Upper Quartile = 4

Question Number	3	7	20	22	31	37	54	18	36	50
Lies	5	5	5	5	5	5	5	6	6	6
Truths	2	7	2	3	3	1	1	4	6	1

[3] A single answer was given by one participant who didn't indicate whether they had told the truth or lied, hence the total number of lies and truthful answers (1259) does not equal the number of questions asked (1260)

There were no questions that were answered deceptively at a frequency greater than the upper quartile in all three media conditions. There were only two questions that senders gave deceptive answers at a frequency above the upper quartile in two media conditions. This would suggest that any pattern in the kinds of questions that participants in this study chose to lie to is fairly well hidden. Considering the frequencies aggregated across all media conditions, the ratio of false to truthful answers given ranged from 5:14 to 13:7.

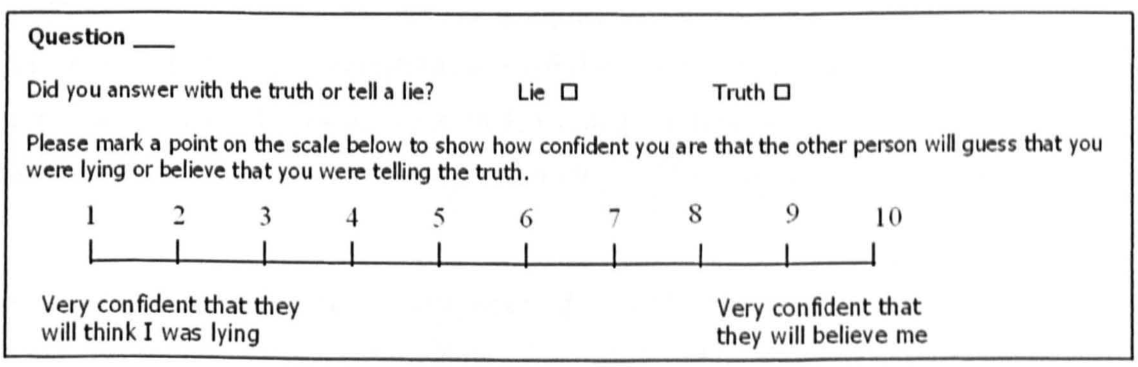
Textual analyses could perhaps further illuminate any differences between the questions which may reveal their "deceptability", but these are beyond the scope of this work. There is little evidence to suggest that some questions should be particularly identified as problematic to use in these studies because they are always, or never, lied to when asked.

To investigate the communicative processes of honesty and deception, it is important to assess how believable senders feel they are after they have either told the truth or attempted to deceive. The next section discusses the confidence senders had with their answers in this study.

6.3.3 *Sender confidence in believability of answers*

Research question two asked: Do senders feel less confident that they will escape detection of their deception in visual media?

The scale shown below in Figure 17 was used to assess senders' confidence in their answers which ranged from 1- "Very confident that they will think I was lying" to 10 - "Very confident that they will believe me"



Question ____

Did you answer with the truth or tell a lie? Lie ☐ Truth ☐

Please mark a point on the scale below to show how confident you are that the other person will guess that you were lying or believe that you were telling the truth.

1 2 3 4 5 6 7 8 9 10

Very confident that they will think I was lying

Very confident that they will believe me

Figure 17 **Senders' Confidence in the Believability of their Answers**

6.3.3.1 *Confidence of senders that their lies would be believed*

If participants told a lie, this measure assessed how confident they were that they would be believed. A high value indicated that senders felt that they would be believed. Table 30 below shows the means values of confidence senders had in the believability of their deceptions. Values for *N* are less than 42 in each condition as some participants did not tell any lies.

Table 30

Mean Confidence of Senders That Lies are Believed

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	40	38	40
M	**7.05**	**6.65**	**6.86**
SD	1.67	2.00	1.80

A repeated measures ANOVA was used to compare the effect of communication media on the confidence that senders had in the detectability of their answers between the face-to-face (M = 7.05, SD = 1.67, N = 38), audio-video (M = 6.65, SD = 1.20, N = 38) and audio-only (M = 6.91, SD = 1.77, N = 38) conditions. There was no significant effect of media condition, $F(2, 74) = 0.94$, $p = .395$.

Three single sample t-tests were used to compare the mean confidence of senders in the detectability of their deceptions to the mid-point (5.5) of the scale. The value of 5.5 would be expected if senders were neither confident that they would be believed or confident that their deception would be detected. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that participants rated the confidence they had in the detectability of their deceptions as significantly greater than 5.5 in the face-to-face, $t(39) = 5.86$, $p < .001$, 1-tailed; audio-video, $t(37) = 3.56$, $p < .001$, 1-tailed; and audio-only conditions, $t(39) = 4.79$, $p < .001$, 1-tailed.

6.3.4 *Proportion of lies that senders expected would be detected*

If senders told lies, this measure shows the proportion of those lies which were rated as less than the midpoint of the scale (5.5) measuring their confidence that they would be believed. The midpoint of the scale is the value that would be expected if senders were neither confident that they would be believed or confident that their deception would be detected. A value of less than 5.5 indicates that the sender was more confident of being detected than believed. Table 31 shows mean proportions for each media condition.

Table 31

Proportions of Lies Senders Expect to be Detected

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	40	38	40
M	**0.25**	**0.30**	**0.32**
SD	0.29	0.30	0.31

A repeated measures ANOVA was conducted to determine if the proportion of lies that were expected to be detected varied between the face-to-face (M = 0.24, SD = 0.28, N = 38), audio-video (M = 0.30, SD = 0.29, N = 38) and audio-only (M = 0.31, SD = 0.29, N = 38) conditions. No significant effect of media condition was identified, $F(2, 74) = 0.83$, $p = .440$.

Three single sample t-tests were used to compare the mean proportion of lies in each condition that were expected to be discovered to a test value of 0.5. The value of 0.5 would be expected if senders believed that receivers were guessing and had a 50/50 chance of getting the guess correct. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that the proportion of lies that senders expected to be discovered was significantly less than 0.5 in the face-to-face, $t(39) = -5.40$, $p < .001$, 1-tailed, audio-video, $t(37) = -4.17$, $p < .001$, 1-tailed, and audio-only conditions, $t(39) = -3.69$, $p < .001$, 1- tailed.

The results indicate that participants were significantly more likely to rate their deceptive answers as being believable than detectable in each of the media conditions.

6.3.5 *Confidence of senders that their truths would be believed*

If participants told the truth, this measure assessed how confident they were that they would be believed. Table 32 below shows the mean values of confidence senders had in their truthful answers. N values are less than 42 in each condition as some participants answered every question with a deceptive answer. Descriptive statistics are shown in Table 32.

Table 32

Confidence of Senders that their Honest Answers are Believed

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	40	41	41
M	7.28	7.05	7.44
SD	1.22	1.45	1.10

A repeated measures ANOVA with a Greenhouse-Geisser correction was conducted to determine if the confidence of senders that their honest answers would be believed varied between the face-to-face (M = 7.28, SD = 1.22, N = 40), audio-video (M = 7.05, SD = 1.46, N = 40) and audio-only (M = 7.45, SD = 1.11, N = 40) conditions. No significant effect of communication media was found, $F(1.71, 66.83) = 1.52$, $p = .228$.

Single sample t-tests were used to compare the mean values in each media condition of their deceptions to the mid-point (5.5) of the scale. The value of 5.5 would be expected if senders believed that receivers were guessing and had a 50/50 chance of getting the guess correct. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that the confidence that senders had in their truthful answers being believed was significantly greater than 5.5 in the face-to-face condition, $t(39) = 35.25$, p <.001, 1-tailed, in the audio-video condition, $t(40) = 28.99$, p <.001, 1-tailed, and the audio-only condition, $t(40) = 40.50$, p <.001, 1-tailed.

Research Question two asked: Do senders feel less confident that they will escape detection of deception in visual media?

There was no evidence that senders felt any differently about their chances of discovery in visual media conditions compared to the audio-only condition. In all media conditions, senders were significantly more confident that their truthful and deceptive answers would be believed than would have been expected if they thought receivers were guessing. A possible explanation is that they only chose to lie when they were fairly confident that they would escape detection. However between a quarter and a third of deceptions were expected to be discovered. No significant media differences were identified in the confidence that either truthful or deceptive answers would be believed, or in the proportion of lies that might be expected to be discovered. The results indicate that in general, people were confident that they would be believed whether being honest or dishonest with their answers.

6.3.6 *Comparison of senders' confidence of believability in lies and honest answers*

Three paired sample t-tests were conducted to investigate whether the confidence senders had in their believability varied according to whether they lied or told the truth. A Bonferroni corrected value for alpha of .0167 was used (.05/3). The confidence in believability was not found to be significantly different between lies (M = 7.00, SD = 1.70, N = 38) and honest answers (M = 7.30, SD = 1.22, N = 38) in the face-to-face condition, $t(37) = -0.86$, $p = .395$. Believability was not significantly different between lies (M = 6.66, SD = 2.03, N = 37) and honest answers (M = 7.03, SD = 1.39, N = 37) in the audio-video condition, $t(36) = -1.00$, $p = .323$. No significant difference was identified between the believability of lies (M = 6.83, SD = 1.81, N = 39) and honest answers (M = 7.43, SD = 1.12, N = 39) in the audio-only condition, $t(38) = -2.04$, $p = .048$.

There was no significant evidence that senders regarded their lies to be more or less believable than their honest answers in any media condition.

6.3.7 *Receiver Perceptions*

Research Question 3 asked: **Are receivers biased towards judging senders as more honest than dishonest?**

Research Question 4 asked: **Are receiver judgements more biased towards honesty when the communication media are visual compared to when audio-only?**

The frequencies of senders' deceptions reported earlier showed a significant tendency for rates of deception to be higher in the audio-only condition. Receivers judged the veracity of those answers and although it is not normally reported, the percentage of stimuli judged as lies is a measure of the tendency of receivers to judge answers they are given as honest or deceptive. Table 33 shows the results of the percentage of answers that were judged to be dishonest by receivers.

Table 33

Percentage of Answers Judged by Receivers as Dishonest

Media Condition (*N* = 42)	Face-to-face	Audio-Video	Audio-Only
M	**31.67**	**31.90**	**34.52**
SD	19.87	20.51	18.51

A repeated measure ANOVA was used to compare the effect of communication media condition on receivers' judgements of veracity. This was measured as the percentage of answers classified as dishonest. No significant effect of media condition was identified, $F(2, 82) = 0.48$, $p = .621$. Single sample t-tests were used to compare the percentage of answers judged as dishonest in each media condition to a value of 50%. The value of 50% would be expected if receivers were equally likely to judge an answer as deceptive or honest. Significantly fewer than 50% of the judgements of dishonesty were found in the face-to-face condition, $t(41) = -5.98$, $p < .001$, 1-tailed, audio-video, $t(41) = -5.72$, $p < .001$, 1-tailed, and audio-only conditions, $t(41) = -5.42$, $p < .001$, 1-tailed.

Research question three asked if there was a tendency for senders to be judged as more honest than dishonest. The results showed that this was the case, there was a truth bias. Research question four asked if there was a visual bias which may have been shown as a greater proportion of answers judged as honest in the media conditions that supported visual information (face-to-face and audio-video) compared to audio-only. No media differences and evidence of a visual bias were found with these data analyses. These analyses do not take into account the relative frequencies of honest and deceptive answers which may be problematic for interpretation of the results. This shortcoming is addressed later in this chapter.

6.3.8 *Receiver Behaviour*

Research question five asked if the classification accuracy of honest and dishonest messages is influenced by the media condition.

The present study attempted to discover whether there are differences in the judgements of veracity under varying media conditions and if these judgements impact the detection of deception. Much previous research has investigated the accuracy with which people can discriminate between lies and truthful statements. Typically, the accuracy score is reported as the percentage of correct answers. This may be a combined value for both dishonest and honest statements or reported individually.

The behaviour of receivers is revealed by the correct and incorrect judgements of veracity of individual answers given to their questions.

6.3.8.1 Percentage correct classification of answers

The accuracy of receivers' classification all answers is shown in Table 34.

Table 34

Percentage Correct Classification of Answers

Media Condition (*N* = 42)	Face-to-face	Audio-Video	Audio-Only
M	**53.54**	**55.15**	**57.37**
SD	18.06	16.57	21.81

A repeated measures ANOVA with a Greenhouse-Geisser correction was conducted to compare the effect of media condition on the overall percentage correct classification of answers. No significant effect of communication media was found, $F(1.70, 69.86) = 0.60, p = .528$.

The overall accuracy of answer classification by receivers was superficially similar to that found in previous studies. The extensive review by Bond and DePaulo (2006) reported an overall classification accuracy level of 53%. This experimental study found a mean accuracy rate of 56%.

In order to investigate whether there might be consistencies in individual receiver classification accuracy between conditions, Pearson's r was calculated[4]. There was a significant positive correlation between overall percent correct classification in the

[4] Normal distribution of data was assessed with one-sample Kolmogorov-Smirnov tests and all media conditions were found to have a non-significant deviation from normality

face-to-face and audio-video conditions ($r = 0.41$, $N = 42$, $p = .008$); audio-video and audio-only conditions ($r = 0.38$, $N = 42$, $p = .013$) but there was no significant relationship between face-to-face and audio-only conditions ($r = 0.10$, $N = 42$, $p = .532$).

Although the gross measure of percentage correct classification was not significantly different between media conditions. A potentially confounding factor was that the proportion of lies and truthful answers that were told was not equal or even consistent between senders. As reported in the introduction, some research has suggested that receivers tend to be truth biased and therefore tend to get truthful answers correct more often than lies. Most studies of lie detection present participants with equal numbers of lies and truths. If there is a truth bias and receivers tend to classify answers as truthful, they will also tend to get a higher proportion of total answers correct if the rate of lying by senders is lower. Levine et al. (2006) has claimed that the sender veracity, that is, whether the sender is lying or telling the truth, is the single most important predictor of judgement accuracy by receivers.

In this study, senders were able to choose whether to lie or tell the truth. According to Levine et al. (2006), the greater the proportion of lies that are told, the lower the overall judgement accuracy of all answers should as a result of the veracity effect. The results are shown in Figure 18. Data points represent the number of lies told by an individual sender and the overall lie and truth classification success of the corresponding receiver in each of the three media conditions.

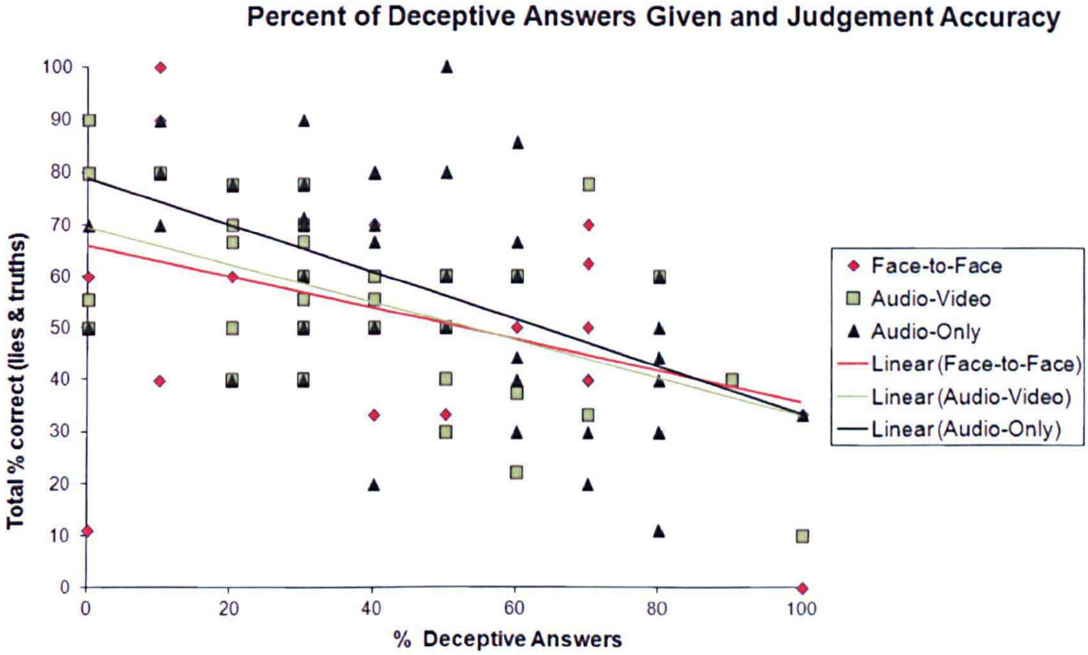


Figure 18 **Receivers' Classification Accuracy and the Number of Lies Told by Senders**

Pearson correlations were completed to investigate whether the number of lies told by senders was related to the overall classification accuracy. A significant negative correlation was found in the face-to-face condition (r = -0.40, N = 42, p = .004, 1-tailed), audio-video (r = -0.51, N = 42, p < .001, 1-tailed) and audio-only conditions (r = -0.52, N = 42, p < 0.001, 1-tailed). Increases in the number of lies told by senders reduced senders' overall classification accuracy.

According to Levine et al. (2006), due to this veracity effect, it is necessary to separately report lie and truth detection accuracy. Lie accuracy may be characterized as the proportion of the total number of lies told that were correctly classified. Truth accuracy is calculated in a similar manner. Henceforth these measures will be referred to as the **hit rate for lies and truths or p(hit)_lies** and **p(hit)_truths**. The hit rate for lies in each media condition is shown in Table 35, for truths in Table 36.

Table 35

Hit rate for Lies

Media Condition *(N* = 42)	Face-to-face	Audio-Video	Audio-Only
M	**0.37**	**0.29**	**0.38**
SD	0.33	0.26	0.27

A repeated measures ANOVA was conducted to compare the effects of communication media condition on the hit rate for lies. No significant effect was identified, $F(2, 82) = 1.98$, $p = .144$. The percentage of correctly identified deceptions ranged from 29% to 38% which was less than the mean of 48% reported by Bond and DePaulo (2006) but is not an exceptional finding.

Table 36

Hit rate for Truths

Media Condition *(N* = 42)	Face-to-face	Audio-Video	Audio-Only
M	**0.63**	**0.64**	**0.65**
SD	0.249	0.264	0.305

A repeated measures ANOVA was conducted to compare the effects of communication media condition on the hit rate for truths. No significant effect was found, $F(2, 82) = 0.03$, $p = 0.969$.

As suggested earlier, Levine and his colleagues claim that sender veracity is the most important predictor of detection accuracy. Metrics from a number of studies reported by Levine (https://www.msu.edu/~levinet/deception.htm) are shown in Table 37, and for comparison, results from the present study are included.

Table 37

Proportion of Deceptive and Truthful Answers in Previous Studies (retrieved from https://www.msu.edu/~levinet/deception.htm)

Study	% Honest	Truth Accuracy	Lie Accuracy
McCornack & Levine (1990)	72%	81.8%	31.3%
Levine et al. (1999) Study 4	68%	68.5%	37.5%
Levine & McCornack (2001) Study 1	72%	75.0%	31.0%
Levine & McCornack (2001) Study 2	69%	76.7%	39.2%
Levine & McCornack (2001) Study 3	56%	56.8%	44.1%
Park & Levine et al. (2002)	66%	67.0%	37.0%
Levine et al. (2005) Study 1	63%	56.3%	38.6%
Levine et al. (2005) Study 2	62%	66.4%	43.0%
Levine et al. (2005) Study 3	62%	66.4%	43.2%
Levine et al. (2008) Study 1	68%	74.2%	37.7%
Levine et al. (2008) Study 2	70%	62.9%	22.5%
Levine et al. (2008) Study 3	70%	73.8%	32.3%
Levine et al. (2009)	72%	74.5%	37.7%
Levine et al. (2009a)	61%	69.1%	46.4%
Levine et al. (2009b)	60%	65.4%	45.9%
Current study media conditions			
Face-to-face	60%	63.4%	37.4%
Audio-Video	61%	64.3%	29.1%
Audio-only	53%	64.7%	38.3%

Truth accuracy exceeds 50% in all studies and lie accuracy never exceeds 50%. As a consequence of these consistent findings, Park and Levine (2001) propose a probability model that predicts that overall detection accuracy is a linear function of the base rates for truths and lies. This is because the base veracity rate directly impacts accuracy in a predictable manner. Specifically the model proposes that the overall detection accuracy will be a product of the probability of correctly identifying a truth plus the probability of correctly identifying a lie. The probability of correctly identifying a truth is the product of the probability of a truth judgement (P(hit)_Truth) multiplied by the base-rate of truthful statements. The probability of correctly identifying a lie is similarly the product of the probability of a lie judgement (P(hit)_Lies) multiplied by the base-rate of lies. That is:

Total accuracy = (P(hit)_Truths * P(Truths)) + ((P(hit)_Lies * P(Lies))

The model would predict the accuracy rates shown in Table 38 using results from the current study:

The method of calculation is shown in footnote [5] by example with the face-to-face media condition. Total accuracy = probability of correctly identifying a truth + probability of correctly identifying a lie.

5

total accuracy = probability of correctly identifying a truth + probability of correctly identifying a lie

Face-to-face	Total accuracy	Probability of identifying a truth	+	Probability of identifying a lie
	=	P(hit)_Truths * P(Truths)	+	(P(hit)_Lies * P(Lies)
	=	(0.634 * 0.595)	+	(0.374*0.405)
Predicted =	0.528	0.377	+	0.151
Actual finding =	0.535			

Table 38

Park and Levine Predicted and Actual Percentage Correct Classification of Answers

Media Condition	Face-to-Face	Audio-Video	Audio-Only
Predicted	52.8	50.7	52.2
Measured	53.5	55.2	57.4

Single sample t-tests were used to determine if the measured percentage of correctly classified answers for each participant was greater than the value predicted by the model. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The percentage of correctly classified answers was not significantly larger than that predicted in the face-to-face condition ($t(41) = 0.27$, $p = .396$, 1-tailed), the audio-video condition ($t(41) = 1.74$, $p = .045$, 1-tailed) or in the audio-only condition ($t(41) = 1.54$, $p = .067$, 1-tailed).

Actual findings were not significantly different to those predicted by the Park and Levine probability model. This may have been unsurprising when also considering the negative correlations found between the number of lies told by senders and the percentage correct classification of answers upon which the model is based.

The Park and Levine model predicts overall classification success in part by using the success of lie and truth detection. This appears to reduce its value as a predictive model. Using the model, analyses of percentage correct classification and investigation of the detection success for lies and truths (the hit rates) all fail to take into account the degree to which receivers are getting it wrong, when they are judging truths as lies, and lies as truths. To take these factors into account, it is proposed to use signal detection theory (Green & Swets, 1966 cited in Stanislaw & Todorov, 1999) to analyse the results from this first experimental study.

6.4 Using Signal Detection Theory for the Analysis of Results

Problems with simple classification are due to variable response biases and stimulus base rates, both of which can be addressed by using signal detection theory (Bond & DePaulo, 2006). Signal detection theory (SDT) provides a methodology for computing discrimination accuracy and response bias independently. Signal detection theory was applied to the results in order to investigate whether it could throw light on the effects of the media conditions on the perceptions and behaviour of receivers in terms of response bias and detection accuracy respectively. Rarely have the methods of signal detection theory been applied to studies of lie and truth detection, however, it can be applied whenever an attempt is made to distinguish two possible stimulus types (Stanislaw & Todorov, 1999). In this case, the two stimulus types being "lies" and "truths". Performance may be separated into two conceptually different components. A small number of studies have used signal detection theory to investigate and separate detection accuracy from response bias (e.g. Meissner & Kassin, 2002: Mann et al., 2008) but it is still fairly rare in the literature.

In the experimental situation, receivers are presented with either a lie or a truthful statement and they must choose to respond with either "Lie" or "Truth". On signal trials (lies), "Lie" responses are correct and are termed "hits". This is the hit rate defined earlier in this chapter. On signal trials, "Truth" responses are incorrect and are termed "misses". On no signal trials (truths), "Lie" responses are incorrect and are termed "false alarms" and truth responses are correct and termed "correct rejections". This set of possible outcomes is shown as the truth table in Figure 19.

		Sender behaviour	
		Lie	Truthful
Receiver Judgement	Lie	Hit	False Alarm
	Truth	Miss	Correct rejection

Figure 19 **Signal Detection Theory Truth Table**

Measures are expressed as proportions. The hit and false-alarm rates reflect the two components that make up performance, the response bias (tendency to respond with "True" or "Lie") and the discrimination accuracy (or sensitivity in standard signal detection theory language). Discrimination accuracy is, technically, the ability of an individual to correctly identify a stimulus (lies) from the absence of stimuli (truths). Response bias is the degree to which receivers will tend to respond with "False" or "True", or "Lie" or "Truth". If a participant tends to believe most answers they are given and frequently respond with "True", they have a high response bias (a conservative response criterion in signal detection theory terms), hit-rates will be low and they will also have a low false-alarm rate. If a participant is suspicious and frequently responds with "Lie", they have a low response bias and both hit and false-alarm rates will be high (a liberal response criterion). There are a number of measures of discrimination accuracy and response bias. This work will use d' which quantifies discrimination accuracy by using the hit and false-alarm rates to calculate the distance between the lie and truth means in standard deviation units. The greater the value of d' (with a theoretical maximum of $+\infty$) the greater the observed ability to detect lies. A d' value of 0 indicates an inability to distinguish between lies and truths and a negative value of d' (with a theoretical minimum of $-\infty$) would indicates that lies are consistently labelled as true. There are various methods to calculate response bias; this work will use c, again measured in standard deviation units, where a value of 0 indicates no response bias towards lie or truth. Negative values of c indicate a tendency to respond "Lie" and positive values indicate a tendency to respond "True". The use of signal detection theory allows comparisons to be made between studies with different proportions of honest and dishonest stimuli.

6.4.1 *Calculation of Signal Detection Theory measures*

Signal detection theory measures are calculated as follows:

- Hit rate, p(hit)_Lies = number of hits/total number of lies
- False-Alarm rate, p(fa)_Lies = number of false-alarms/total number of truths
- Correct rejection rate is the hit rate for truths, this is calculated by number of correct rejections/total number of truths
- d' is found by subtracting the z-score that corresponds to the false-alarm rate from the z-score that corresponds to the hit rate.
- c is found by averaging the z-scores that corresponds to the hit and false-alarm rates, then multiplying the result by negative one.

Problems arise with calculating signal detection theory measures when hit and false-alarm rates are at the extremes, i.e. 1 or 0. The z-score that corresponds to 0 is $-\infty$ and for 1 is +∞. There are several solutions to this problem. Hautus' (1995) described in Stanislaw and Todorov (1999) suggests using a method termed *loglinear.* This involves adding 0.5 to both the total number of hits and false alarms and adding 1 to both the number of lies and truths. According to Stanislaw and Todorov (1999), advocates of this approach recommend using it regardless of whether or not extreme values are found, and the method is used in this work. All c and d' scores reported are calculated using the loglinear method.

6.5 Receiver Response Bias

There are a number of measures of response bias in the application of signal detection theory. The measure used in these studies will be *c*, as it is suggested that it is independent of other signal detection theory measures (Stanislaw & Todorov, 1999). Negative values indicate a tendency of receivers to respond with "Lie", 0 indicates that there is no response bias, and positive values indicate a tendency to respond with "Truth". Mean values for response bias (*c*) are shown in Table 39.

Table 39

Response Bias (c) of Receivers

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	42	42	41
M	**0.40**	**0.42**	**0.35**
SD	0.49	0.50	0.47

A repeated measures ANOVA was conducted to determine if the response bias varied between the face-to-face (M=0.42, SD=0.48, N=41), audio-video (M=0.43, SD=0.50, N=41) and audio-only (M=0.35, SD=0.47, N=41) conditions. No significant difference was identified, $F(2, 80) = 0.50, p = 0.611$.

Single sample t-tests were used to determine if the mean response bias in each media condition was significantly greater than a value of 0. The value of 0 indicates no bias towards judging answers either as truthful or deceptive. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that the response bias of receivers was significantly greater than 0 in the face-to-face, $t(41) = 5.28$, p <.001, 1-

tailed, audio-video ($t(41) = 5.44$, $p < .001$, 1-tailed, and audio-only conditions, $t(40) = 4.75$, $p < 0.001$, 1-tailed. Single sample t-tests indicated that participants in all conditions showed a tendency to judge answers as truthful.

Research question three asked if there was a tendency for senders to be judged as more honest than dishonest. The results from the signal detection theory analysis support those reported earlier in this chapter which showed that this was the case. Mean values for response bias, *c*, were significantly greater than 0 in all media conditions showing a tendency for receivers to judge answers as honest. Research question four asked if there was a visual bias which may have been shown as a greater proportion of answers judged as honest in the visual media conditions compared to the audio-only condition. There was little evidence of a visual bias, no media differences were found.

As discussed in the previous chapter, problems with simple classification can be addressed by using signal detection theory (Bond & DePaulo, 2006). For calculating discrimination accuracy (d'), signal detection theory uses the hit rates and false alarm rates.

6.6 Discrimination Accuracy of Receivers' Judgements

To calculate signal detection discrimination accuracy (d') for the experimental studies, it was necessary to use the proportions of hits and false alarms. The values for deception hit rates, p(hit) were shown earlier in Table 35. No significant differences were found between media conditions in the hit rate for deceptive answers. Descriptive statistics for the false alarm rates are shown in Table 40.

Table 40

P(false alarms) for Deception

Media Condition (N = 42)	Face-to-face	Audio-Video	Audio-Only
M	**0.33**	**0.34**	**0.34**
SD	0.17	0.19	0.23

A repeated measures ANOVA with a Greenhouse-Geisser correction was used to determine the effect of media condition on the false alarm rate for lies. There was no significant differences found between the means in the three conditions, $F(1.75, 71.87) = 0.08, p = 0.904$.

The discrimination sensitivity *d'*, was calculated using the methods described earlier and values for each media condition are shown in Table 41. It was not possible to calculate *d'* for some participants and consequently values of N are less than 41 in all conditions.

Table 41

Discrimination Sensitivity (d') for Lies

Media Condition (N = 41)	Face-to-face	Audio-Video	Audio-Only
M	**0.23**	**0.12**	**0.30**
SD	0.72	0.64	0.90

A repeated measures ANOVA with Greenhouse-Geisser correction was used to assess the effect of media condition on the discrimination sensitivity for lies. No significant difference in *d'* was identified between the media conditions, $F(1.75, 69.90) = 0.66, p = 0.522$.

Single sample t-tests were conducted to assess whether the discrimination sensitivity of lies was significantly different from 0 in each media condition. Zero is the value found when there is no sensitivity to the stimulus. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that the discrimination sensitivity of receivers was not significantly greater than 0 in the face-to-face, $t(40) = 2.09, p = .022$, 1-tailed, audio-video, $t(40) = 1.19, p = .121$, 1-tailed, and audio-only conditions, $t(40) = 1.12, p = .135$, 1-tailed.

Individual variation in detection accuracy was high in each media condition. In the face-to-face condition discrimination sensitivity for lies ranged from -1.69 to 2.32; in the audio-video condition from -1.47 to 1.31 and in the audio-only condition from -1.64 to 2.07.

6.7 Interaction with the Ratio of Lies/Truths Told by Senders

In Experimental Study 1, senders determined when and how often they would lie. According to the Park and Levine probability model, veracity of the stimuli is the single most important predictor of lie and truth discrimination accuracy. Some participants in each communication media condition achieved high levels of discrimination accuracy. Does this accuracy relate to the number of lies receivers had to judge? Table 42 below shows the percentage of answers given by senders that were deceptive.

Table 42

Percentage of Deceptive Answers Given by Senders

Media Condition (*N* = 42)	Face-to-face	Audio-Video	Audio-Only
M	**40.47**	**38.81**	**47.14**
SD	23.78	23.29	24.72

As reported earlier, repeated measures ANOVA indicates that there were significant variations in the number of lies told in each of the three media conditions. Significantly more deceptive answers were given by senders in the audio-only media condition compared to the audio-video media condition. Figure 20 represents the number of lies told by an individual sender and the lie detection success of the corresponding receiver in all media conditions.

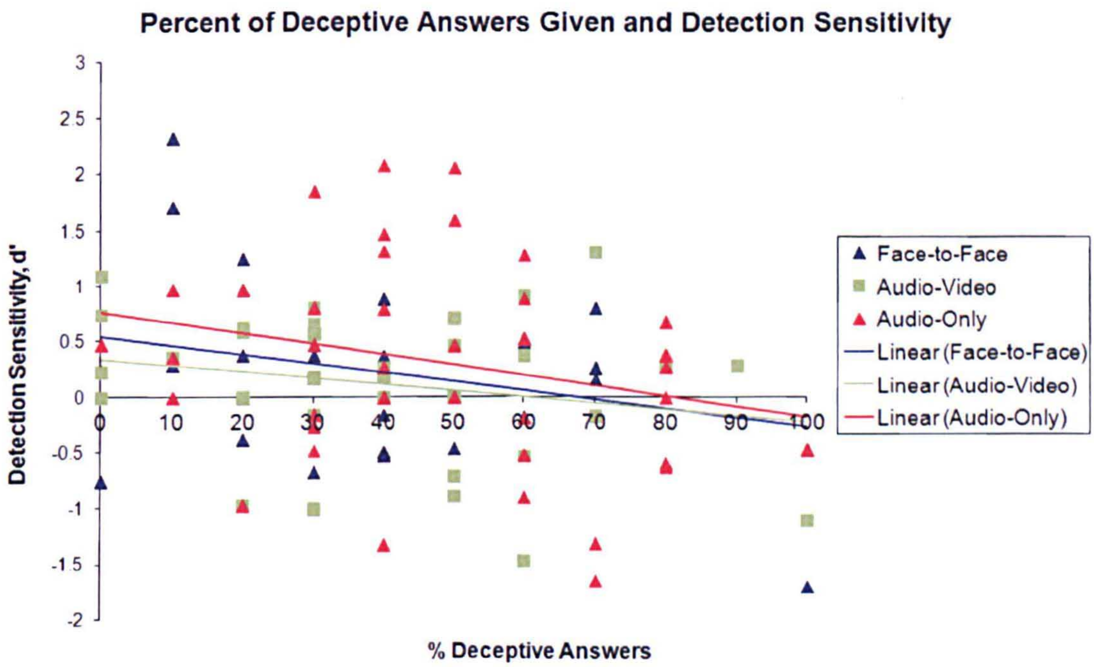


Figure 20 **Relationship of Frequency of Sender Lies to Receiver Discrimination Accuracy**

Any association between the rates of attempted deception by senders and the discrimination accuracy shown by receivers in each media condition was assessed with bivariate correlations and linear regression analyses. A significant relationship was found between sender deceptions and detection accuracy in the face-to-face condition. The model revealed that the proportion of sender deception accounts for 11% of the variance in discrimination accuracy with a Pearson $r = 0.34$, $F(1, 39) = 5.06$, $p = .030$. The resulting linear regression equation is y'= 0.671 - 0.011x, R square = 0.115. In the audio-video condition the model was not significant; $r = 0.22$, $F(1, 39) = 2.00$, $p = .165$. The resulting linear regression equation is y' = 0.366 - 0.006x, R square = 0.049. The model also revealed no significant relationship in the audio-only condition; $r = 0.25$, $F(1, 39) = 2.56$, $p = .118$. The resulting linear regression equation is y' = 0.753 - 0.009x, R square = 0.062.

The results show limited support for the veracity effect. Only in the face-to-face condition was there any significant relationship between the degree to which senders lied and the accuracy of lie detection by receivers. Even when a significant relationship was found, the proportions of deceptive answers only accounted for 11% of the variance in receivers' detection accuracy.

6.7.1 *Perception of receivers after judgements have been made*

Receivers' confidence in their judgements of veracity was measured by values from the Likert-type scale that was also used to judge veracity of the answers. That is, receivers were asked to mark the seven-point scale from -3: *very confident that the sender was lying* to +3: *Very confident that they were telling the truth.* Values less than 0 indicated that they thought the sender was lying, and greater than 0, that the sender was telling the truth. It was possible for receivers to mark the scale at 0 if they were undecided. There were few instances of receivers marking the scale at 0. Results for confidence in the ratings were analysed as two groups, those less than 0 where the answer was judged to be deceptive, and those greater than 0 where the answer was judged to be truthful.

Descriptive statistics for confidence in the answers judged as lies are shown in Table 43.

Table 43

Confidence in Receivers' Judgements of Deception

Media Condition (*N* = 36)	Face-to-face	Audio-Video	Audio-Only
M	**-1.82**	**-1.80**	**-1.90**
SD	0.59	0.52	0.57

A repeated measures ANOVA was conducted to determine the effect of media condition on the confidence of lie judgements, $F[2, 70] = 0.55$, $p = 0.581$. No significant effect of media condition was found.

Descriptive statistics for confidence in the answers judged as truthful are shown in Table 44.

Table 44

Confidence in Receivers' Judgements of Honesty

Media Condition (*N* = 42)	Face-to-face	Audio-Video	Audio-Only
Mean	**2.11**	**2.10**	**2.04**
SD	0.51	0.51	0.54

A repeated measures ANOVA with Greenhouse-Geisser correction was conducted to determine the effect of media condition on receivers' confidence in the accuracy of their judgements of honesty. No significant effect was found $F[1.75,71.59] = 0.65$, $p = 0.503$.

Pearson correlations were completed to investigate whether the confidence senders had in their judgements of deception was related to the measure of detection sensitivity (d'). No significant correlations were found in the face-to-face condition ($r = 0.28$, $N = 38$, $p = .088$), audio-video ($r = -0.04$, $N = 38$, $p = .798$) and audio-only condition ($r = -0.17$, $N = 38$, $p = 0.301$). Increased confidence of receivers in their judgements of deception was not related to detection accuracy.

Research question six asked: **Is the confidence receivers have in their veracity judgements greater in richer media conditions compared to lean media conditions?**

There was no evidence that receivers varied in the confidence of their deceptive or truthful judgements between media conditions. As predicted, there was no relationship between the confidence receivers had in their judgements of deception and the accuracy of detection.

6.8 Frequency of Lie/Truth Judgements and Classification Accuracy

A possible confounding factor in the live experimental study was that some questions might be more likely than others to be judged as deceptive. Therefore, it was necessary to investigate the frequencies of honest and deceptive judgements by receivers, and also the frequencies of correct and incorrect judgements. The complete list of 60 Questions is attached in the appendix.

6.8.1 *Frequencies of answers classified as truthful and deceptive by question number*

The frequency of answers judged to be lies ranged from two to twelve over all the media conditions, the number of answers classified as honest ranged from eight to 17. Averaged over all three media conditions and considering all 60 questions, the mean number of answers judged as lies by receivers was 6.85. This is in comparison to the mean number of answers judged as truthful which was 13.35. The ratio of dishonest to honest judgements ranged from 2:19 to 12:8 when considering all media conditions. One sample Pearson's Chi-Squared tests were conducted to determine whether any questions were more likely to be judged as deceptive. Bonferroni adjusted alpha levels of .000833 per test (.05/60) were used. Two questions were shown to be significantly more likely to be judged as honest than deceptive. These were, question 38 (*What do you think of first if someone mentions the USA?*), X^2 (1, N = 20) = 12.80, p = .00035, and question 56 (*Have you ever been caught speeding, if so how many times?*), X^2 (1, N = 21) = 13.76, p = .00021. The low proportion of the answers which were significantly more likely to be judged as honest rather than deceptive suggests that the content of individual questions is not a concern for analyses.

6.8.2 *Receiver discrimination accuracy*

The ratio of correct to incorrect judgements of each question ranged from 5:15 to 16:7. None of the questions were shown by Pearson's Chi-Squared tests (at the 5% confidence level with Bonferroni correction) to have significantly more correct than incorrect judgements made when they were answered. This would suggest that there are no questions that may reasonably be suspected to be significantly hard to lie to. As such it is not a concern for future analyses in this work.

6.9 Discussion

The study aimed to investigate the processes of deceptive communication from the perspective of both senders and receivers communicating in different media conditions in a controlled experimental study. The intention was to address some of the limitations of previous work. Crucially, this study investigated real deceptions which were freely given by senders in a fully interactive context. The majority of deception studies have used a small number of recorded stimuli, participants have been instructed to lie or hypothetical scenarios have been assessed. Other limitations of previous research were also addressed such as controlling the levels of media use by participants and including face-to-face as a media condition.

A laboratory based study was undertaken where participants acted as both senders and receivers. They asked and answered personal questions using three live, synchronous communication media; face to face; audio-video and audio-only. As senders, they had the freedom to choose whether to give honest or deceitful answers. As receivers, participants attempted to correctly judge the veracity of the answers they had been given.

Sender behaviour: the propensity to deceive

The results in this study indicated that when participants were not visible to their communication partner, they had a significantly greater propensity to deceive than when they used audio-video. There were no significant differences found between the face-to-face and audio-video conditions or between the audio-only and face-to-face conditions. The results did not directly support DePaulo et al.'s (1996a) and Hancock et al.'s (2004) predictions that audio-only would be preferred for deception over face-to-face. However, the non-visual audio-only was preferred over audio-video which in common with face-to-face, supports visual cues. The results do not support the media richness and interactivity hypotheses suggesting that richer media should be preferred. DePaulo et al. (1996a) suggest that the discomfort brought about by lying means that deceivers will try to maximise the apparent social distance between them and the target of their deception and will prefer lean media. Hancock et al. (2004) term this the Social Distance Hypothesis (p. 130). Hancock et al. (2004) propose that neither social distance or media richness can predict media preferences for deception and in fact the media most preferred will be synchronous, recordless (is not routinely recorded) and distributed. Both the social distance hypothesis and the three-factor model predict that deceivers will prefer audio-video over face-to-face as it is distributed. According to the three-factor model, audio-video and audio-only would have been equivalent. However, results did not fully support the social distance hypothesis or the three-factor model as variability in the distributed nature of the media appeared to have no effect on the propensity to deceive. Face-to-face and audio-video conditions showed equivalence in this study. There are a number of possible explanations for this finding. Participants may have felt no more distributed or distant from each other in the two visual media conditions, perhaps they only felt more distance from each other in the audio-only condition. It is also possible that they did feel more distributed with audio-video, but this effect was offset by audio-video being a mediated condition and therefore perhaps more easily recorded. The findings supports the results of the questionnaire studies reported in earlier chapters which suggested that people will feel more comfortable when they are not visible, rather than preferring richer media for deception. It is possible that participants feel more comfortable being deceptive when they are not visible, or they believed that the deceptions were less likely to be detected regardless of how comfortable they felt. It also supports the findings that audio-video is regarded as equivalent to face-to-face even though it is likely to be distributed. This may suggest that visibility is the most important factor.

Sender perceptions: do senders feel more vulnerable to detection in visual media conditions?

It was hypothesised that senders should feel less confident that they will escape detection in visual media conditions compared to an audio-only if participants feel that their deceptions are likely to be revealed through visual cues and the illusion of transparency has an effect on participants. The results did not support this hypothesis. Senders were significantly likely to rate both their deceptions and honest answers as more believable than likely to be detected in all media conditions. No media differences were found. There was no evidence that participants felt more or less believable according to whether they were visible to their partner or not. Gilovich et al. (1998) discussed the *illusion of* transparency where participants will overestimate the extent to which their deceptions are detectable. There was no evidence that participants were affected by an *illusion of transparency* in any media condition.

Receiver perceptions: are receivers biased towards judgements of honesty and do any biases vary between media conditions?

This study investigated whether receivers might be more biased towards honesty when the communication media are visual compared to when audio-only. The study also investigated whether the effect might be more pronounced in the face-to-face condition compared to audio-video. To date, there appears to be no studies reported which have directly compared truth and visual biases in face-to-face and audio-video conditions.

Results as measured by the number of answers judged to be deceptive and also with the signal detection measure *c* showed that there was a truth bias. The truth bias is the tendency to assume that people are telling the truth regardless of their actual veracity. Receivers were significantly more likely to judge senders' answers as truthful rather than deceptive. The frequency of deceptive answers ranged from approximately 40%-

47% and the judgements of deception ranged from approximately 32%-35%, therefore the truth bias may perhaps also reflect some classification accuracy.

There were however, no significant media differences identified. If there was a visual bias then we might have expected to observe fewer judgements of deception in the face-to-face and audio-video conditions than in the audio-only condition. As no media differences were found, there was little support for the finding reported in the literature that people appear to trust each other more when face-to-face than when using other media (e.g. Valley et al., 1998; Burgoon et al., 2003). Burgoon et al. (2008) claim that the intensified bias towards judging deceptive receivers as truthful in the audio-video condition is a result of a visual bias, that being a tendency to assign primacy of visual information over other social information. The results reported here showed a truth bias, but no visual bias. This suggests that a truth bias can operate independently of a visual bias.

Accuracy of veracity judgements

The study investigated whether classification accuracy is affected by media condition. The overall classification accuracy of both lies and truthful answers is typically reported in deception studies and so this study analysed this measure. The overall classification accuracy of lies and honest answers was not significantly different between media conditions. Classification accuracy was not found to be better than chance in any of the media conditions. If there is a bias towards judging answers as truthful in visual and also more interactive media conditions, then we might have expected to find reduced accuracy in the face-to-face and audio-video conditions compared to audio-only. We might have also expected to find reduced accuracy in visual media conditions if visual cues tend to be used by receivers to make judgements of veracity as these cues are generally not diagnostic of deception.

This study investigated the relationship between sender veracity and overall classification accuracy and found evidence for a significant negative relationship between the number of lies senders told and classification accuracy in all media conditions. Some work has suggested that sender veracity is the single most important factor in predicting overall judgement accuracy (e.g. Levine et al., 2006); the veracity effect. As a consequence, this study calculated lie and truth classification separately and applied the methods of signal detection theory to the results. Signal detection theory allows a receiver sensitivity metric (d') to be calculated in addition to a separate response bias metric (c). Lie detection accuracy, as measured by d', was not significantly greater than chance in the three media conditions. No significant media differences in lie detection accuracy were found.

The present study is uncommon in comparing face-to-face with audio-video and audio-only media conditions. Kassin et al. (2005) are rare in reporting that judgments of truthful and false confessions were more accurate in an audio-only condition compared to an audio-video condition. Approximately 25%-33% of participants achieved negative values for d', that reveals that they were more likely to judge deception as truthful. However, some participants did achieve values of d' which suggested that they were successfully detecting deception. This large individual variability will unfortunately mask any media effects that might be operating. Interpretation of the results as a whole is complex as many of the measures interact with each other. For instance, the veracity effect suggests that the fewer lies are told, the better the overall classification success will be. The number of lies told did vary between media conditions, but overall classification was not shown to vary between media conditions. However, if very high or very low proportions of senders' answers are deceptive, then it may be more difficult for receivers to achieve high levels of detection success as they have fewer opportunities to observe and compare both truthful and deceptive answers. This study investigated the relationship between sender veracity and receiver lie detection accuracy. Results showed that sender veracity accounted for only 11% of the variability in the face-to-face condition and no significant relationship was identified in the other media conditions. These results indicate that signal detection methods are a valuable tool to analyse deception detection data as they allow a separation between response bias and detection sensitivity. The signal detection analyses also indicate that the veracity effect may not be a significant factor to take into account in further studies reported in this thesis.

Confidence of receivers' judgements

This study also investigated whether the confidence of receivers in their judgements of veracity confidence is related to lie detection accuracy. In all media conditions, we would expect to find that senders' confidence in their judgments will not be related to lie detection accuracy. The results support this hypothesis, there was no relationship between confidence in judgements of deception and detection accuracy. The results support previous findings reported where confidence in judgements has not been found to be related to detection accuracy (Mann et al., 2002). No media differences in receivers' confidence in their judgements of veracity were identified. There were no differences in either the confidence with judgments of deception or judgements of honesty. This result was perhaps surprising. If participants expected some cues to be diagnostic of deception, then their presence or absence in some media conditions might have been expected to influence the confidence they had in their veracity judgements. The lack of any significant media differences has a number of possible and speculative explanations. Receivers may have been using cues for their judgements which were present in all media conditions (for instance, tone of voice) and so were similarly confident in all conditions. The scale used by receivers to indicate whether they judged the sender to be lying or telling the truth was the same measure used to assess their confidence in the judgement. It is possible that receivers were confused and were using the scale predominantly to indicate their veracity judgement rather than their confidence in the judgement. It is also possible that variability in confidence judgements between individuals obscured any media effects.

6.10 Conclusions

This chapter reported an experimental study which aimed to address some of the limitations of previously reported work. These developments included; a truly interactive context with high ecological validity combined with a high degree of experimental control; investigating the propensity to deceive under varying media conditions where participants could not choose when to use media, only when to deceive; comparing interactive media and including face-to-face to as a media condition; requiring participants to make classification judgements of thirty answers which is much greater than typically reported.

The study reported an important finding that the propensity to deceive was greater when senders could not be seen in an audio-only condition compared to visual media conditions. Participants in the study were free to deceive or be honest, but the number of overall interactions in each media condition was controlled. This allowed a number of perspectives on the media choice of deceptive senders to be compared. The results tended to support the social distance hypothesis and the three-factor model, but showed less support for media richness theory. None of the theories were adequate to explain the similarity of the face-to-face and audio-video conditions in the propensity to lie. There was little support for the distributed nature of media being an important factor. However, as George and Carlson (2005) argue, the context of deception is likely to be important. In this study, lies were told between strangers and consequences were probably limited to the experimental context. This makes comparisons with other studies tentative.

Significant media differences in overall classification accuracy and lie detection accuracy were not found. There was a high degree of variability in the rates of deception which may have made the job of detection harder for receivers. Neither the overall classification accuracy of all answers or lie detection accuracy were found to be better than would be expected if receivers were making veracity judgements by guessing. There was a high degree of variability in receivers' detection accuracy which potentially masked any media effects.

The next chapter reports an experimental study which was designed to control the variability in receivers' detection accuracy in order to further investigate media differences in deception detection.

7. The Effects of Fixed Deception Frequency on Receiver Perception and Behaviour: Biases and Detection Accuracy in a Second Experimental Study

7.1 Introduction

The previous chapter reported results from Experimental Study 1 which investigated the propensity of senders to deceive under varying communication media conditions. We reported that senders attempted to deceive receivers more frequently when they were communicating in an audio-only media condition compared to audio-video and when face-to-face. The study also investigated the tendency of receivers to judge senders as deceptive or truthful, and the accuracy of receivers' judgements of veracity. The results showed that receivers had a significant tendency to judge senders as honest in all media conditions, but there were no significant differences identified between media conditions. Detection of deception in each of the three different media conditions was not found to be significantly more accurate than would be expected by chance. However, detection accuracy scores showed a high degree of individual variability, some receivers demonstrated high sensitivity to the deception stimuli, while others showed little ability to detect lies. Any media effects on detection accuracy that might have been taking place would potentially be obscured by this variability in individual receiver behaviour. There are a number of possible sources of this variability, including the variation in senders' behaviour. There were differences observed in the proportions of lies and honest answers that senders gave which were potentially influenced by a host of possible factors including the questions asked, senders' propensity to deceive, and the communication media they were using. Analyses of individual questions did not suggest that there were particular questions that systematically biased the likelihood of deception or detection. The variability in the propensity of senders to deceive may be a confounding factor and a second study was designed to control for this variable. The study reported in the previous chapter was repeated with a significant modification. In Experimental Study 1, participants were free to deceive as much or as little as they wished, and to whichever questions as they chose. In the current study (Experimental Study 2) the proportion of deceptive answers given by senders was fixed at 3/10 in each media condition and participants were not free to choose which questions they answered deceptively. Because senders had little control over their behaviour (in terms of when and to which question they attempted to deceive), Experimental Study 2 was only to able to investigate sender perception in terms of the confidence they had with their detectability. The majority of analyses cover receiver perceptions and behaviour. We will first review the relevant previous literature reported in Chapters 2 and the results of Experimental Study 1.

Perceived detectability of senders

In the Experimental Study 1, senders were significantly likely to rate both their deceptions and honest answers as more believable than likely to be detected in all media conditions. No media differences were found. There was no evidence that participants felt more or less believable according to whether they were visible to their partner or not. Participants did not overestimate the extent to which their deceptions were detectable as might have been suggested by some previous research into the *illusion of transparency*. In Experimental Study 1, participants were free to lie or be honest whenever they chose. The majority of senders told between three and six lies in each media condition. It may be reasonable to assume that they chose which answers to lie to, perhaps on the basis that they thought they could generate a convincing answer. In the current study, senders are not able to choose which answers to lie to and so may feel that their forced deceptions are less convincing. If this is the case then we may expect their confidence in escaping detection to be lower than in Experimental Study 1. Gilovich et al. (1998) found evidence for an illusion of transparency where senders overestimated the detectability of their deceptions. In their studies, participants could not choose when to lie. The lack of an overestimation, and any media differences of detectability in Experimental Study 1 may have been related to a high confidence in believability as a result of this free choice in veracity. The current study replicates the forced lie/honesty design of Gilovich et al. (1998) and may be expected to reduce the confidence senders have in their believability of their deception. As Gilovich hypothesise, for the illusion of transparency effect to influence participants, there must be a route by which senders believe their deceptions will be detected. There is evidence that people believe their deceptions are revealed by visual cues, therefore any overestimation of detection may be greater in visual media conditions. This generates the first two research questions:

Does instructing senders when to lie reduce the confidence they have that their deception will be detected?

Do senders overestimate the detectability of deception in visual media conditions?

If the effect of forcing senders to lie reduces their confidence in evading detection, we will expect to find a reduction in their confidence of evading detection compared to Experimental Study 1. If the *illusion of transparency* has an effect in this study we will expect that senders will show greater perceptions of detectability in visual media conditions compared to when not visible.

Biases in receiver judgements of deception

In the previous study, we asked whether receivers were biased towards judging senders as more honest than dishonest. The results suggested that this was the case. There was a significant tendency to judge senders' answers as truthful. We also investigated whether receivers' judgements were more biased towards honesty when the communication media were visual compared to when audio-only. The results showed no evidence for media differences in judgement biases. A number of studies have reported that people appear to trust each other more when face-to-face than when using other media (e.g. Valley et al., 1998; Burgoon et al., 2003). Also, Burgoon et al. (2005) argued that visual media assist deceivers because immediacy and involvement can be capitalised on, so our lack of significant media differences were perhaps surprising. The results of receiver responses in our study showed a high degree of variability which may have obscured media effects. In Experimental Study 2 reported here senders were instructed when to lie or tell the truth so there was a fixed proportion of truthful and deceptive answers given by senders. All participants were informed in advance of the number of deceptive and truthful answers they would be required to give. This advance information would be expected to reduce the variability in the number of answers that participants would judge to be lies. This experimental design feature was intended to allow any media effects on response biases to be revealed and prompts us to ask the same research questions as the previous study:

Are receivers biased towards judging senders as more honest than dishonest when they know what the ratio of truthful to dishonest answers is?

Are receivers' judgements more biased towards honesty when the communication media are visual compared to when audio-only?

The truth bias has been reported as a robust effect in a number of studies and we expected to find evidence for a truth bias even when participants know the ratio of truthful to dishonest answers The change in experimental design is intended to reduce variability in receiver responses and we expected to find media differences if a visual bias has an effect in this experimental context. We may expect to find a greater bias towards judging answers as truthful in the visual media conditions.

Accuracy of deception detection

The previously reported experimental study did not find significant effects of media condition on the accuracy of deception detection. Kassin et al. (2005) reported studies where receivers were presented with audio-video and audio-only recordings of truthful and deceptive confessions from prison inmates. Receivers judged two statements from each sender, one truthful and one deceptive. The truthful statements related to crimes, of which the sender had been convicted. They reported that participants were 11.5% more accurate in their classification of truthful and deceptive recordings in an audio-only media condition compared to an audio-video condition. They argue that their results are "consistent with prior research indicating that people are better lie detectors when focused on content and auditory cues than on less diagnostic but distracting visual information" (p222). The ratio of truthful to deceptive stimuli was 50/50, and in one study receivers were told that 50% of the statements would be deceptive.

The current study was designed to investigate whether the media effects found by Kassin et al. (2005) could be replicated and extended to include a face-to-face media condition. We replicated a methodological feature of their second study by having a fixed ratio of deceptive and truthful statements which receivers are aware of. The current study extended the methodology by using multiple truthful and deceptive statements from senders and also by employing a live and fully interactive experimental context in all three media conditions. We can again ask a similar research question to Experimental Study 1.

Is the accuracy of deception detection influenced by the media condition with which people communicate?

If the results of Kassin et al. (2005) are replicated then we would expect to find that lie detection accuracy will be better in the audio-only condition compared to the audio-video condition. Detection in the face-to-face condition would also be expected to be less accurate than when communicating with audio-only as it also transmits the "distracting visual information". We identified no significant media differences in the previous experimental study, however, the experimental design in the current study is intended to reduce variability of receivers' responses and assist in the identification of any media effects. Some differences in lie detection accuracy have been found between conditions of varying temporal and spatial quality of recorded audio-video stimuli (Horn, Olson & Karasik, 2002). They reported results of a study where lie detection performance was degraded by a slight reduction in audio-video quality. They found that detection performance was not reduced in a severely spatially degraded video quality. They suggest that severely degrading the image masks non-diagnostic cues, however, they also found audio-only performance to be poor. In the studies reported here, audio-video quality was high, however, the spatial and temporal quality cannot be as high as when communicating face-to-face. If a slight reduction in quality leads to lowered accuracy then we might expect to find audio-video detection accuracy to be lower than face-to-face.

Receiver confidence in their judgements of veracity

In Experimental Study 1, we found no evidence that receivers' confidence in their judgements was related to detection accuracy. We also found no evidence that confidence in veracity judgements varied between media conditions. We suggested that because the measure used to assess receivers' confidence was also used to judge veracity, this may have caused some confusion. A re-design of the measures receivers use to indicate their confidence in judgements may allow any media effects to be revealed. Cues to deception have been reported in the literature to be predominantly visual. This would suggest that people might be expected to feel more confident in their judgments if they are made in face-to-face or audio-video conditions. This generates the final research question:

Is the confidence receivers have in their veracity judgements greater in richer media conditions compared to lean media conditions?

A laboratory based study was undertaken where participants acted as both senders and receivers. They communicated using three live, synchronous communication media; face to face; audio-video and audio-only. As receivers, participants attempted to correctly judge whether they had been given honest or deceitful answers. The study aimed to address some of the limitations of previous research that the previous study tackled, but with a significant modification. As senders, participants were instructed when to give honest or deceitful answers to a set of personal questions. Similar to Experimental Study 1, receivers made judgements of multiple messages in an extended interaction. Again, few studies have been conducted with face-to-face as a media condition, and this study, we were able to compare face-to-face to other media conditions.

7.2 Method

7.2.1 *Participants*

56 participants (33 women, 23 men) were recruited from staff and students at the University of Nottingham via email and poster advertisements. The poster indicated that the study was investigating lying and truth telling and that the person performing best in the study would receive a prize of £100.

7.2.2 *Materials*

Experimental Study 2 used the same bank of 60 questions probing personal and factual information which was designed for Experimental Study 3. Questions were intended to be open-ended but could be unambiguously answered truthfully or deceptively (for example, "What was the last movie that you went to see"). To reiterate, questions were designed to be emotionally neutral to reduce the chance that participants would be reluctant to answer. 60 Question sheets for receivers were constructed in the form shown in Figure 21.

What was the last movie that you went to see

Please tick one box to indicate whether you believe the statement made by the other person was true or false. Then circle a number on the scale below to show how confident you are with your guess.

True ☐ false ☐

I am confident that my guess is correct

1 2 3 4 5 6 7

Not confident at all

Very confident

Figure 21 Answer Sheet for Receivers

Receivers assessed the truth or falsehood of the answer given by ticking the boxes "true" or "false" and rated the confidence they had with their answer by marking the seven-point scale below. The scale was changed from Experimental Study 1 as it was felt the new version was easier for receivers to clearly state whether they thought the answer was truthful or dishonest.

60 answer sheets were also produced of the form shown in Figure 22, instructing participants to give truthful or deceptive answers to the question asked. They either had "Truth" printed at the top of the sheet and asked whether "The other person will guess that I was telling the truth" or "Lie" printed and asked whether "The other person will guess that I was telling a lie".

Senders indicated whether they thought the other person would judge that they were lying or telling the truth and rated the confidence they had with their detectability when lying or believability when telling the truth by marking the seven-point scale from "Not confident at all" to "very confident".

Please tick one box to indicate whether you believe that the other person will guess you were telling the truth or not. Then circle a number on the scale below to show how confident you are with your answer.

The other person will guess that I was telling the truth (or telling a lie)

Yes ☐ No ☐

I am confident that the other person could tell that I was telling the truth/lying

1 2 3 4 5 6 7

Not confident at all — Very confident

Figure 22 **Answer Sheet for Senders**

7.2.3 *Design and procedure*

A 1x3 design was used, with media condition as the within-participants factor with three levels: Face-to-face; audio-video and audio-only. Participants were paired and checked that they were unacquainted with each other. They were seated in separate test rooms and given identical written instructions. The instructions informed them that they were paired with another person and that they both had a set of ten question sheets and ten answer sheets. Their task would be to take the first question sheet from the set and ask their partner the question written at the top. The person asked the question must take the first answer sheet and answer either truthfully or deceptively depending on the instruction written at the top of the sheet. The questioner must then complete the measure below the written question assessing whether they believe or not the answer given. The person answering the question completed the sheet assessing whether they think they were believed or not. They were instructed to take turns asking and answering questions and work through the set of sheets until they had both asked, and answered ten questions each. The order of question and answer sheets were randomised for each trial. Participants were told that there would be three rounds of each of them asking ten questions of the other person. They were also informed that they would be required to answer seven questions truthfully and lie to three questions in each set of ten. All participants were instructed that their task was to be a good lie detector when listening to answers and to try to appear as if they were telling the truth when lying. They were told that they would receive points for being believed when answering questions and points for correctly identifying whether their partners were lying or telling the truth. Pairs were then informed how they would communicate with each other in that round. Although there was no fixed time imposed upon senders or receivers in the study, participants realistically only had a few seconds with which to prepare and deliver an answer. When each person had asked and had answered their set of ten questions they then were given a new set of question and answer sheets and told how they would communicate for that round. This was repeated for each of the three communication media conditions. The order of communication media condition was counterbalanced in the study. Participants did not know what media they would be using or in which order.

7.2.4 *Technical set-up*

The study used an identical technical set-up as Experimental Study 1.

7.3 Results

7.3.1 *Sender perceptions*

One participant failed to complete the experimental measures and was excluded from all analyses. Experimental Study 2 reported here used the scale shown in Figure 23 to assess the confidence senders had that their answers would be believed.

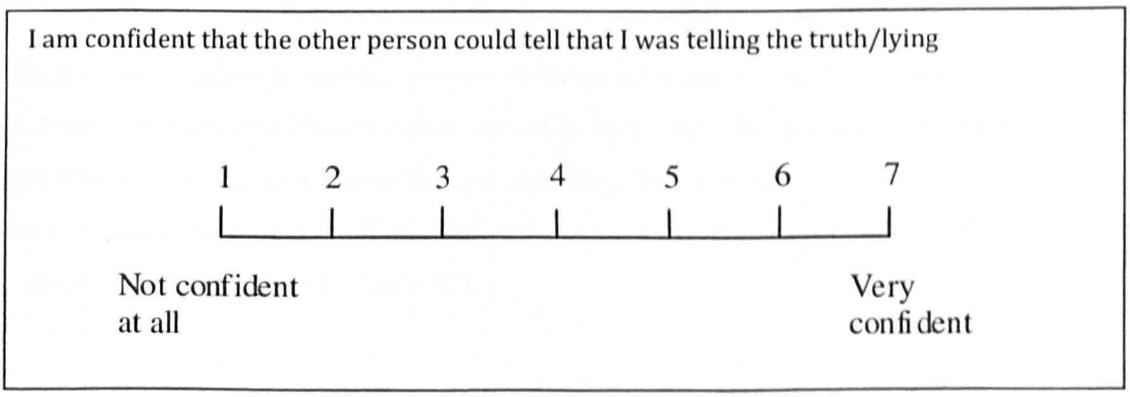


Figure 23 **Measure of senders' confidence**

7.3.1.1 Confidence of senders that their lies would be believed

This measure assessed how confident senders were that receivers would judge that they were lying. The scale ran from 1: *Not confident at all*, to 7: *Very confident*. A high value indicates that senders were confident that they would be detected. In order to make comparisons with the previous study where a high value on the confidence scale indicated that senders felt that they would be believed, the scores were reversed when the sender was deceiving. Therefore a higher value indicates senders felt more strongly that they would be believed. Results from each media condition are shown below in Table 45. Values of N varied as some participants did not complete all the measures. We used an alpha level of .05 for all statistical tests.

Table 45

Mean Confidence of Senders that Lies would be Believed

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	53	54	54
M	**3.00**	**3.32**	**3.15**
SD	1.15	1.10	1.28

A repeated measures ANOVA was conducted to investigate whether confidence that senders had that their lies would be detected varied between the face-to-face (M = 3.00, SD = 1.17, N = 51), audio-video (M = 3.28, SD = 1.09, N = 51) and audio-only (M = 3.17, SD = 1.31, N = 51) conditions. No significant difference was identified between the media conditions, $F[2,100]$ = 1.59, p = 0.209.

Senders were asked to make a yes/no decision after each answer they gave in order to indicate whether they thought they would be believed. This measure allows frequency distribution tables to be constructed showing the number of lies that each sender judged would be detected (Table 46) and the number of truthful answers that senders judged would be believed (Table 50).

Table 46

Frequency Distribution of Lies Expected to be Detected

Freq. of lies expected to be detected	Face-to-face	Audio-Video	Audio-Only
0	14	3	15
1	23	25	20
2	9	17	8
3	4	5	7
Total	50	50	50

Kolmogorov-Smirnov and Shapiro-Wilk tests of normality revealed that data was not normally distributed. A Friedman non-parametric test was conducted to investigate whether the frequency of lies judged by senders as likely to be detected varied between the three media conditions. No significant difference was found, X^2 $(2, N = 52) = 4.49$, $p = .106$.

Three chi-square tests of goodness of fit were performed to determine whether the frequency of deceptive answers judged to be detected were equally distributed. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The frequency of deceptive answers judged as likely to be detected was not equally distributed in the face-to-face condition, X^2 $(3, N = 50) = 15.76$, $p = .001$ or the audio-video condition, X^2 $(3, N = 50) = 25.84$, $p < .001$. In the audio-only condition the distribution was not significantly different from expected, X^2 $(3, N = 50) = 9.04$, $p = .029$. The results show that in the audio-video condition, senders were more likely to judge that their lies would be detected.

7.3.1.2 Proportion of lies that senders expected would be discovered

The proportion of deceptions that were expected to be detected was assessed by the frequency of answers where a lie was told and the sender checked the "yes" box assessing that the lie would be detected. Mean proportions of the lies expected to be discovered are shown in Table 47.

Table 47

Proportions of Lies which are Expected to be Discovered

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	53	54	55
M	**0.36**	**0.47**	**0.38**
SD	0.31	0.27	0.33

A repeated measures ANOVA was conducted to determine if the perceived detectability of senders deceptions varied between the face-to-face (M = 0.35, SD = 0.29, N = 52), audio-video (M = 0.47, SD = 0.27, N = 52) and audio-only conditions (M = 0.38, SD = 0.33, N = 52). No significant difference between media condition was identified, $F[2,102]$ = 2.79, p = .066.

Three paired sample t-tests were performed to make post-hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. Two comparisons were not significant, those comparing audio-video and audio-only conditions, $t(53)$ = -1.82, p = 0.038, 1-tailed, and comparing face-to-face and audio-only, $t(52)$ = -.54, p = .30, 1-tailed. A third comparison between face-to-face and audio-video was significant, $t(51)$ = 2.27, p = .014, 1-tailed. The results indicate that the number of deceptive answers judged to be detected was greater in the audio-video condition compared to when senders were communicating face-to-face.

Three single-sample t-tests were performed to determine whether senders judged their deceptions to be significantly more detectable than expected baseline detection rate of 0.15 (if senders expect that receivers have a 50/50 chance making the correct judgement: 0.5 * 3/10 deceptive answers) in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The proportion of deceptive answers expected to be detected was significantly greater than half of the known proportion of lies (0.15), in the face-to-face condition, $t(52)$ = 4.97, p < 0.001, 1-tailed, in the audio-video condition, $t(53)$ = 8.65, p < 0.001, 1-tailed, and in the audio-only condition $t(54)$ = 5.21, p < 0.001. Results indicate that in all media conditions, senders expected their deceptions to be detected at a higher rate than would be expected if receivers were making veracity judgements on the basis of the known proportions of lies and making a 50/50 judgement.

7.3.1.3 Comparison of the proportion of lies expected to be detected with Experimental Study 1

Results from Experimental Study 1 in the proportion of lies that were judged by senders to be likely to be detected are shown in Table 48.

Table 48

Proportions of Lies Senders Expect to be Detected: First Experimental Study

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	40	38	40
M	**0.25**	**0.30**	**0.32**
SD	0.29	0.30	0.31

Three independent samples t-tests were conducted to investigate whether the proportion of lies expected to be detected was greater in the current study than in Experimental Study 1. The t-tests compared the proportion of lies expected to be detected between the experimental studies in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. No significant differences were found between the studies in the face-to-face condition, $t(91) = -1.71$, $p = .046$, 1-tailed, or in the audio-only condition, $t(92) = -1.17$, $p = .122$, 1-tailed. The proportion of lies expected to be detected was significantly greater in the current study compared to Experimental Study 1 in the audio-video condition, $t(90) = -2.83$, $p = .003$, 1-tailed. Although results across media conditions were mixed, the proportion of lies which senders judged would be detected was lower in the audio-video condition when senders were free to choose when to deceive.

7.3.1.4 Confidence that truthful answers would be believed

The measure was not reversed for truthful answers, so a higher number suggests greater confidence that truthful answers would be believed. Descriptive statistics for the confidence that truthful answers would be believed are shown in Table 49.

Table 49

Confidence that Truthful Answers Would be Believed

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	53	54	55
M	**5.21**	**4.95**	**5.10**
SD	0.85	0.85	0.93

A repeated measures ANOVA revealed a significant difference in the confidence of senders that their honest answers would be believed between the face-to-face (M = 5.23, SD = 4.94, N = 52), audio-video (M = 4.94, SD = 0.87, N = 52) and the audio-only (M = 5.10, SD = 0.95, N = 52) conditions, $F[2,102]$ = 4.34, p = 0.016.

Three paired sample t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. Two paired sample t-tests showed that there were no significant differences in the confidence that truthful answers would be believed between the audio-only media condition and the audio-video media condition, $t(53)$ = -1.60, p = .058, 1-tailed, or between the face-to-face and audio-only conditions, $t(52)$ = 1.11, p = .136, 1-tailed. A third test indicated that there was a significant difference in the confidence that truthful answers would be believed face-to-face compared to the audio-video condition, $t(51)$ = 3.04, p = .002, 1-tailed.

The frequency distribution of truthful answers which senders judged would be believed is shown in Table 50.

Table 50
Frequency Distribution of Honest Answers Expected to be Believed

Freq. of answers believed in each media condition	Face-to-face	Audio-Video	Audio-Only
0	0	0	0
1	0	0	1
2	0	2	0
3	2	6	1
4	8	8	8
5	16	15	21
6	13	16	13
7	11	3	6
Total	50	50	50

Kolmogorov-Smirnov and Shapiro-Wilk tests of normality revealed that data was not normally distributed. A Friedman non-parametric test indicated that the frequency of lies judged as deceptive by senders was significantly different between the three media conditions., X^2 (2, N = 52) = 6.29, p = .043.

Three Wilcoxon signed ranks tests were used to make post hoc comparisons between conditions, Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The frequency of truthful answers expected to be believed was significantly greater in the face-to-face condition than in the audio-video condition, Z = -2.76, p = .003, 1-tailed. The number of truthful answers expected to be believed in the audio-only condition was not significantly greater than in the audio-video condition, Z = -1.64, p = .051, 1-tailed, or less than in the face-to-face condition, Z = -1.39, p = .083, 1-tailed.

Three chi-square tests of goodness of fit were performed to determine if the frequencies of answers judged as likely to be believed were equally distributed. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The frequencies of answers were not equally distributed in the face-to-face condition, X^2 (7, N = 50) = 48.24, p < .001, in the audio-video condition, X^2 (7, N = 50) = 45.04, p < .001, or in the audio-only condition, X^2 (7, N = 50) = 63.92, $p < .001$. In each media condition, results indicate that senders are more likely to judge that their truthful answers will be believed than disbelieved.

The proportions of honest answers which senders judged would be believed in each media condition are shown in Table 51.

Table 51

Proportions of Honest Answers which are Expected to be Believed

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	53	54	55
M	**0.78**	**0.70**	**0.75**
SD	0.16	0.18	0.16

A repeated measures ANOVA indicated that there was a significant difference between the face-to-face (M = 0.78, SD = 0.16, N = 52), audio-video (M = 0.70, SD = 0.18, N = 52) and audio-only (M = 0.75, SD = 0.16, N = 52) conditions in the proportions of honest answers judged to be believed, $F[2,102] = 4.27$, $p = .017$.

Three paired sample t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. Two paired sample t-tests showed that there were no significant differences in the proportions of truthful answers that would be believed between the audio-only media condition and the audio-video media condition, $t(53) = 1.31$, $p = .056$, 1-tailed, or between the face-to-face and audio-only conditions, $t(52) = 1.24$, $p = .110$, 1-tailed. A third test indicated that there was a significant difference in the proportion of truthful answers that would be believed face-to-face compared to the audio-video condition, $t(51) = -2.96$, $p = .003$, 1-tailed.

7.3.1.5 Comparison of Senders' Confidence Measures with Experimental Study 1

The experimental study reported in the previous chapter used a measure of senders' confidence ranging from 1, "very confident that they will think I was lying" to 10, "very confident that they will believe me". The current study asked senders to judge whether they thought they would be believed or not and then rate the confidence they had with that judgement on a scale from 1, "not confident at all" to 7, "very confident". The single scale used in Experimental Study 1 was used so that senders could indicate whether they judged that they would be believed or not. The measure in the current study asked senders to judge whether they would be believed and then asked for a confidence rating for that judgement. The potential difference in interpretation of the scales by senders does not allow for a direct comparison of the results. Interpretation of the direction of any effects is possible, however no significant differences between media conditions in the confidence that lies would be believed was identified in either experimental study. A significant effect of media condition was shown in the confidence that senders had that their truthful answers would be believed in the current study. Confidence of believability was higher in the face-to-face condition compared to the audio-video condition. This effect of media condition was not found in Experimental Study 1.

7.4 Response Bias of Receivers to Senders' Lies

The measure of receivers' response bias used in these studies will be the signal detection measure *c*, as it is suggested that it is independent of other signal detection theory measures (Stanislaw & Todorov, 1999). Negative values indicate a tendency of receivers to respond to the deceptive stimuli with "Lie", 0 indicates that there is no response bias, and positive values indicate a tendency to respond with "Truth". Descriptive statistics for response bias are shown in Table 52.

Table 52

Response Bias (c) of Receivers

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	52	55	55
M	**0.33**	**0.25**	**0.28**
SD	0.38	0.43	0.34

A repeated measures ANOVA indicated that there was no significant difference in the response bias of receivers between the face-to-face (M = 0.33, SD = 0.38, N = 52), audio-video (M = 0.25, SD = 0.43, N = 52) and audio-only (M = 0.28, SD = 0.34, N = 52) conditions, $F[2, 102]$ = 0.62, p = .541.

Three single sample t-tests were used to determine if the response bias, *c* was greater than 0 in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The analyses showed that the response bias was significantly greater than 0 in the face-to-face, $t(51) = 6.25$, $p < .001$, 1-tailed, audio-video, $t(54) = 4.19$, $p < .001$, 1-tailed, and audio-only conditions, $t(54) = 6.16$, $p < .001$, 1-tailed. The results indicate that there was a significant tendency to judge deceptive answers as truthful; there was evidence for a truth bias in all media conditions.

Comparison of Response Bias with first experimental study

The descriptive statistics from Experimental Study 1 for the response bias measure, *c*, are shown in Table 53.

Table 53

Response Bias (c) of Receivers

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	42	42	41
M	**0.40**	**0.42**	**0.35**
SD	0.49	0.50	0.47

Three independent samples t-tests were conducted to investigate whether the response bias was less in the current study than in Experimental Study 1. The t-tests compared the measure, *c*, between the experimental studies in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. No significant differences were found between the studies in the face-to-face condition, $t(92) = 0.75$, $p = .228$, 1-tailed, in the audio-video condition, $t(95) = 1.88$, $p = .032$, 1-tailed, or in the audio-only condition, $t(68.03) = 0.87$, $p = .193$, 1-tailed. The response bias was not significantly different between the studies where in one context receivers knew the proportion of lies and truthful answers and in the other, where senders were free to choose when to deceive.

7.5 Receiver behaviour

7.5.1 *Hit rate for lies*

The proportion of lies that were correctly identified, the hit rate for each media condition is shown in Table 54.

Table 54

Hit Rate for Lies: p(hit)

Media Condition	Face-to-face	Audio-Video	Audio
N	53	54	55
M	**0.45**	**0.46**	**0.45**
SD	0.26	0.34	0.30

A repeated measure ANOVA did not reveal a significant difference in the hit rate for lies between the face-to-face (M = 0.45, SD = 0.26, N = 52), audio-video (M = 0.45, SD = 0.33, N = 52) and audio-only (M = 0.45, SD = 0.31, N = 52) conditions, $F[2, 102]$ = 0.08, p = .992.

7.5.2 *Hit rate for truths*

The proportions of the honest answers in each media condition that were correctly identified by receivers are shown in Table 55.

Table 55

Hit Rate for Honest Answers

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	51	54	55
M	**0.71**	**0.64**	**0.68**
SD	0.18	0.17	0.16

A repeated measures ANOVA showed a significant difference in the hit rate for truthful answers between the face-to-face (M = 0.72, SD = 0.18, N = 50), audio-video (M = 0.63, SD = 0.16, N = 50) and audio-only (M = 0.68, SD = 0.15, N = 50) conditions, $F(2, 98)$ = 4.05, p = .021.

Three paired samples t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The first paired sample t-test showed that there were significantly more truthful answers correctly identified in the face-to-face condition compared to the audio-video media condition, $t(49)$ = -2.75, p = .004, 1-tailed. Two further tests indicated that there was no significant difference between the hit rate in the face-to-face and in the audio-only condition, $t(50)$ = 1.15, p = .129, 1-tailed, or between the audio-video and audio-only conditions, $t(53)$ = 1.19, p = .119, 1-tailed.

7.5.3 *Discrimination accuracy*

To calculate signal detection discrimination sensitivity, a measure of detection accuracy (d') for the deceptive answers senders gave, it was necessary to use the proportions of hits and false alarms.

Values for p(false alarms) and detection accuracy (d') for each media condition are shown in Tables 56 and 57. The numbers of participants vary between media conditions as it was not possible to calculate measures for some participants.

Table 56

P(False alarms) Rate for Deceptions

Media Condition (N = 50)	Face-to-face	Audio-Video	Audio-Only
N	53	54	55
M	**0.27**	**0.36**	**0.32**
SD	0.19	0.17	0.16

A repeated measures ANOVA identified a significant difference in the false alarm rates between the face-to-face (M = 0.27, SD = 0.19, N = 52), audio-video (M = 0.36, SD = 0.17, N = 52) and audio-only (M = 0.32, SD = 0.15, N = 52) conditions, $F[2, 102]$ = 4.65, p = .012.

Three paired samples t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The first paired sample t-test showed that there were significantly greater false alarm rate in the audio-video media condition compared to the face-to-face media condition, $t(51)$ = 2.91, p = .003, 1-tailed. A second test indicated that there was no significant difference in the false alarms rate in the audio-video condition compared to the audio-only condition, $t(53)$ = -1.19, p = .121, 1-tailed. A third test indicated that there was no significant difference in the false alarm rate found in the face-to-face and in the audio-only conditions, $t(52)$ = -1.44, p = .078, 1-tailed.

The results indicate that when participants communicated with audio-video, they were more likely to judge truthful answers as deceptive compared to when communicating face-to-face.

Hit rates and false alarm rates were used to calculate the discrimination sensitivity a measure of the lie detection accuracy. Descriptive statistics are shown in Table 57.

Table 57

Discrimination Accuracy of Deceptive Answers

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	52	55	55
M	**0.48**	**0.28**	**0.33**
SD	0.77	0.96	0.91

A repeated measures ANOVA did not show a significant difference in lie detection accuracy between the face-to-face (M = 0.48, SD = 0.77, N = 52), audio-video (M = 0.25, SD = 0.94, N = 52) and audio-only (M = 0.35, SD = 0.93, N = 52) conditions, $F[2, 102]$ = 1.30, p = .277.

Three single sample t-tests were performed to tests whether the values of *d'* were significantly greater than 0, the value that would indicate no sensitivity to the deceptive stimuli. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The values of sensitivity in both the face-to-face condition, $t(51) = 4.52$, $p < .001$, 1-tailed, and the audio-only condition, $t(54) = 2.66$, $p = .005$, 1-tailed, were significantly greater than 0. Sensitivity to deception in the audio-video condition was not significantly different from 0, $t(54) = 2.16$, $p = .018$, 1-tailed. The results indicate that in both the audio-only and face-to-face conditions, participants were significantly more likely to identify deceptions than would be expected if receivers were performing at chance levels.

7.5.3.1 Comparing deception sensitivity in the two experimental studies

Results of discrimination accuracy in Experimental Study 1 are shown in Table 58. Results from Experimental Studies 1 and 2 are shown in Figure 24 for comparison.

Table 58

Discrimination Sensitivity (d') for Lies in Experimental Study 1

Media Condition ($N = 41$)	Face-to-face	Audio-Video	Audio-Only
M	**0.23**	**0.12**	**0.30**
SD	0.72	0.64	0.90

In order to determine if the lie detection accuracy was significantly better if senders lied or told the truth according to instructions compared to when they were free to choose when to lie, three independent samples t-tests were conducted. The t-tests compared *d'* between the experimental studies in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. No significant differences were found between the studies in the face-to-face condition, $t(87) = -1.01$, $p = .158$, 1-tailed, the audio-video condition, $t(93.02) = -0.98$, $p = .165$, 1-tailed or the audio-only condition, $t(94) = -1.54$, $p = .063$, 1-tailed. There was no evidence that instructing senders when to lie affected receivers' accuracy at detecting deception.

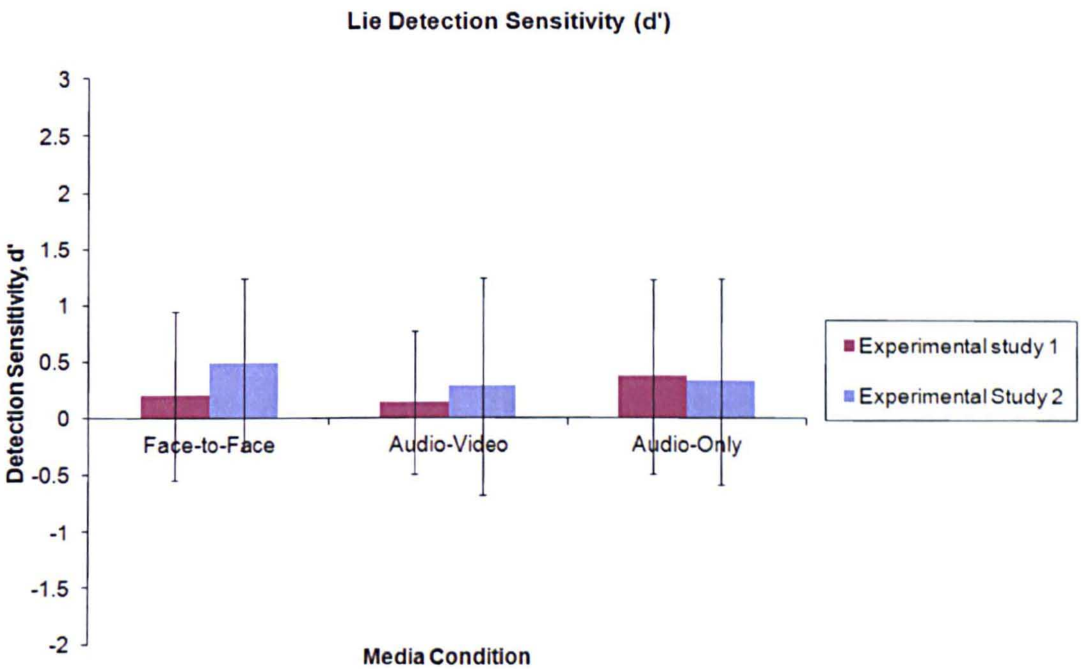


Figure 24 **Detection Accuracy in Experimental Studies 1 and 2**

In order to determine whether there were media differences in detection accuracy when taking into account the findings from both experimental studies, the results were meta-analysed using a method implemented with the application MetaP (Donliang, Ge). The application uses Stouffer's z-score method to produce an overall combined probability from two or more independent tests. The combined probability value from Stouffer's z was .333. This value indicates that there was no significant difference in detection accuracy at the 5% level between media conditions even when taking results from both studies into account.

7.5.3.2 Comparison of variance in detection accuracy between studies

The change in methodology in Experimental Study 2 from the Experimental Study 1 was controlling the ratio of truthful and deceptive answers that senders gave. The control of this variable was designed to reduce the variance in receivers' judgements of veracity. Levene's test of homogeneity of variance was conducted to compare the variance measures in each media condition between the studies. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The first test comparing the variance in d' scores between the studies in the audio-video condition, no significant difference was identified, $F(1, 90) = 0.20$, $p = .66$. The second test compared variance in d' scores between studies in the audio-only condition and identified no significant difference, $F(1,$

88) = 5.79, p = .018. The third test compared variance in d' scores between studies in the face-to-face condition and identified no significant difference, $F(1, 87) = 1.61$, p = .21. There is little evidence that fixing the ratio of truthful and deceptive answers reduced variability in receivers' detection accuracy.

7.6 Perception of Receivers After Judgements Have Been Made

A different scale type was used in the current study to Experimental Study 1 to assess veracity and confidence judgements. The measure asked receivers to first judge whether they thought the sender was lying or telling the truth and then rate the confidence they had with that judgement with a seven-point scale labelled "*I am confident that my guess is correct*". The confidence scale ran from 1: "*Not confident at all*" to 7:"*Very Confident*" It was decided to separate the veracity judgement from the confidence judgement as it would be clearer for participants when responding.

Results from judgements of deception are analysed separately from judgements of honesty. Descriptive statistics for confidence in the answers judged as deceptive are shown in Table 59.

Table 59

Receivers' Confidence in their Judgements of Deception

Media Condition	Face-to-face	Audio-Video	Audio-Only
N	51	54	55
M	**4.65**	**4.43**	**4.87**
SD	1.18	1.11	0.99

A repeated measures ANOVA comparing the face-to-face (M = 4.65, SD = 1.19, N = 50), audio-video (M = 4.38, SD = 1.13, N = 50) and audio-only (M = 4.87, SD = 1.02, N = 50) conditions showed a significant effect of media condition on the confidence receivers had in their judgements of deception, $F[2, 98] = 7.67$, p = .001.

Three paired samples t-tests were used to make post hoc comparisons between conditions. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. The first paired sample t-test showed a significant difference in confidence between the audio-only and audio-video conditions, $t(53) = 3.49, p < .001$, 1-tailed. A second test showed a significant difference in confidence between the face-to-face and audio-video conditions, $t(49) = -2.31, p = .013$, 1-tailed. A third test showed no significant difference in confidence between the face-to-face and audio-only conditions, $t(50) = -1.71, p = .047$, 1-tailed. The results indicated that the confidence receivers had in their judgements of deception were greater in both the face-to-face and audio-only media conditions compared to the audio-video condition.

Descriptive statistics for receivers' confidence in the answers judged as honest are shown in Table 60.

Table 60

Receivers' Confidence in their Ratings of Honesty

Media Condition	Face-to-face	Video	Audio
N	53	54	55
M	**5.38**	**5.20**	**5.30**
SD	0.79	0.91	0.87

A repeated measures ANOVA comparing the face-to-face ($M = 5.36, SD = 0.79, N = 50$), audio-video ($M = 5.19, SD = 0.93, N = 50$) and audio-only ($M = 5.27, SD = 0.88, N = 50$) conditions showed no significant difference in the confidence receivers had in their judgements of honesty, $F(2, 102) = 1.61, p = .204$.

7.6.1 *Comparison of receivers' confidence measures with Experimental Study 1*

The experimental study reported in the previous chapter used a measure of receivers' confidence ranging from -3, "very confident that they were lying" to 3, "very confident that they were telling the truth". The current study asked senders to judge whether the sender was lying or not, and then rate the confidence they had with that judgement on a scale from 1, "not confident at all" to 7, "very confident". The single scale used in Experimental Study 1 was used so that senders could indicate whether they judged the answer as truthful or not. The measure in the current study asked senders to judge the veracity of the answer and then asked for a confidence rating for that judgement. The single scale used in the first study can be regarded as two four-point scales from 0 (not confident) to 3/-3 (very confident). So the seven-point confidence scores in the current study may be transformed to a four-point score by multiplying them by 4/7. Results are shown in Table 61. For answers judged as lies, inverse scores are used to allow a comparison with the negative values from the first study.

Table 61

Receivers' Confidence in their Judgements of Deception - Converted

Media Condition	Face-to-face	Video	Audio
N	51	54	55
M	**-1.66**	**-1.53**	**-1.78**
SD	0.68	0.64	0.57

Results from Experimental Study 1 are shown in Table 62.

Table 62

Receivers' Confidence in their Judgements of Deception - Experimental Study 1

Media Condition (*N* = 36)	Face-to-face	Audio-Video	Audio-Only
M	**-1.82**	**-1.80**	**-1.90**
SD	0.59	0.52	0.57

3 independent sample t-tests were performed to make comparisons between the studies in the values in each media condition. Bonferroni adjusted alpha levels of .0167 per test (.05/3) were used. Each t-test showed no significant difference in confidence between the studies. The first test compared the face-to-face conditions, $t(88) = -1.12$, $p =$ .133, 1-tailed. The second test compared audio-video conditions, $t(91) = -1.90$, $p = .030$, 1-tailed. A third test showed compared audio-only conditions, $t(92) = -0.76$, $p = .225$, 1-tailed. The results indicated that the confidence receivers had in their judgements of deception were not significantly different between the two studies.
There is a potential difference in interpretation of the scales by receivers and therefore a direct comparison of the results may need to be treated with caution..

7.7 Discussion

Sender Perceptions: does instructing senders when to lie or tell the truth reduce the confidence they had that their deception would be detected?

The first research question asked whether instructing senders when to lie or tell the truth would reduce the confidence they had that their deception would be detected. Senders judged the proportions of lies that would be detected from 0.36 to 0.47. These proportions were significantly greater than would be expected if senders assessed the likelihood of detection by looking at the proportions of lies they would have to tell and they assumed receivers were making veracity judgements by guessing. This might suggest that senders were overestimating the likelihood of lie detection. However, judging the proportion of lies that might be expected to be detected was a fairly complex calculation to make in the experimental context, and an alternative hypothesis is that senders judged the likelihood of detection after each answer they gave and took no account of the actual proportions of deceptive answers. If that was the case then drawing conclusions from the proportions of lies that senders expected to be detected may be problematic. If the effect of forcing senders to lie reduces their confidence in evading detection, we will expect to find a reduction in their confidence of evading detection compared to Experimental Study 1. Comparison with Experimental Study 1 indicated that in the audio-video condition, the proportion of lies expected to be discovered was greater when senders were instructed to lie compared to when they were free to choose the veracity of their answers. There was no significant difference between the studies in the face-to-face and audio-only conditions. The suggestion that instructing senders to lie would increase their assessment of detectability was only partially supported.

Would senders overestimate the detectability of their deception in visual media conditions?

The second research question asked if senders would overestimate the detectability of their deception in visual media conditions. The proportion of lies expected to be detected was found to be greater in the audio-video condition compared to face-to-face. The proportion of truthful answers expected to be believed was also lower in the audio-video condition compared to face-to-face. The confidence senders had that their truthful answers would be believed was also lower in the audio-video condition than when face-to-face. We did not find evidence that detectability of deception was perceived to be higher when visible. It was hypothesised that the *illusion of transparency* might show a greater effect in this study in visual media conditions, however this was not supported. In all media conditions senders judged their deceptions as more likely to be detected than would be expected. However, because the calculation of likelihood of detection was complex, the results need to be treated with caution. The results suggest that in the audio-video condition, senders felt that both their honest and deceptive answers were less believable. In Experimental Study 1 where the frequency of deception was not fixed, in all media conditions senders were significantly likely to rate their deceptions as more believable than likely to be detected. There were no significant differences between media conditions. A possible explanation for the results is that when people are both instructed to lie and also communicate using a media condition they feel unfamiliar with, their anxiety levels are raised and they perceive that they are showing signals of deception. This suggestion needs further research before it might be accepted.

Receiver perceptions: are receivers biased towards judgements of honesty and do any biases vary between media conditions?

We asked whether receivers were biased towards judging senders as more honest than dishonest when they knew the ratio of truthful to dishonest answers. Results indicated that receivers were significantly biased towards judging answers as truthful in all media conditions. There were no significant differences identified between media conditions. We might reasonably have expected receivers to be biased towards judgements of honesty as they knew that the proportion of lies was 0.3 in advance of making judgements. We compared the results with those from Experimental Study 1 and found no significant difference. Participants were biased towards judging answers as truthful whether they knew the deception baseline rate or not.

We also asked whether receivers' judgements were more biased towards honesty when the communication media were visual compared to when audio-only. No significant differences in response bias were found between media conditions. There was no evidence that receivers were more biased towards judging answers as more truthful in the visual media conditions. The results were similar to those found in Experimental Study 1.

Detection of deception

We asked whether the accuracy of deception detection was influenced by the media condition with which people communicated. Signal detection theory was used to analyse the results, so metrics of the proportion of hits and false alarms were used to calculate deception sensitivity metric, *d'*. Results suggested a high degree of variability in individual performance. Values for *d'* ranged between -1.31-2.04 in the face-to-face condition, between -1.64-2.68 in the audio-video condition and ranged from -0.99-2.68 in the audio-only condition. Results indicated that the proportion of lies that were correctly judged, p(hits) was significantly smaller in the audio-video condition than when participants were communicating face-to-face. The proportion of truthful answers that were incorrectly judged to be deceptive, p(false alarms) was significantly greater in the audio-video condition compared to face-to-face. However, no significant difference was found in *d'* between the three media conditions. Values for *d'* for each media condition were compared to 0 which would indicate no sensitivity to the stimuli. In both the face-to-face and audio-only conditions, detection accuracy was significantly better than 0, however, in the audio-video condition, *d'* was not significantly greater than 0. These results indicate that receivers' detection performance was poor in the audio-video condition. Results from both experimental studies were meta analysed but significant media differences were not identified. The results were compared for each media type between the two studies and were not found to be significantly different. This suggests that instructing senders when to lie and tell the truth did not influence receivers judgement accuracy. If the results of Kassin et al. (2005) were replicated then we would expect to find that lie detection accuracy would be better in the audio-only condition compared to the audio-video condition. Detection in the face-to-face condition would also be expected to be less accurate than when communicating with audio-only as it also transmits the "distracting visual information". Results did not support the hypotheses that detection in the audio-only condition would be better than both the audio-video and face-to-face conditions. The evidence that detection performance in the audio-video condition was poor, in combination with the finding that the proportion of hits was lower and false alarms higher than when face-to-face, suggests that successful discrimination of lies and honest answers is harder in the audio-video condition. The findings reported by Horn et al. (2002) suggested that performance in audio-video might be worse than face-to-face. We suggested that the slight reduction of quality in audio-video compared to face-to-face may lead to lowered detection accuracy. Although the results for *d'* did not significantly differ between the conditions, there was some evidence that performance was poorer in audio-video compared to face-to-face.

Comparing the two experimental studies, the variance in *d'* results only significantly differed in the audio-video conditions. This suggests that change in the experimental design did not significantly reduce the variability in participant's individual performance. Again, this variability may have obscured media effects on detection accuracy.

Receivers' confidence in veracity judgements

We asked if the confidence that receivers have in their veracity judgements was greater in richer media conditions compared to lean media conditions. The results indicated that there were no significant differences in receivers' confidence with their veracity judgements between the media conditions. Previous studies had suggested that cues to deception are expected to be predominantly visual and non verbal (Taylor and Hick, 2007). If receivers tend to use visual cues, they might have been expected to feel more confident in their judgments if they are made in face-to-face or audio-video conditions. Confidence in veracity judgements were measured with different scales in the two experimental studies which made direct comparison problematic. Results were transformed to allow a comparison between the studies and were not found to be significantly different. Because the data were transformed, the results need to be treated with a degree of caution, however, the lack of significant difference suggests that knowing the proportion of lies and honest answers did not change receivers' confidence in their judgements of veracity.

7.8 Conclusions

An experimental study was conducted to investigate the effects of communication media on senders' perceptions of their believability, and receivers' response biases, lie detection accuracy on confidence in veracity judgements. Results from Experimental Study 1 indicated that variability in individual behaviour was high and this was suggested as a possible reason why few significant media effects were found. An experimental design modification was proposed where senders were instructed when to lie and tell the truth. This was intended to reduce variability in results and any allow any effects of communication media on behaviour to be identified. There was evidence that senders felt less believable when they were being honest, and more likely to be detected when they were lying in the audio-video condition compared to when face-to-face. Comparison between the experimental studies in senders' confidence was problematic, but some results indicated that senders expected their lies to be detected at a higher rate than would have been expected. This perhaps suggested that instructing participants when to lie increased their perceptions of detectability. There was also some evidence that discrimination of lies from truthful answers was worse in the audio-video condition compared to the face-to-face condition. However, in the measure of discrimination accuracy, *d'*, significant media differences were not found. Variability in the results was compared between the experimental conditions and considering each of the media conditions, was not reduced by fixing the proportions of truthful and deceptive answers. Response biases of receivers were investigated and not found to significantly vary between media conditions. Receivers were however, biased towards judging answers as truthful in all media conditions. This was a similar finding to results from Experimental Study 1.

The change in experimental design was intended to reduce variability in receivers' responses, however individual variability appeared to remain high which may have again obscured media effects. There was some evidence of media effects on veracity judgements, suggesting that there is a need investigate these issues further, but a different experimental strategy is required in order to reduce the variability. The next experimental steps are designed to reduce this variability by increasing receiver numbers and reducing the variability in stimuli. In order to increase the size of the receiver discrimination data sets, it was necessary to move away from live experimental studies with fully interactive communication contexts towards studies using recordings of deceptive and truthful interactions.

7.8.1 *Next steps*

In the live experimental studies of reported in the previous two chapters, significant differences were found between media conditions in the perceptions and behaviour of both senders and receivers. In Experimental Study 1 where senders were able to choose whether to lie or tell the truth, significantly fewer lies were told in the audio-video condition compared to the audio-only condition. There was also some evidence that some factors which influence lie detection were less accurate in the audio-video condition compared to audio-only and face-to-face conditions. In Experimental Study 2, there was some evidence that senders believed their lies to be more detectable under audio-video conditions than when communicating face-to-face or with audio-only.

Some problems with the experimental studies, in common with much of the literature in deception detection, is that although lie detection can sometimes be more accurate than chance, typically, the effects are small and there may be considerable individual variability. For example, Mann et al. (2008) investigated the classification accuracy of recorded truthful and deceptive confessions which were presented to receivers under various media conditions. They reported evidence that the accuracy of classification was lower in a video-only condition compared to audio-only and audio-video conditions. However, a high degree of individual receiver variability was reported, the overall classification accuracy ranged from 14-100%. It is possible that experimental effects may be obscured by this variability. In the experimental studies reported in the previous chapters, although attempts were made to control for as many factors as possible, considerable variability in the results was identified (indicated by high standard deviations). The variability in Experimental Study 1 was hypothesised to be in part a consequence of the variable frequencies which lies were told by senders. This factor was controlled in Experimental Study 2, but variability in detection measures was not shown to be reduced. Other potential sources of variability included: variation in senders' demeanour and ability to appear honest; biases of receivers to judge communications as truthful (regardless of the actual veracity of messages); variation in the ease with which some questions may be answered deceptively (and detected) and also the individual abilities of receivers to correctly classify honest and deceptive communications. All of these factors, and conceivably many others, may introduce high variability into measures of deception detection which can disguise any effects of communication media.

In an attempt to control the sources of variability, the following chapters report studies which were designed in order to develop a corpus of truthful and deceptive media recordings to use as stimuli. These stimuli were used in a further series of studies in order to investigate media effects on response biases and deception detection. The motivation for developing a corpus of media recordings of senders being truthful and attempting to deceive was that studies could be conducted with a greater degree of control than the live experiments allowed. Using recordings as stimuli is intended to reduce the variability in sender behaviour which was observed in the reported experimental studies by controlling the proportions of truthful and deceptive messages and by receivers judging fewer senders. The experimental design decision for receivers to judge recorded messages also allows larger number of judgments to be made of the same set of stimuli which is intended to reduce the variability of the judgements.

A primary aim of the next studies reported was to develop a corpus of audiovisual media recordings which were rated for truth or falsity by a large number of people. The intention was to produce a set of media recordings that were reliably rated as truthful and deceptive. Practically, this means deceptive answers which were consistently judged correctly to be lies and those consistently incorrectly judged to be truthful. It also means truthful answers which are correctly judged as honest and those consistently judged incorrectly as lies. These stimuli may then be used in further studies to control for variability in frequency of lies told and credibility of senders. In order to gather a large data set of detection metrics two studies were undertaken: Experimental Studies 4 and 5. These studies were identical in methodology, the only difference being the identity of the sender, the person who was recorded answering questions.

This methodological approach relies on the use of recorded stimuli. However, some research has suggested that detection metrics may vary between live and recorded stimuli, or between participants and observers of deception. For instance, Vrij, Mann, and Fisher (2006a) reported that passive observers tended to be more accurate in detecting truths and lies than active interviewers. Interpersonal deception theory (Buller, Burgoon, Buslig & Rolger, 1998) in particular makes the claim that detection of deception will be higher with recorded stimuli. It was necessary to investigate whether detection metrics are significantly different or not between live interactions and recorded stimuli. This was addressed by conducting Experimental Study 3, which is reported in the next section. It is worth noting that the senders in Experimental Study 1 were recorded with both video and audio regardless of the experimental condition which allows their use in a media corpus.

8. Investigating the effects of interaction: Experimental Study 3

8.1 Introduction

The majority of previous studies (although certainly not exclusively) of deception and its detection reported in the literature have been conducted using the following procedure: senders are asked questions by an interviewer and are either instructed to lie or tell the truth, or they answer according to their own volition. Their answers are recorded, typically with audio and video. These recording are then replayed to individuals or groups of receivers who judge whether or not the person is lying (see Vrij, 2008 for a review). In a small minority of studies the sender and receivers are engaged in a live interaction where they are both present (e.g. Burgoon, Bonito, Ramirez, Dunbar, Kam & Fischer, 2006). Burgoon et al. (2002) claim that "Human communication processes and outcomes vary systematically with the degree of interactivity that is afforded or experienced" (p. 659). If human communication processes and outcomes include the deception and its detection, then differences in the interactivity of experimental contexts may be expected to influence the detection of deception.

Interpersonal deception theory (Buller et al., 1998) suggests that deceivers approach deception in a strategic manner. It is a framework to account for the nature and success of deceptive interchanges with the critical feature being interactivity. "The *principle of interactivity* holds that interaction processes and outcomes are systematically influenced by the degree of interactivity that is afforded and transpires" (Burgoon et al., 2003, p. 2).

Interpersonal deception theory suggests that it is a constellation of affordances or properties that determine the degree of interactivity present in a given communication context (Burgoon et al., 2001). These affordances include contingency, transformation, participation and synchronicity. There are also a range of properties which are dependent upon the medium of communication. Some of these properties of the interaction would appear to be co-dependent, which makes the predictive value of interpersonal deception theory problematic to assess. However, there may be qualitative differences between communication contexts which can be identified as related to these affordances. Burgoon et al. (1999) argue that deceivers engage in both unintentional displays of internal cognitive and physiological processes such as arousal, felt emotions, cognitive effort and attempted control: the four factor model (Zuckerman et al., 1981), but also communicative, goal directed acts. Interpersonal deception theory predicts that strategic behaviour evident in deceptive displays incorporate management of information, behaviour and self presentation.

If interpersonal deception theory is correct, then deceivers should attempt to use feedback from the other party to modify their behaviour over time and appear more truthful. In more interactive contexts such as face-to-face, senders will a) behave more strategically, i.e. more information, behaviour and image management; b) behave less non-strategically i.e. less arousal, lower performance, less positive affect and c) engage in more self-monitoring. In more interactive contexts, deceivers would be expected to be more successful at avoiding detection. Also, and crucially in this context, interpersonal deception theory predicts that in more interactive contexts receivers will a) judge senders as more credible and b) achieve lower accuracy in detecting deception. Why should this be the case? According to interpersonal deception theory, interaction fosters *mutuality*, a sense of relational connectedness that leads people to behave to one another differently than if they had not interacted. This perceived connectedness leads to increased ratings of rapport and similarity. This increased rapport can be observed as responsive, coordinated and synchronous communication, with gestural matching and smooth turn-taking. Also, in addition to elevated positive affect towards interactional partners, interpersonal deception theory claims that if receivers are suspicious of message veracity, this will be revealed to senders. Senders are then in the position to modify their performances towards greater believability (Burgoon et al., 2001). Some researchers have also hypothesised that the cognitive and behavioural energy required to uphold a conversation make interactive partners inferior lie detectors compared to passive observers (Hartwig et al., 2002).

These predictions from interpersonal deception theory have been tested in a number of studies with mixed support. Compared to passive interrogators, face-to-face interactants have been shown to evaluate each other with greater leniency and more positivity (Burgoon et al, 2001). A number of studies reported (e.g. Vrij et al., 2006a) have investigated lie detection with interviewers either actively involved or passively observing the senders and reported that passive observers tended to be more accurate in detecting truths and lies than active interviewers (Vrij et al., 2006a). According to interpersonal deception theory, all things being equal, conditions that create the highest mutuality should be the worst for detecting deceit. In face-to-face contexts, deceivers have been shown to deliberately and successfully modify their performances over time (Burgoon et al., 2008). Burgoon et al. (2001) compared interactions where parties engaged in dialogue to monologues as an operalisation of interactivity. They found evidence that participants in dialogues produced more perceived behavioural mutuality (measured by matching and mirroring), and perceptual mutuality (measured by rapport, similarity and trust). The differences between monologue and dialogue were only found when interacting with strangers. Rating of their partners' speech and information management were also greater under conditions of dialogue compared to monologue. They found some evidence that detection of deception was lower under conditions of dialogue than monologue, although the results were equivocal.

In other reported work, Burgoon et al. (2003) compared a face-to-face media condition with audio-video (low quality), audio-only and text-chat. They measured trust and involvement (a measure of social presence). They reported that during face-to-face interactions, participants indicated a greater involvement in the interaction, but that deceivers were only less trusted in an audio only condition. In a study of mock interrogations, Hartwig et al. (2002) reported no differences in biases of judgements of veracity, lie detection accuracy or receivers' confidence in their judgements in a study comparing three conditions of interactivity. The conditions were: active (fully interactional, receiver asking questions); passive (in the same room as the sender and active receiver) or when observing from behind a one-way mirror. Bond and DePaulo (2006) reviewed eleven studies where the degree of interactivity of senders and receivers was experimentally manipulated. In some studies, senders interacted with a receiver; in others deception was judged by a third party (via recordings or through live observation). They found no evidence of differences in overall discrimination accuracy. They did, however, find evidence that receivers who were directly interacting with senders, compared to third-party observers, were more likely to judge them as truthful. However, these studies did not use signal detection theory to analyse results, which may have allowed further unpacking of the communication processes involved.

There is some evidence that some perceptions and behaviours vary according to the degree of interactivity in communication, but there is scant evidence that accuracy in deception detection is significantly influenced. This may be in part due to a difficulty in experimentally operationalising interpersonal deception theory, but also due to the small experimental effects often observed in deception detection studies. This generates the two research questions:

Does lie detection performance vary according to the degree of communication interactivity?

If some predictions from interpersonal deception theory are correct, then we would expect to find that detection of deception would be more accurate in a passive observational experimental context compared to a fully interactive experimental context under which recordings were made.

Are receivers more or less biased towards judging senders as honest in a passive context compared to an interactive context?

If the predictions from interpersonal deception theory and some evidence from previous studies are replicated, then we would expect to find that receivers are less biased towards judgements of honesty in a passive, observational context compared to a fully interactive experimental context.

The study reported in this chapter was not intended to test the influence of interactivity on the behaviour or perceptions of senders engaged in deception, rather to investigate whether it has influence on receivers' judgements of veracity. The judgments of veracity include tendencies to judge answers as truthful or deceptive and the accuracy of lie detection. A parallel aim of the study is that described earlier, to determine whether there are significant differences between receivers' judgements of recordings and receivers' judgements of live, synchronous messages. If significant differences are not identified, then we may use recordings as stimuli in further studies with more confidence that any findings are applicable to interactive contexts. Of course, finding no experimental effects does not mean that there is no effect of interaction, merely that this controlled study has not been able to demonstrate it.

8.2 Method and procedure

15 participants (i.e. a subset of the full set of participants) were recorded with digital audio and video during their participation in Experimental Study 1, where senders

could choose whether to answer questions honestly or dishonestly. The recordings were made as raw feeds from the audio-video conferencing equipment used at the time. The technical set-up has been described elsewhere in detail, but it consisted of a Tandberg 6000 conferencing system feeding a 29" CRT television with audio (G722 protocol) and 25 fps video (CIF quality H263 codec). Recordings were made of participants under all communication media conditions in Experimental Study 1, but it was only feasible to use audio-video (AV) and audio-only (AO) recordings in the current study, as recordings from the face-to-face interaction were not recorded with the same fidelity. Also, face-to-face recordings could not be replayed to participants except as audio-video, or some other media condition. The audio-video and audio-only recordings as far as possible, were replayed under the same technical and experimental conditions as recorded to a new set of receivers. That is, the recordings were replayed in the same rooms with the same furniture setup and audio-video equipment and hence appeared almost identical to the original presentation. The new set of fifteen participants was recruited from the staff and students at the University of Nottingham. Participants were presented with recordings of a single sender from Experimental Study 1 and were shown a still image of the sender who they were judging and asked to confirm that they were unacquainted.

Participants were instructed to watch and listen to some audio and audio-video clips of a person answering some questions. Their task was to decide whether they thought that they were telling the truth or not. Participants were told that the media clips were recorded in an experiment where the person answering questions gained points depending on whether their answers were believed by the questioner in the following way:

Told the truth and was believed: 2 points

Told the truth and was not believed: -2 points

Told a lie and was believed: 3 points

Told a lie and was not believed: -10 points

This was the same points scoring system that the recorded participants had used. They were informed that when the audio-video clips were recorded, participants could both see and hear each other, when the audio-only clips were recorded, participants could only hear one another.

The clips were replayed one at a time in the order that they were recorded. Participants were instructed to listen carefully to the question and answer in the recording. If they could not hear or understand the question, they were asked to indicate to the experimenter that they were having difficulties.

After each clip was played, participants judged whether they believed the answers given by completing the same answer sheet as receivers in Experimental Study 1. After each judgement, they then indicated when they were ready to hear the next question and answer.

Participants were instructed that their task was to get as many points as possible by identifying whether the other person was lying or telling the truth. They would achieve points in the following ways;

Correctly believe the other person when they are telling the truth: 2 points

Incorrectly believe someone when they were lying: -2 points

Incorrectly rate the other person as lying when they were telling the truth: -2 points

Correctly think the other person was lying: 2 points

Participants gained or lost points in the same manner as in the original experimental study. The instructions included the points scoring system from Experimental Study 1 to ensure that the context was as close as possible to the original interactive study. Participants were also motivated to succeed with their judgements of veracity with the promise of a prize for the person who gained the most points.

8.3 Results

To determine if interactivity had any effect on receiver judgements, it is necessary to use data from the subset of receivers in Experimental Study 1 to compare with the new participants. The study investigated discrimination accuracy and any response biases or tendencies to judge answers as either truthful or deceptive.

The tables and graphs below include both the lie detection and response bias results from the subset of receivers in Experimental Study 1 (interactive) and from the current study (non-interactive).

8.3.1 *Comparing the subset of interactive data with the data set from Experimental Study 1*

To ensure that the data from the subset of receivers in Experimental Study 1 did not significantly differ from those participants who were not used in the current study, independent samples t-tests were conducted to compare the signal detection measures in each media condition. No significant differences were found in the measure of response bias, c, in the audio-only condition, $t(39) = -0.93$, $p = .358$ and in the audio-video condition, $t(40) = -0.73$, $p = .470$. No significant differences were identified in detection accuracy, d' in the audio-only condition, $t(35) = 1.32$, $p = .200$ or in the audio-video condition, $t(39) = -0.41$, $p = .684$.

8.3.1.1 Response biases

The response bias, *c* is a measure of the tendency for receivers to respond with a true or false judgement. A value of 0 indicates no bias; a positive value indicates a tendency to judge the majority of messages as true, and a negative value, a tendency to judge the majority of messages as lies. Descriptive statistics for the response bias measure (*c*) are shown in Table 63.

Table 63

Receivers' Response Bias, c

Media Condition (N = 15)	Audio-Video		Audio-Only	
	Interactive	Non-Interactive	Interactive	Non-Interactive
M	**0.34**	**0.11**	**0.26**	**0.12**
SD	*0.54*	*0.52*	*0.39*	*0.46*

The results of receivers' response bias measures from the interactive and non-interactive studies are shown graphically in Figure 25.

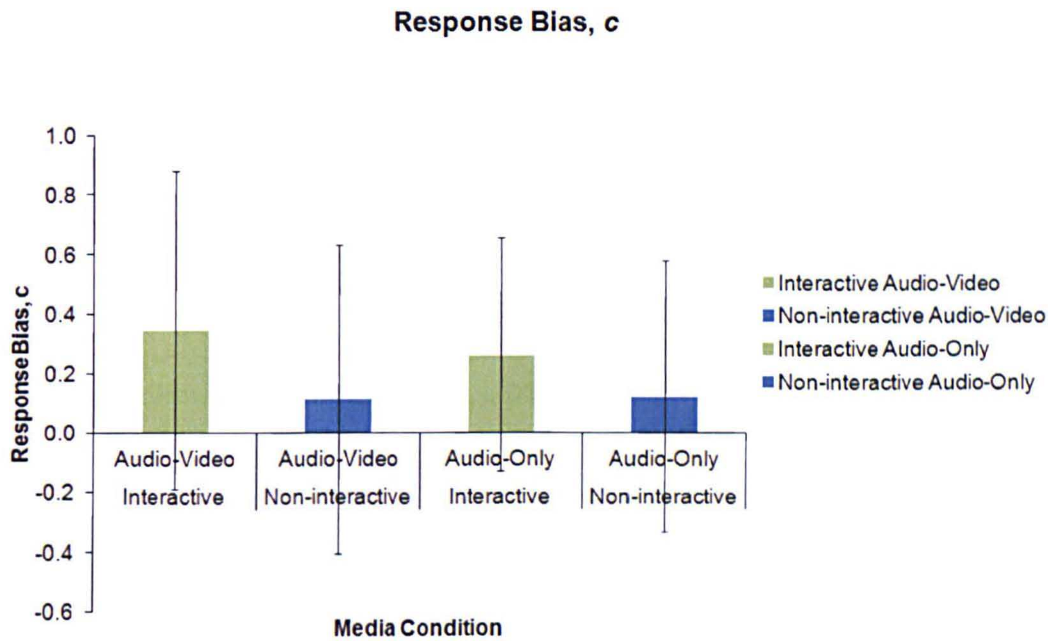


Figure 25 **Response Bias**

Paired sample t-tests were conducted to compare the response bias between audio-video and audio-only conditions in the interactive data set and the non-interactive data set. No significant differences between media conditions were identified in either the interactive data, $t(14) = -0.60$, $p = .560$ or in the non-interactive data set, $t(14) = 0.06$, $p = .955$.

Independent samples t-tests were performed to determine if interactivity had an effect on receivers' response bias. No significant differences were found in the measure of response bias, *c*, between the judgements of deception of the audio-only stimuli in the interactive and non-interactive conditions, t(28) = 0.91, p = .371 or of the audio-video stimuli, t(28) = 1.19, p = .244. The analyses identified no significant effect of interactivity on receivers' tendency to judge answers as truthful or deceptive.

8.3.2 *Detection of deception in the subset of interactive data*

Descriptive statistics for the measure of detection accuracy in the subset of data from the interactive first experimental study and the non-interactive third experimental study are shown in Table 64.

Table 64

Accuracy of Deception Detection, d'

Media Condition (N = 15)	Audio-Video		Audio-Only	
	Interactive	Non-Interactive	Interactive	Non-Interactive
M	**0.01**	**0.00**	**0.67**	**0.66**
SD	0.55	0.77	0.81	0.83

The results are shown graphically in Figure 26.

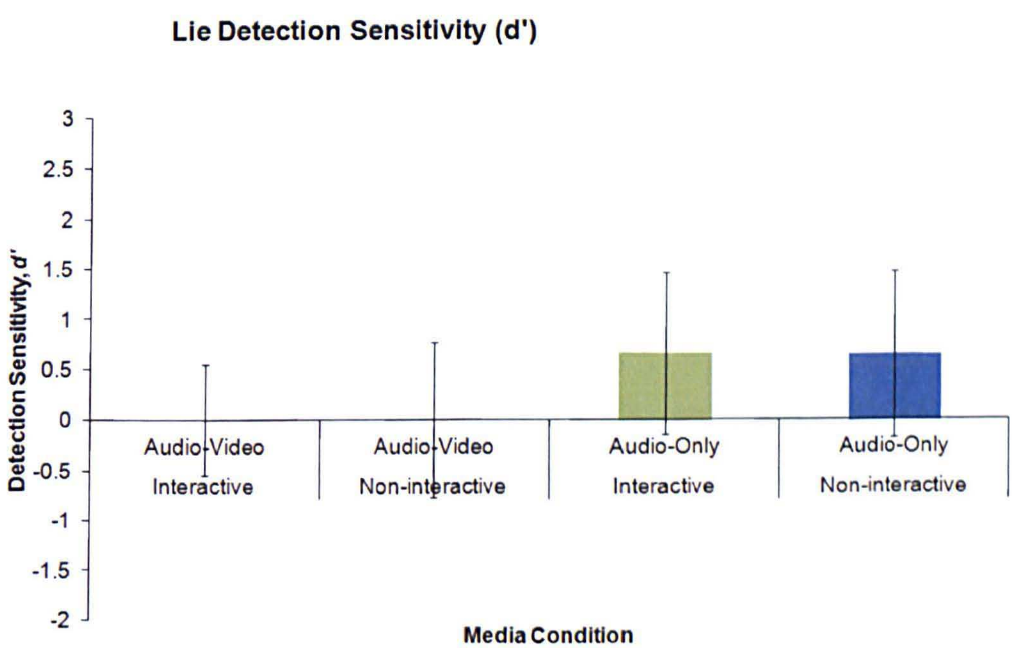


Figure 26 **Lie Detection Accuracy in Interactive and Non-interactive Studies**

8.3.3 *Comparing detection accuracy in non-interactive media conditions*

Although analyses suggested that the subset of data chosen from Experimental Study 1 was not significantly different to the data not used, further tests were conducted to allow comparisons between results found in the non-interactive data set. Bonferroni adjusted values of alpha were used (.05/2 = .025). In the subset of receiver data from Experimental Study 1, single sample t-tests indicated that detection accuracy as measured by d' was significantly better than 0 (which would indicate no sensitivity to the lie stimulus) in the audio-only condition, $t(14) = 3.18$, $p = .003$, 1-tailed. No significant difference from 0 was identified in the audio-video condition $t(14) = 0.04$, $p = .484$, 1-tailed.

The detection accuracy as measured by d' was compared between the audio-video and audio-only media conditions using paired sample t-tests. Unlike the original full data set, in the subset of data, lie detection was significantly better in the audio-only condition compared to the audio-video condition, $t(14) = 3.45$, $p = .002$, 1-tailed.

Analyses were conducted to investigate whether a similar pattern of results were found in the non-interactive study. Single sample t-tests were conducted to investigate whether detection accuracy was significantly better than would be expected if receivers had no sensitivity to the deception stimuli. Bonferroni adjusted values of alpha were used (.05/2 = .025). Detection accuracy, d' was found to be significantly better than 0 in the audio-only condition, $t(14) = 3.07$, $p = .004$, 1-tailed, but no significant difference from 0 was identified in the audio-video condition, $t(14) = 0.004$, $p = .50$, 1-tailed.

A paired sample t-test was conducted to determine if detection accuracy was greater in the audio-only condition compared to the audio-video condition. Results indicated that detection accuracy was significantly better in the audio-only condition, $t(14) = 2.20$, $p = .023$, 1-tailed. A similar pattern of significant and non significant test results were identified in the non-interactive data.

8.3.4 *Comparing interactive and non-interactive conditions*

Two independent samples t-tests indentified no significant differences between detection accuracy between the interactive study and in the non-interactive study for audio-video stimuli, $t(28) = 0.02$, $p = .984$ or for audio-only stimuli, $t(28) = .04$, $p = .968$. No evidence was found for an effect of interactivity on detection accuracy in either media condition.

8.4 Discussion

The first research question asked whether accuracy of lie detection would vary according to the degree of communication interactivity. We compared data from receivers judging deceptions produced by senders in a fully interactive experimental context with data from receivers who judged the same stimuli as recordings. Results indicated that there were no significant differences in detection accuracy when receivers judged answers in a non-interactive context compared to the judgements of receivers in the original, interactive context. Interpersonal deception theory suggested that receivers were likely to achieve lower detection accuracy in an interactive context because amongst other factors, senders are able to use feedback to modify their appearance and behaviour to appear more credible. It was also hypothesised that cognitive and behavioural effort is greater in a conversational context and so receivers have fewer resources to devote to detection (e.g. Burgoon et al., 2008). Hartwig et al. (2002) found no evidence for an effect of conversational involvement (interactive vs. non-interactive) on detection accuracy. The results presented here replicated this non-significant finding, we found limited evidence for interactivity or involvement in the conversation to have an effect on detection accuracy. Of course, finding a non-significant result does not mean that there is no effect of involvement or interactivity on deception detection. We did not find evidence for an effect, but in common with the previous experimental studies reported, results showed a high degree of variability. Variability in the detection measures from the non-interactive study did not appear to be less than those found in the interactive study. The poorer detection performance duplicated in the audio-video condition may suggest that even without interaction and thus any social or cognitive pressure to pay visual attention to each other or uphold a conversation, participants' attempts to discriminate lies from truths are being disrupted by the visual cues, or that they are not paying the same attention to the audio cues as receivers in audio-only conditions. An alternative explanation for this finding may be that there is significant variation in the behaviour of senders in different media conditions.

We also asked if receivers were more or less biased towards judging senders as honest in a passive context compared to an interactive context. We found no evidence for an effect of interactivity on the measure of receivers' tendency to judge answers as deceptive. Hartwig et al. (2002) suggest that an assumption of truthfulness is part of general conversational maxims; this should mean that receivers would be more biased towards judgements of honesty in an interactional, involved conversational context compared to a passive, non-interactional context. We replicated their finding of no significant differences in response biases between interactive and passive receivers.

8.5 Conclusions

The results from this study are positive in terms of using media recordings in further experimental studies. Lie detection appears to be as accurate regardless of whether the receivers are judging the veracity of recordings or participating in a live interaction with senders. The lack of significant effects of interactivity on response biases or detection accuracy suggest that we are justified in presenting recorded answers from senders to greater numbers of receivers in an attempt to reduce the effects of variability in response and detection measures. There is a range of other means by which we may address the problem of response variability between individual receivers. The two experimental studies reported in the next chapter were designed to further the development of a corpus of truthful and deceptive stimuli. The studies were designed to allow a large data set to be collected of receivers' veracity judgements of lies and truthful answers produced by two senders from Experimental Study 1.

9. Detection of Deception with Recordings of Single Senders: Experimental Studies 4 and 5

9.1 Introduction

The experimental studies described in the previous chapters have identified some effects of the medium of communication on both senders' and receivers' perceptions and behaviour. However, a high degree of variability in experimental results has also been observed. In an attempt to reduce the variability in receivers' judgements of veracity, some experimental design measures were taken. Variability in detection accuracy and response bias measures remained consistently high. There may be a number of possible sources for the variability in the detection metrics observed in Experimental Studies 1, 2 and 3, including: variability in sender behaviour e.g. expertise in deception, variability in senders' propensity to lie or tell the truth and variability in receiver detection expertise. Further experimental control was one motivation for developing a corpus of media recordings of senders answering questions both truthfully and deceptively. Constructing a corpus of media recordings to use as stimuli may allow experimental studies to be conducted with a greater degree of control than the live experiments allow. Using recordings as stimuli may reduce the variability in dependent variables as experimental studies can be designed with: control over the proportions of truthful and deceptive messages. This experimental design decision also makes it easier to collect larger data sets of receiver perceptions and behaviour which may also help to identify media effects by increasing the power of statistical analyses. A corpus of recordings also allows variability in sender behaviour to be controlled, which may also reduce variability in receivers' behaviour. Investigation into the effects of varying the information content and appearance of stimuli is also made possible with a corpus of sender recordings. The experimental studies reported in earlier chapters found some evidence that lies were less successfully detected in an audio-video condition compared to audio-only conditions. However, as discussed earlier, variability in the detection measures was problematic for statistical analyses. Experimental Studies 4 and 5 were designed to obtain measures of response bias and detection accuracy with lower variability by presenting video and audio recordings of lies and truthful stimuli from individual senders in Experimental Study 1 to a much larger set of receivers. The aims of Experimental Studies 4 and 5 were twofold: firstly, to investigate whether the limited evidence for media differences in detection accuracy would be supported by a larger set of receiver judgements, and secondly, to collect detection metrics from a large set of receiver judgements of individual sender statements in order to develop a corpus of truthful and deceptive stimuli which are somewhat reliably judged as truths or lies.

Response bias

The previously reported experimental studies found evidence for a response bias in receivers' judgements of veracity. In Experimental Studies 1 and 2, there was a significant tendency for receivers to judge answers as truthful in all media conditions, regardless of the actual veracity. There was evidence for a truth bias. Previous literature suggested that there might be a tendency for the truth bias to be more evident in visual media conditions, however no media differences were identified. There was no evidence found for a visual bias. The experimental design employed in the current study is intended to reduce variability in dependent measures compared to previous studies and any experimental effects may be more easily identified. Previously reported experimental results and the literature indicate that a truth bias is likely to be evident. Findings from previous research has been mixed, Mann et al. (2008) compared the response bias between video-only, audio-video and audio-only media conditions and reported a bias toward judging answers as lies in both visual conditions compared to audio-only. Burgoon et al. (2008) compared text-only, audio-video and audio-only conditions and reported evidence for a truth bias in all media conditions. They also found evidence that the truth bias was greatest when visual cues were present. These findings suggest the first two research questions:

Are receivers biased towards judging senders as more honest than dishonest?

Are receiver judgements more biased towards honesty or dishonesty when the sender can be seen and heard, compared to when only heard?

Results from previous experimental studies indicate that a truth bias may be found in receivers' judgements. If our results and those from previous literature such as Burgoon et al. (2008) are supported, we will expect to find a truth bias in all media conditions. We have not reported evidence for a visual truth bias, but if the results reported by Burgoon are supported, we may expect to find a visual truth bias. If the findings reported by Mann et al. (2008) are replicated, we may expect to find a bias towards judging answers as lies in the audio-video media condition. The results from both reported studies suggest that media differences will be identified.

Detection accuracy

The experimental studies previously reported some evidence for an influence of communication media condition on the accuracy of lie detection. In Experimental Study 2, the accuracy of detection was significantly better than would be expected by chance in both the face-to-face and audio-only conditions. Detection accuracy was not significantly better than would be achieved by chance in the audio-video condition. In the third experimental study where we compared the detection accuracy data between receivers in the interactive first study and passive observers, detection accuracy was significantly better in the audio-only condition compared to audio-video. This finding was identified in both the interactive and passive observer data sets. Comparisons between audio-video and audio-only in the literature are uncommon, however Kassin et al. (2005) reported evidence that judgments of truthful and false confessions were more accurate in an audio-only condition compared to an audio-video condition. Mann et al. (2008), in contrast, did not find evidence for a difference in detection accuracy between audio-video and audio-only conditions. These findings prompt the third research question:

Is the accuracy of deception detection lower in an audio-video media condition compared to audio-only?

If our previous findings and the results reported by Kassin et al. (2005) are supported, we may expect to find the detection accuracy lower in the audio-video condition compared to the audio-only condition.

Recordings of two senders from experimental study 1 were judged for veracity by receivers in the current study. Response bias and detection accuracy measures were collected for stimuli recorded in the audio-video and audio-only conditions. The response bias and detection metrics were compared between media conditions and between the two sets of sender stimuli. Detection metrics for individual answers given by senders were calculated and used to determine the selection of individual stimuli to form a corpus of stimuli to employ in further studies.

9.2 Method

9.2.1 *Participants*

Participants were recruited by emailing groups of students at the University of Nottingham through the Information Services student administration system, posting to local and national mailing lists and by asking people to forward on the survey URL to others they felt might be interested. Experimental Study 4 attracted 105 participants, Study 5, 65 participants.

9.2.2 *Materials*

Stimuli from Experimental Study 1 were used because the lies were unsolicited and naturalistic. Recorded answers from Experimental Study 1 participants ***LS*** and ***AM*** were used in Experimental Studies 4 and 5 respectively. These senders were chosen for a number of reasons: Only a subset of senders in Experimental Study 1 were recorded in all media conditions; both senders spoke clearly throughout their answers and consistently faced the camera squarely throughout audio-only communication conditions; each sender gave both truthful and deceptive answers in all media conditions. Stimuli from two senders were used in order to ensure that any significant findings would not be the result of idiosyncratic behaviour from a single sender.

Stimuli from the face-to-face condition were not used in this study. In Experimental Study 4, media recordings of sender ***LS*** giving answers in the audio-video and audio-only conditions were judged as truthful or deceptive by new participants. The stimuli consisted of ten audio-video recordings and ten audio-only recordings. There were three lies and seven truthful answers in each media condition.

Experimental Study 5 was identical in methodology to Experimental Study 4, except that the audio-video and audio-only media recordings were from a different individual sender, ***AM***. The decision to repeat the study with a different sender was in order to investigate whether sender characteristics impacted on response biases and accuracy of deception detection. The audio-video stimuli consisted of nine recordings (one recording was excluded from the study as sender ***AM*** admitted he was lying during his answer), with five lies and four truthful answers in this condition. The audio-only stimuli consisted of ten recordings, with four lies and six truthful answers.

A summary of the recordings and detection metrics[6] from Experimental Studies 1 and 3 are shown in Table 65.

Table 65

Summary of Results for Senders LS and AM

Study (sender)	Media condition	No. of lies told	No. of truthful answers	Study 1 detection accuracy (d')	Study 3 detection accuracy (d')
4 (***LS***)	Audio-Video	3	7	0.57	-0.17
	Audio-Only	3	7	1.85	0.48
5 (***AM***)	Audio-Video*	5	4	0.37	0.79
	Audio-Only	4	6	1.32	1.65

* 1 answer from ***AM***'s video condition data was excluded as the participant admitted to not telling the truth during his answer.

Although the detection metrics from Experimental Studies 1 and 3 are each from single receivers, they may indicate that the veracity judgements of two receivers were more accurate in the audio-only condition than the audio-video condition for both senders. The results also may indicate that there was high individual variability in receivers' performance.

Tables 66 and 67 show which questions were asked of the participants ***LS*** and ***AM*** (from the bank of 60 alternatives shown in the appendix). The column "Sender veracity" refers to whether ***LS*** or ***AM*** answered truthfully or with a lie. The column "Study 1 receivers % correct" shows the discrimination success of all participants who an-

[6] In both studies 1 and 3, the detection metrics reported are those calculated from single receivers

swered that particular question in experimental study 1. The questions used here were answered by participants in Experimental Study 1 between 16 and 22 times (they were allocated randomly).

Table 66

Results of Individual Questions Answered by Sender "*LS*"

	Audio-Video			Audio-Only		
Order of Questions asked	Question No.	Sender veracity	Study 1 receivers % correct	Question No.	Sender veracity	Study 1 receivers % correct
1	60	Truth	60.0	8	Truth	36.8
2	39	Truth	52.4	41	Truth	47.1
3	50	Truth	68.4	4	Truth	50.0
4	47	Lie	50.0	3	Lie	55.6
5	19	Truth	47.6	57	Truth	42.1
6	14	Lie	60.9	25	Truth	55.6
7	1	Truth	72.2	10	Lie	57.9
8	18	Truth	57.9	15	Lie	65.0
9	38	Truth	63.2	56	Truth	75.0
10	55	Lie	47.4	40	Truth	70.0
		M	58.0		*M*	55.5

Table 67

Results of Individual Questions Answered by Sender "*AM*"

	Audio-Video			Audio-Only		
Order of Questions asked	Question No.	Sender veracity	Study 1 receivers % correct	Question No.	Sender veracity	Study 1 receivers % correct
1	49	Truth	72.7	20	Lie	45.0
2	17	Truth	55.6	7	Truth	47.4
3	14	Lie	60.9	34	Truth	61.1
4	16	Truth	55.0	24	Truth	44.4
5				29	Truth	26.3
6	5	Lie	40.0	43	Lie	60.0
7	4	Lie	50.0	32	Truth	64.7
8	56	Truth	75.0	53	Lie	57.9
9	13	Lie	50.0	18	Truth	57.9
10	8	Lie	36.8	52	Lie	50.0
		M	55.1		***M***	51.5

A possible confounding factor for studies which may use these recordings is that questions may vary in their inherent deceptability and detectability. That is, particular questions may be easier (or more difficult) to answer with convincing deception than others. If participants ***LS*** and ***AM*** happened (through random allocation of questions) to get a large number of questions in one media condition that were rarely judged correctly in the original study, then this has the potential to bias results. If there are no significant differences in the proportion of correct judgements made in Experimental Study 1 between media conditions, then it may be possible to assume that such a bias is not present.

Questions that were answered untruthfully by ***LS*** or ***AM***, were judged correctly in Experimental Study 1 from 37-65% of the time. Questions that were answered truthfully by ***LS*** or ***AM***, were judged correctly by participants in Experimental Study 1 26-75% of the time. Analyses of the frequencies of correct and incorrect judgements of each question were discussed more fully in Chapter 6.

Two independent samples t-tests were performed to determine if there were significant differences in the judgement accuracy of the questions asked of each sender ***LS*** and ***AM***. The tests compared media condition in the percentage of correct judgements achieved for each question from the full data set of sender responses in experimental study 1. No significant differences in the judgement accuracy between questions answered in the audio-video and audio-only conditions were identified for either sender ***LS***, $t(18) = 0.53$, $p = .603$, or ***AM*** $t(17) = 0.65$, $p = .524$.

As no significant differences were found between media conditions in the judgement accuracy of all receivers who answered the questions asked of the senders ***LS*** and ***AM*** in Experimental Study 1, it may suggest that any differences found in classification accuracy between media conditions in Experimental Studies 4 and 5 are unlikely to be due to the media recordings consisting of questions that were exceptionally likely to be judged correctly or incorrectly.

9.2.2.1 Procedure

To collect a larger data set of receiver responses, the media recordings were presented to new participants using an online survey website. Original recordings were converted from DV AVI (720x576, 1536kbps bit rate) format to Microsoft Windows Media Video format (384x288, 569Kbps bit rate). Audio-only media recordings were encoded with "clip playing" text on a black background until they finished playing, when "clip ended" was displayed. In the survey introduction, participants were informed that "***The people in the clips were playing a game where they could decide to answer questions truthfully or not. They won points on each question if they were believed after they had told the truth, or escaped detection if they had told a lie. If they were detected lying, then they lost more points than if they weren't believed telling the truth. They were free to lie sometimes, always or not at all***". Recordings were then presented one at a time in the order that they were recorded. Each media recording was embedded in an individual survey page. After each recording had finished playing, participants were asked "***Do you think the answer this person gave was true or false?***" and had to check a box with either "true" or "false" before they could continue to the next page. There was nothing to stop participants replaying the recording; however, they were asked not to unless it had not played correctly the first time. The study existed as two versions. One version presented the audio-only recordings first, followed by audio-video recordings and the second version reversed the order of presentation to control for order effects. The number of participants who had completed each survey version was tracked to ensure that participants were split approximately 50/50 between versions in each study.

9.3 Results from Experimental Studies 4 and 5

The statistics used to assess the accuracy of lie detection are the same as used in previous studies. Measures used are the proportion of the lies that are correctly identified (hits), lies wrongly classified as true (misses), truths wrongly classified as lies (false alarms) and percentage of the answers that are classified as lies (whether correct or incorrect). The derived signal detection theory (SDT) measures used are d', the measure of detection sensitivity (varying from $-\infty$ to $+\infty$ where 0 no sensitivity to the stimulus) and *c*, the response bias. The response bias, *c*, is a measure of the participant's tendency to classify answers as true or false. Values range from -1 to +1 with a neutral response bias equalling 0). Values of less than 0 signify a tendency to judge answers as lies, values greater than 0 indicate a tendency to judge answers as truthful.

9.3.1 *Receiver perceptions (response bias)*

The perceptions of receivers may be reflected in the frequencies of answers which are judged as lies and consequently the response bias. Descriptive statistics from Experimental Studies 4 and 5 are shown in Tables 68 and 69.

Table 68

Tendency to Judge Answers as Deceptive - Response Bias for LS recordings

Media condition (N = 104)	**Audio-video**		**Audio-only**	
	M	*SD*	*M*	*SD*
c	**0.24**	0.36	**0.06**	0.33

A paired samples t-test was performed to determine if the media condition had an effect on the response bias of receivers. Results indicated that the response bias was significantly more positive than in the audio-video condition compared to audio-only, $t(103) = 4.02, p < .001$.

Single sample t-tests were conducted determine if values were significantly greater than 0, which would indicate no response bias. Bonferroni adjusted values of .025 were used (0.05/2). The tests indicated that the response bias was significantly greater than 0 in the audio-video condition, $t(104) = 6.96$, $p < .001$, 1-tailed. The response bias was not identified to be significantly greater than 0 in the audio-only condition, $t(104) = 1.94$, $p = .028$, 1-tailed. Results indicated that the tendency to judge answers as truthful was greater in the audio-video condition than in the audio-only condition. Only in the audio-video condition were participants more likely to judge answers as truthful than as deceptive.

Table 69

Tendency to Judge Answers as Deceptive - Response Bias for Sender AM Recordings

Media condition (N = 65)	**Audio-video**		**Audio-only**	
	M	***SD***	***M***	***SD***
c	0.28	0.40	0.25	0.36

A paired samples t-test indicated that there was no significant difference in the tendency to judge answers as honest between the media conditions, $t(64) = 0.51$, $p = .612$.

Single sample t-tests were conducted to determine if values of c were significantly greater than 0 (which would indicate no response bias). Bonferroni adjusted values of .025 were used (0.05/2). The tests indicated that there was a significant tendency to judge answers as honest in both the audio-video condition, $t(64) = 5.67$, $p < .001$, 1-tailed and in the audio-only condition, $t(64) = 5.62$, $p < .001$, 1-tailed.

Results indicated that there was no significant difference between media conditions in the bias towards judging answers as honest or deceptive. However, in both media conditions, receivers were more likely to judge answers as truthful rather than deceptive.

9.3.1.1 Comparing response bias between single senders

We investigated whether the response bias was different between the studies, that is, between the stimuli from the single senders. Two one-way ANOVA with a Bonferroni corrected alpha of .025 (.05/2) were performed comparing the response bias between the studies in the audio-video and audio-only conditions. The response bias was significantly more positive with the audio-only stimuli from the ***AM*** sender compared to the ***LS*** sender, $F(1, 167) = 12.25$, $p = .001$. No significant difference was identified between studies in the audio-video condition, $F(1, 167) = 0.46$, $p = .500$. The results show that receivers' response bias varies according to the sender stimuli.

9.3.2 *Receiver behaviour (detection accuracy)*

Descriptive statistics from Experimental Study 4, which used recordings from sender ***LS*** are shown in Table 70.

Table 70

Detection Accuracy for Sender LS Recordings

Media condition ($N = 104$)	**Audio-Video**		**Audio-Only**	
	M	*SD*	*M*	*SD*
Proportion of hits	**0.42**	0.25	**0.68**	0.26
Proportion of misses	**0.58**	0.25	**0.32**	0.26
Proportion of false alarms	**0.37**	0.16	**0.29**	0.17
Proportion of correct rejections	**0.62**	0.16	**0.68**	0.15
d'	**0.14**	0.65	**0.93**	0.84

Paired samples t-tests indicated that the proportion of lies, p(hit) correctly identified in the audio-only condition was significantly greater than in the audio-video condition, $t(103) = -7.31$, $p < .001$, 1-tailed.

A paired samples t-test indicated that the accuracy of lie detection was significantly greater in the audio-only condition compared to audio-only, $t(103) = -7.86$, $p < .001$, 1-tailed. Results indicated that participants were significantly less successful at detecting lies in the audio-video condition compared to the audio-only condition.

Two single sample t-tests were performed to determine if detection accuracy was significantly better than 0, the value that would be expected if receivers are not sensitive to the deception stimulus. Bonferroni adjusted values of .025 were used (0.05/2). Test results indicate that participants achieved scores significantly greater than 0 in both the audio-only, $t(103) = 11.29, p < .001$, 1-tailed) and audio-video conditions , $t(103) = 2.23, p = .014$, 1-tailed. Results indicated that participants were more successful at detecting deception in both media conditions than would have been expected if they were judging veracity by guessing. However, detection was significantly less accurate in the audio-video condition.

Table 71

Detection Accuracy for Sender AM Recordings

Media condition (N = 65)	**Audio-Video**		**Audio-Only**	
	M	*SD*	*M*	*SD*
Proportion of hits	**0.35**	0.21	**0.39**	0.23
Proportion of misses	**0.64**	0.22	**0.60**	0.22
Proportion of false alarms	**0.41**	0.23	**0.39**	0.19
d'	**-0.15**	0.73	**0.02**	0.69

Paired samples t-tests indicated that the proportion of lies correctly identified, p(hit) in the audio-only condition was not significantly greater than in the audio-video condition, $t(64) = -1.05, p = .149$, 1-tailed.

A paired samples t-test indicated that the accuracy of lie detection was not significantly greater in the audio-only condition compared to audio-video, $t(64) = -1.34, p = .092$, 1-tailed. Results indicated that participants were not significantly more successful at detecting lies in the audio-only condition compared to the audio-video condition.

Two single sample t-tests were performed to determine if detection accuracy was significantly different from 0, the value that would be expected if receivers are not sensitive to the deception stimulus. Bonferroni adjusted values of .025 were used (0.05/2). Test results indicate that participants did not achieve scores significantly greater than 0 in the audio-only condition, $t(64) = 0.20, p = .421$, 1-tailed, and participants in the audio-video condition did not achieve scores significantly less than 0, $t(64) = -1.65, p = .052$, 1-tailed. Results indicated that participants were not more successful at detecting deception in either media conditions than would have been expected if they were judging veracity by guessing. Accuracy of detection did not appear to be significantly different between the media conditions.

9.3.2.1 *Comparing results of detection accuracy between senders*

Two independent samples t-tests were used to investigate whether the lie detection accuracy from receivers in Experimental Study 4 was significantly different from those in Experimental Study 5. Bonferroni adjusted alpha values of .025 were used (0.05/2). The first t-test compared detection accuracy (d') between audio-video recordings in the two studies and identified that accuracy was significantly greater for sender ***LS*** compared to ***AM***, $t(167) = 2.70$, $p = .004$, 1-tailed. The second t-test compared audio-only detection accuracy between the studies and found that accuracy was significantly greater for sender ***LS*** recordings than for ***AM*** recordings, $t(167) = 7.34$, $p < .001$ 1-tailed

9.3.2.2 *Individual variability in detection accuracy*

It was hypothesised that the design of the current studies might reduce the variability in dependent variables by increasing the number of receivers who were judging the veracity of a small set of recording of answers from only a single sender. Was variability in receivers' responses reduced?

In Experimental Study 2, values for d' in the face-to-face condition ranged from -1.31 to 2.04 ($M = 0.48$, $SD = 0.77$). Values in the audio-video condition ranged from -1.64 to 2.68 ($M = 0.28$, $SD = 0.96$). Values ranged from -0.99 to 2.68 ($M = 0.33$, $SD = 0.91$) in the audio-only condition. In Experimental Study 4 with stimuli from sender ***LS***, detection accuracy scores (d') ranged from -1.64 to 2.68 ($M = 0.93$, $SD = 0.84$) in the audio-only condition. In the audio-video condition, scores ranged from -1.31 to 1.64 ($M = 0.14$, $SD = 0.65$). In Experimental Study 5 with stimuli from sender ***AM***, in the audio-only condition, participants' detection accuracy scores ranged from -1.65 to 1.47 (M = 0.02, SD = 0.69). In the audio-video condition, scores ranged from -1.96 to 1.20 ($M = -0.15$, $SD = 0.73$).

To determine if variance in detection accuracy scores differed between studies, six Levene's tests of homogeneity of variance tests were conducted. Bonferroni corrected values for alpha of 0.008 were used (0.05/6). The first pair of tests compared the variance in d' scores between Experimental Studies 2 and 4 for the audio-video and audio-only scores. A significant difference between variances was identified between the studies in the audio-video condition, $F(1, 157) = 11.12$, $p = .001$. No significant differences in variance were identified between studies in the audio-only condition, $F(1, 157) = 1.45$, $p = .230$.

The second pair of tests compared the variance in d' scores between Experimental Studies 2 and 5 for the audio-video and audio-only scores. No significant differences in variance were identified between the studies in the audio-video condition, $F(1, 118) = 4.80$, $p = .030$ or in the audio-only condition, $F(1, 118) = 7.21$, $p = .008$.

The third pair of tests compared the variance in d' scores between Experimental Studies 4 and 5 for the audio-video and audio-only scores. No significant differences in variance were identified between the studies in the audio-video condition, $F(1, 167) = 0.64$, $p = .425$ or between studies in the audio-only condition, $F(1, 167) = 2.69$, $p = .103$.

There was little evidence that the variance in detection accuracy scores was significantly reduced when larger number of participants judged recorded answers of single senders. The lack of a consistent significant reduction in the variance in judgement accuracy suggests that a different approach may be required for analyses.

As has been noted, in signal detection analyses, low and negative values for d' can result from a number of sources. These may include receivers being confused with the task requirements or judging more truthful answers as lies than correctly identifying deceptions. In the lie detection context, negative scores may suggest that participants are unable identify deceptions. An alternative explanation may be that senders appear to be dishonest when they are telling the truth more often than when they deceive. In Experimental Study 2, approximately 30-40% of receivers in each media condition achieved negative scores. The other 60-70% of receivers in each condition achieved positive scores. In the audio-only condition of Experimental Study 4, 13% of receivers achieved negative values for detection accuracy. In the audio-video condition, 40% of the participants achieved negative scores for detection accuracy. In Experimental Study 5, 42% of receivers achieved negative values for detection accuracy in the audio-only condition. In the audio-video condition, 57% of the participants achieved negative scores for detection accuracy.

One method by which the variability in scores may be reduced for statistical analyses is the median split. This method may allow media effects to be identified by excluding participants who performed poorly at detection. It is proposed to conduct a median split of the detection accuracy data in each media condition and conduct analyses using only the high scoring participants. Any participants who achieved a score of exactly the median value were included in the high scoring group.

Descriptive statistics for detection accuracy in Experimental Studies 4 and 5 are shown in Tables 72 and 73 with the full data set and the spilt data set with low scoring participants excluded.

Table 72

Detection Accuracy for Sender LS recordings

Media condition	**Audio-Video**		**Audio-Only**	
	M	*SD*	*M*	*SD*
d' ($N = 104$)	**0.14**	0.65	**0.93**	0.84
d' ($N = 42$)	**0.61**	0.42	**1.33**	0.55

Two Levene's tests of homogeneity of variance tests were conducted in order to determine if variance in detection accuracy scores was reduced by excluding negative scoring participants. Bonferroni corrected values for alpha of 0.025 were used (0.05/2). A significant difference in variance was identified between the two audio-video data sets, $F(1, 160) = 13.68$, $p < .001$, and also the two audio-only data sets, $F(1, 163) = 8.03$, $p = .005$.

A paired samples t-test was performed to determine whether the accuracy of deception detection accuracy was greater in the audio-only media condition compared to audio-only when only high scoring participants were included in the analysis. A significant effect of media condition on the accuracy of detection was identified, $t(41) = -6.58$, $p < .001$, 1-tailed.

Table 73

Detection Accuracy for Sender AM recordings

Media condition	Audio-Video		Audio-Only	
	M	*SD*	*M*	*SD*
d' (N = 65)	**-0.15**	0.73	**0.02**	0.69
d' (N = 21)	**0.34**	0.34	**0.46**	0.39

Two Levene's tests of homogeneity of variance tests were conducted in order to determine if variance in detection accuracy scores was reduced by excluding low scoring participants. Bonferroni corrected values for alpha of 0.025 were used (0.05/2). A significant difference in variance was identified between the two audio-video data sets, $F(1, 98) = 10.75$, $p = .001$ and between the two audio-only data sets, $F(1, 101) = 7.28$, $p = .008$.

A paired samples t-test was performed to determine whether the accuracy of deception detection accuracy was greater in the audio-only media condition compared to audio-only when low-scoring participants were excluded from the analysis. No significant effect of media condition on the accuracy of detection was identified, $t(20) = -1.02$, $p = .160$, 1-tailed.

The tests of homogeneity of variance indicated that variance could be significantly reduced by excluding low scoring participants. The reduction in variance was significant in all media comparisons. The purpose of excluding low scoring participants was to improve the sensitivity of tests comparing the accuracy of detection in different media condition. To test whether the sensitivity has been increased, detection accuracy scores in the media conditions were compared using the subset of data from each study. The t value produced by the paired samples t-tests of Experimental Study 4 data reduced from -7.31 to -6.58 when participant data were excluded, and with Experimental Study 5 participant data excluded, t values showed a decrease from -1.05 to -1.02. These findings indicate that the method has value and will be employed for analysis of data reported in later chapters.

9.3.2.3 Analyses of individual question recordings

Descriptive statistics from receivers' judgments of the recordings used in Experimental Studies 4 and 5 are shown in Tables 74 and 75. It is not possible to calculate all signal detection measures because each receiver's judgements of individual recordings can only generate data for hits and misses, that is, the proportion of the judgements that are correct and incorrect. Questions which were answered with deception by senders are shaded.

Table 74

Descriptive Statistics for Each Media Recording of Sender LS

Question No.	Audio-Video Truth/ Lie	Audio-Video Proportion of hits N	*M*	*SD*	Audio-Only Truth/ Lie	Audio-Only Proportion of hits N	*M*	*SD*
1	Truth	101	**0.58**	0.50	Truth	104	**0.65**	0.48
2	Truth	101	**0.81**	0.39	Truth	104	**0.51**	0.50
3	Truth	104	**0.38**	0.49	Truth	104	**0.54**	0.50
4	Lie	104	**0.13**	0.33	Lie	104	**0.45**	0.50
5	Truth	104	**0.50**	0.50	Truth	104	**0.79**	0.41
6	Lie	104	**0.60**	0.49	Truth	104	**0.81**	0.40
7	Truth	104	**0.62**	0.49	Lie	104	**0.78**	0.42
8	Truth	104	**0.68**	0.47	Lie	104	**0.82**	0.39
9	Truth	104	**0.85**	0.36	Truth	104	**0.93**	0.25
10	Lie	104	**0.55**	0.50	Truth	104	**0.72**	0.45

Table 75

Descriptive Statistics for Each Media Recording of Sender AM

	Audio-Video				Audio-Only			
Question No.	Truth/ Lie	Proportion of hits			Truth /Lie	Proportion of hits		
		N	*M*	*SD*		N	*M*	*SD*
1	Truth	64	**0.59**	0.50	Lie	64	**0.52**	0.50
2	Truth	64	**0.61**	0.49	Truth	64	**0.81**	0.40
3	Lie	64	**0.44**	0.50	Truth	64	**0.94**	0.25
4	Truth	64	**0.61**	0.49	Truth	64	**0.65**	0.48
5					Truth	64	**0.65**	0.48
6	Lie	64	**0.52**	0.50	Lie	63	**0.13**	0.34
7	Lie	64	**0.02**	0.13	Truth	64	**0.21**	0.41
8	Truth	64	**0.55**	0.50	Lie	64	**0.49**	0.50
9	Lie	63	**0.57**	0.50	Truth	64	**0.33**	0.48
10	Lie	64	**0.23**	0.43	Lie	64	**0.43**	0.50

The individual recording statistics showed a large variation in the detection accuracy for both truthful answers and lies. The proportion of correct judgements for lies ranged from 0.02 to 0.82, that is, ranging from almost completely believed (deception missed) to almost 100% correct detection (hits). The proportion of correctly identified truthful answers ranged from 0.21 to 0.93.

9.4 Discussion

This chapter reported studies in which recordings from two senders' truthful and deceptive answers were used as stimuli and judged for veracity by participants. The studies were identical in design and differed only in the stimuli set which was each from a single sender recorded giving answers in Experimental Study 1. The senders were identified as ***LS*** and ***AM***. Single senders were judged by a set of receivers via an Internet based survey system. Receivers were presented with stimuli in the order and mode of presentation that they had been recorded, either in an audio-video condition, or audio-only condition. Receivers judged the veracity of each recording allowing signal detection measures of response bias, *c*, and detection sensitivity, *d'* to be calculated. The experimental design was intended to reduce the variability in dependent measures that had been observed in previous experimental studies.

Response bias

The first research question asked whether receivers had a significant bias toward judging stimuli as truthful. For sender ***LS***, the proportion of truthful to deceptive answers was the same between media conditions, however, receivers showed a significant tendency to judge stimuli as truthful in the audio-video condition, there was a truth bias. No such truth bias was observed in the audio-only condition. The response bias was greater in the audio-video condition compared to audio-only stimuli. For sender ***AM***, there was a significant truth bias identified in both media conditions, there was however, no significant difference between the conditions. Unlike sender ***LS***, the number of truthful to deceptive answers was not consistent in sender ***AM*** stimuli. The results replicate the truth bias found in the previous experimental studies in all but one media condition. In the majority of conditions the results support the finding frequently reported in the literature of a truth bias (e.g. Burgoon et al., 2008). For the stimuli from sender ***LS***, a visual truth bias was identified, which also supporting the findings of Burgoon et al. (2008). We found no evidence for a lie bias in the visual media condition as reported by Mann et al. (2008). The response bias was compared between the studies and was found to be significantly more positive with the audio-only stimuli from the ***AM*** sender compared to the ***LS*** sender. No significant difference was identified between studies in the audio-video condition. The results indicate that receivers' response bias varies according to the sender stimuli. We may speculate on a number of possible explanations for this finding. Other biases may influence the tendency for receivers to judge stimuli as truthful, such as the demeanour bias where individual senders may be judged consistently truthful or deceptive regardless of their actual veracity. Receivers' responses may also be influenced by an expectancy violations bias, where there is a tendency to judge unusual behaviour as deceptive (Burgoon et al., 2008). This bias may affect receivers differentially according to the media condition. Boyle and Ruppel (2005) argue that richer media may provide inconsistent cues and therefore lead to greater suspicion. Such a bias could also conceivably vary between senders if the behaviour judged to be deceptive or truthful is specific to behaviours only shown by some individuals. There may also be a number of other factors, such as the specific content of answers in some media conditions which have influenced the tendency to judge stimuli as deceptive in these studies which are independent of response biases.

Detection accuracy

The third research question asked if detection accuracy would be lower for audio-video compared to audio-only stimuli. Although there is clearly variability, there was evidence that the accuracy of lie detection varied between the media conditions. Lie detection was less accurate for audio-video stimuli than audio-only for the stimuli from sender ***LS***. These results are consistent with the media differences reported by Kassin et al. (2005). There was no significant difference between media condition for the stimuli from sender ***AM***. The evidence that detection accuracy was lower for audio-video stimuli was consistent with previous experimental results. However, observing variability in results was also consistent with previous studies. Detection accuracy of sender ***LS*** was significantly better than would be expected by chance in both media condition, but accuracy was significantly higher in the audio-only condition which was also the condition where receivers did not appear to be biased toward judging answers as truthful. Accuracy of detection for the ***LS*** stimuli set in Experimental Study 4 was better than found for the ***AM*** set in Experimental Study 5, where accuracy was not better than would be expected if receivers were making judgements by guessing. The lack of media differences in detection accuracy found with sender ***AM*** are consistent with the results reported by Mann et al. (2008).

The studies produced inconsistent results. Clearly, there may be a range of factors which may have lead to this inconsistency, so at this stage we may only speculate. Where media differences were observed, this may be due to senders behaving differently when they believe themselves to be visible or not, or perhaps due to receivers' ability to discriminate lies from truths being disrupted by the visual information present in the audio-visual media recordings. In the former case, perhaps senders attempt to manage their appearance to a greater extent when they are visible, or behave differently from when they are not visible. There was evidence that detection accuracy was highest in the media condition where receivers were not biased toward judging answers as truthful. Perhaps a higher degree of suspicion from receivers results in greater accuracy of lie detection. The differences observed in the response bias and detection accuracy between senders' stimuli might suggest that the behaviour of senders is an important factor.

The variability in receivers' judgements observed in earlier studies was not significantly reduced by the experimental design modification where single senders were judged by sets of receivers. In a further attempt to reduce variance, data sets were median split and were analysed excluding the low performing participants. This strategy was successful in reducing variability and will be employed for analysis of data sets in future. The detection metrics for individual sender answers were calculated and showed high variability in how frequently they were believed. The next chapter outlines the methodology used to select recordings to be used as stimuli in further studies. Further studies are reported which were designed to investigate the effect of changing the mode that stimuli are presented as, on receivers' response bias and detection accuracy.

9.5 Conclusions

Two studies were reported where receivers judged single senders. Some evidence was found for media differences in response bias and detection accuracy, but results were inconsistent. The deceptive stimuli from one sender were detected with greater accuracy than the other sender, who appeared to escape significant detection in both media conditions. Results for one sender supported the findings of media differences reported in the literature. Variance in receivers' judgements were not reduced by the change in experimental design compared to previous experimental studies, and it was argued that a median split would be used for further data analyses as it reduced variance.

10. The Effects of Adding and Removing Visual Information From Stimuli on Response Biases and Detection of Deception: Experimental Study 6

10.1 Introduction

The previous chapter reported findings from two studies which investigated the response bias and detection accuracy for lies told by individual senders in an audio-only and an audio-video media condition. The results were equivocal, but there was evidence that for one sender, receivers' detection accuracy was significantly greater for audio-only recorded stimuli. The greater audio-only detection accuracy was identified for a set of audio-only stimuli which also showed no response bias from receivers. In addition to investigating the veracity judgements made of stimuli recorded in different media conditions, a significant aim of the studies reported in the previous chapter was to collect detection metrics for individual answers from senders which could be used to form a corpus of stimuli. The current chapter outlines the methodology used to select stimuli for a further study. The study described in this chapter was designed to investigate whether the addition or removal of visual cues from stimuli would have an effect on the tendency to judge stimuli as truthful or deceptive and the accuracy of those judgements. The study was designed to separate some effects of the media condition in which receivers judge senders from the condition that senders communicated with.

Before describing the study in detail, the findings from previous experimental studies and relevant literature which generate some research questions the study aims to address are reviewed.

Response bias

Experimental Study 4 reported in the preceding chapter found some evidence for a visual truth bias. That is, for the audio-video stimuli there was a greater tendency to judge senders as truthful compared to the audio-only stimuli. Burgoon et al. (2008) argue that visual cues are used strategically by deceivers to foster mutuality and to appear honest which increases the tendency to judge senders as truthful. In contrast, non visual media afford fewer channels for deceivers to manipulate and fewer cues for receivers to focus upon. If visual cues are used strategically by senders in an attempt to reduce the suspicion of receivers, then removing them from stimuli recorded in audio-video condition might be expected to reduce any truth bias. This generates the first research question

If senders use visual cues to reduce suspicion in receivers, does the removal of visual cues from audio-visual stimuli reduce the truth bias?

If visual cues are used strategically by senders to reduce suspicion, then their removal from audio-video stimuli may be expected to reduce a truth bias in receivers' judgements.

Also, if visual cues are used strategically by senders in visual media conditions to foster trust, then in the original audio-only communication, senders would not be expected to manage their visual behaviour for strategic goals. This suggests the second research question:

Does the addition of the non-strategic visual cues, not transmitted in the original audio-only communication context have an effect on receivers' tendency to judge senders as honest?

If the tendency to judge senders as honest or dishonest is affected by strategic visual cues, then adding non-strategic visual cues to audio-only stimuli may be expected to have no effect on receivers' response bias. It has been argued that the presence of incongruous or unusual behaviour may lead to judgements of deception, the expectancy violations bias (Burgoon et al., 2008). The non-strategic visual cues generated by senders in an audio-only condition may conceivably be incongruent with the audio content (as they knew it was not being transmitted in the original context). If this is the case, then we might expect to find that the addition of these visual cues leads to a reduction in truth bias.

Detection accuracy

In previous experimental studies, we found evidence that detection accuracy was lower in audio-video conditions compared to audio-only. For example, in Experimental Study 4, we found that detection accuracy was greater in the audio-only condition compared to audio-video stimuli. There have been a number of studies which have suggested reasons why detection of deception might be reduced in visual media conditions. There is evidence that a general expectation exists that deception is revealed through visual cues (e.g. Taylor & Hick, 2007). However, the more that visual cues to deception are focused upon, the lower the detection accuracy appears to be (Mann et al., 2002). The classification of lies and truths has been reported to be most successful when using tone of voice (Zuckerman et al., 1982a). A number of studies have reported that detection success is lower in video-only conditions compared to audio-video and audio-only (e.g. Heinrich and Borkenau, 1998; Mann et al., 2008). These studies suggest that visual cues do not necessarily assist lie detection. Some research has suggested that the visual cues distract receivers from attending to the verbal cues which are more diagnostic of deception. Stiff et al. (1989) examined this distraction hypothesis and found little evidence to support it. However the studies reported did not use real deception as stimuli, the interactions were tightly scripted rather than natural discourse. Krauss et al. (1976, cited in Zuckerman 1979) reported that facial expression tended to give away deception, but only when senders were not aware of being watched. These results indicate that there may be a bias toward attending to visual cues. However, these cues may increase accuracy of detection under some circumstances and reduce it under others. If visual cues are diagnostic of deception then attending to them is likely to increase accuracy. In an audio-video media condition, senders may be managing their visual appearance (Buller and Burgoon, 1994; Burgoon and Buller, 2004); Burgoon et al. (2008) argue that this strategic communication is synonymous with the demeanour bias and senders will attempt to manage their appearance with non-verbal cues to appear honest. These findings suggest the third research question:

If receivers use managed, distracting or non-diagnostic visual cues to judge deception in senders, does the removal of visual cues from audio-visual stimuli increase detection accuracy?

If receivers are distracted by visual cues which do not assist lie detection, or they are distracted by visual cues and do not pay as much attention to diagnostic audio cues, then the removal of such cues from audio-video stimuli may be expected to result in improved detection accuracy.

Does the addition of the non-strategic visual cues, un-transmitted in the original audio-only communication context have an effect on receivers' accuracy of lie detection?

If the findings of Krauss et al. (1976, cited in Zuckerman 1979) are supported, then detection accuracy may be expected to improve when diagnostic visual cues are revealed in previously audio-only communication. If the distraction hypothesis is supported, then we may expect to see detection accuracy reduced when visual cues are added to audio-only stimuli. If detection accuracy remains unchanged regardless of presentation mode, this may suggest that the demeanour bias is not influenced by visual cues.

Experimental Study 6 attempted to provide answers to these questions by presenting a subset of the same stimuli sets which were used in Experimental Studies 4 and 5 and either adding video (recorded at source) to audio-only recordings or removing video from audiovisual media recordings. Receivers were tasked with judging the honesty of the media clips in their new form.

10.2 Method

10.2.1 *Participants*

Participants were recruited through bulk emailing students and staff at the University of Nottingham and advertising through various social media websites. The advertisement stated that a study was taking place investigating honesty and deception and potential participants were directed to an online service which hosted the study. 140 people took part in the study.

10.2.2 *Materials and procedure*

10.2.2.1 Selecting recordings of single answers for use as stimuli

A stimuli set consisting of eight lies and twelve truthful answers was developed. Ten stimuli were chosen from each of two senders, ***LS*** and ***AM***, who were recorded giving answers in Experimental Study 1. Five audio-video and five audio-only recordings were chosen from each sender, with two lies and three truths from each media condition. Experimental Studies 4 and 5 used the recordings of answers which ***LS*** and ***AM*** gave in the audio-video and audio-only media conditions. Each gave ten answers in each media condition (although one recording was excluded because the sender admitted lying in his answer).

We argue that in order to test the effect of changing the mode of presentation of deceptive and truthful stimuli, it is be important to use stimuli which were reliably judged as deceptive or truthful. That is, to use stimuli which are reliably over the threshold of detectability. The effect of changing the mode of presentation may be predicted to reduce or increase detection accuracy. Stimuli which are consistently judged correctly at very high levels may show ceiling effects. Stimuli which are judged correctly at no better than chance levels may not be discriminable under any condition. If stimuli are not discriminable, the mode of media presentation may not be expected to have an effect on detection accuracy. An important aim of Experimental Studies 4 and 5 was to collect data to facilitate the identification of single truthful and deceptive answers that were judged correctly by a high proportion, but not 100% of receivers. In order to identify such recordings, we analysed receivers' judgements of individual recordings in each study. For an individual stimulus to be significantly discriminable (using a yes/no choice, Chi-squared test and alpha of .05) approximately 60% of judgements must be correct in a study with 100 participants. We had a limited choice of stimuli for a number of reasons: We needed to use stimuli from Experimental Studies 4 and 5 as detection data were already collected and we needed to have a stimuli set of both truthful and deceptive answers. An ideal stimulus set may consist of a series of recordings which have been judged with identical levels of accuracy, this was not possible to achieve. The proportion of correctly identified individual stimuli in Experimental Studies 4 and 5 ranged from 0.02 to 0.93, so the number of suitable stimuli was limited. Two lies and three truthful answers were selected from each media condition. The stimuli were those from each sender which were judged accurately as closely as possible to the range of 0.6-0.7.

Descriptive statistics from Experimental Studies 4 and 5 for the subset of media recordings to be used are shown below in Tables 76 and 77.

Table 76

Descriptive Statistics from Sender LS Recordings

	Audio-Video				Audio-Only			
Question No.	Truth/ Lie	Proportion of hits			Truth/ Lie	Proportion of hits		
		N	*M*	*SD*		N	*M*	*SD*
2	Truth	101	**0.81**	0.39	Truth	104	**0.79**	0.41
6	Lie	104	**0.60**	0.49	Truth	104	**0.81**	0.40
8	Truth	104	**0.68**	0.47	Lie	104	**0.78**	0.42
9	Truth	104	**0.85**	0.36	Lie	104	**0.82**	0.39
10	Lie	104	**0.55**	0.50	Truth	104	**0.72**	0.45

Table 77

Descriptive Statistics from Sender AM Recordings

	Audio-Video				Audio-Only			
Question No.	Truth/ Lie	Proportion of hits			Truth/ Lie	Proportion of hits		
		N	*M*	*SD*		N	*M*	*SD*
1	Truth	64	**0.59**	0.50	Lie	64	**0.52**	0.50
2	Truth	64	**0.61**	0.49	Truth	64	**0.81**	0.40
4	Truth	64	**0.61**	0.49	Truth	64	**0.65**	0.48
6	Lie	64	**0.52**	0.50	Truth	64	**0.65**	0.48
9	Lie	63	**0.57**	0.50	Lie	64	**0.49**	0.50

10.3 Results

10.3.1 *Results from Experimental Study 4 and 5 subset of stimuli*

Data gathered from the subset of Experimental Studies 4 and 5 stimuli which were selected for the current study were re-analysed to allow comparisons with results from Experimental Study 6. Study 4 used sender ***LS*** recordings, Experimental Study 5 used sender ***AM*** recordings[7]. We used an alpha level of .05 for all statistical tests. It was demonstrated in the previous chapter that conducting analyses with data from only those participants that achieve the median detection score (*d'*) and above reduced variability in the dependent measures of interest. In all further analyses, only these data are reported in analyses. Values of N may vary between media conditions because only accuracy scores above the median value are reported.

10.3.2 *Receiver perceptions: response bias*

Receiver perceptions are reflected in the percentage of judged to be untrue and the signal detection theory response bias, *c* and are shown below in Tables 78 and 79.

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[7] In subsequent sections of this work, the acronym for the media condition under which stimuli are presented (P-) is followed in square brackets by the acronym for the condition under which stimuli were recorded (R-). The acronyms are:

- Audio-Video - AV
- Audio-Only - AO
- Video-Only - VO
- Text-Only - TO

Therefore P-AV[R-AO] indicates a condition where stimuli recorded under the audio-only media condition are presented to participants as audio-video

Table 78

Descriptive Statistics for Subset of Sender LS Stimuli

Media condition	P-AV[R-AV]			P-AO[R-AO]		
	M	*SD*	N	*M*	*SD*	N
c	**0.23**	0.36	52	**-0.07**	0.30	69

A repeated measures ANOVA indicated that there was a significant difference in values of *c* between the audio-video (M = 0.23, SD = 0.37) and audio-only (M = -0.08, SD = 0.26) conditions, $F(1, 34) = 17.28, p < .001$.

Table 79

Response Bias for Subset of Sender AM Stimuli

Media condition	P-AV[R-AV]			P-AO[R-AO]		
	M	*SD*	*N*	*M*	*SD*	*N*
c	**-0.06**	0.37	38	**0.12**	0.40	40

A repeated measures ANOVA indicated that there was no significant difference in values of *c* between the audio-video (M = -0.01, SD = 0.34) and audio-only (M = 0.08, SD = 0.39) conditions, $F(1, 21) = 0.76, p = .393$.

The results comparing media condition for both senders in the subset of data showed the same pattern as in the full set of stimuli. Receivers were less biased toward judging sender ***LS*** stimuli as truthful in the audio-only media condition compared to the audio-only condition. There was no significant difference between media conditions for sender ***AM*** stimuli.

10.3.3 *Receiver behaviour: accuracy of deception detection*

The accuracy of deception detection was measured by the signal detection theory sensitivity measure, *d'*. Descriptive statistics for the subset of recordings made by senders ***LS*** and ***AM*** are shown in Tables 80 and 81. Tests were conducted to investigate if there were significant differences in detection accuracy between media conditions and also whether these stimuli in their originally recorded format would be more detectable than would be expected by chance levels of accuracy. These analyses are conducted in order to allow comparisons with results reported when the modality of media presentation was changed.

Table 80

Accuracy of Deception Detection for Subset of Sender LS Stimuli

Media condition	P-AV[R-AV]			P-AO[R-AO]		
	M	*SD*	N	*M*	*SD*	N
Detection accuracy (*d'*)	**1.50**	0.44	52	**1.61**	0.42	68

A repeated measures ANOVA showed a significant difference between the audio-video ($M = 1.44, SD = 0.42$) and audio-only ($M = 1.67, SD = 0.43$) conditions in the accuracy of deception detection, $F(1, 33) = 4.97, p = .033$.

Single sample t-tests showed that the accuracy of lie detection (*d'*) was significantly greater than that expected by chance in the both the audio-video subset, $t(51) = 24.44$, $p < .001$, 1-tailed, and the audio-only subset, $t(67) = 31.57, p < .001$, 1-tailed.

Table 81

Accuracy of Deception Detection for Subset of Sender AM Stimuli

Media condition	P-AV[R-AV]			P-AO[R-AO]		
	M	*SD*	*N*	*M*	*SD*	*N*
Detection accuracy (*d'*)	**0.90**	0.66	38	**1.05**	0.67	38

A repeated measures ANOVA did not identify a significant difference between the audio-video ($M = 0.75, SD = 0.68$) and the audio-only ($M = 1.07, SD = 0.66$) conditions in the accuracy of deception detection, $F(1, 20) = 2.39, p = .138$.

Single sample t-tests showed that the accuracy of lie detection (*d'*) was significantly greater than that expected by chance in the both the audio-video subset, $t(37) = 8.39, p < .001$, 1-tailed, and the audio-only subset, $t(37) = 9.59, p < .001$, 1-tailed.

Stimuli were selected from Experimental Studies 4 and 5 to comprise a subset for future studies on the basis that they were more likely to be identifiable as either truthful or deceptive than would be expected if receivers were making judgements of veracity by guessing. The statistical tests analysing the scores above the median detection accuracy value show that as would be expected, in each media condition and for each sender, the pair of deceptive answers were detected at significantly greater accuracy than 0. However, the metrics for response bias were more variable, and there was no consistent pattern of results between senders or media conditions.

These statistics indicate that although recordings were selected from Experimental Studies 4 and 5 on the basis of being "reliably classifiable", the subsets used from each media condition are not necessarily equivalent. Consequently, experimental comparisons of results between media conditions in the same study must be treated with caution. For example, it may not be meaningful to compare the detection sensitivity of audio-video recordings from sender ***LS*** with video removed in Experimental Study 6 (i.e. presented as audio-only) with the audio-only recordings from ***LS*** with video added (i.e. presented as audio-video), because the subsets have not shown themselves to be identical in receiver classification metrics. The comparisons that are most reliable are the results from the same subset of recordings that have been experimentally manipulated, for example the detection sensitivity of audio-video recordings from ***LS*** with the sensitivity of audio-video recordings presented as audio-only in Experimental Study 6.

10.4 Results from Experimental Study 6

The results from Experimental Study 6 are those relating to receiver perceptions, their tendency to judge answers as truthful or deceptive, receiver behaviour and the accuracy of lie detection.

10.4.1 *Receiver perceptions : response biases*

The tendency to judge recordings as deceptive or truthful was assessed with the signal detection response bias measure, *c*.

*10.4.1.1 Response bias for sender **LS** stimuli*

In Experimental Study 4, media clips from sender ***LS*** were recorded in either audio-video (R-AV) or audio-only (R-AO), and were judged for veracity, from which response bias scores (c) for AV and AO recordings were calculated. In Experimental Study 6, the AV clips were presented as audio only (P-AO) and the AO clips were presented with video added as audio-video (P-AV) and veracity judgements were used to calculate c. For example, a clip presented as audio-only which was recorded as audio-video is labelled as P-AV[R-AO].

The descriptive statistics for receivers' response bias from Experimental Studies 4 and 6 where stimuli recorded from an audio-only condition had video added, are shown in Tables 82 and 83. Results are shown graphed in Figure 27.

We asked if the addition of the non-strategic visual cues, un-transmitted in the original audio-only communication context had an effect on receivers' tendency to judge senders as honest.

Table 82

Adding Video to Audio-Only Stimuli: Sender LS

Media condition	**P-AO[R-AO] (Study 4)**			**P-AV[R-AO] (Study 6)**		
	M	*SD*	N	***M***	*SD*	N
Response Bias (c)	**-0.08**	0.26	35	**-0.05**	0.22	42

We also asked: if senders use visual cues in an attempt to reduce suspicion in receivers, does the removal of visual cues from audio-visual stimuli reduce any tendency to judge answers as truthful?

Table 83

Removing Video from Audio-Video Stimuli: Sender LS

Media condition	**P-AV[R-AV] (Study 4)**			**P-AO[R-AV] (Study 6)**		
	M	*SD*	N	***M***	*SD*	N
Response Bias (*c*)	**0.23**	0.37	35	**-0.21**	0.31	42

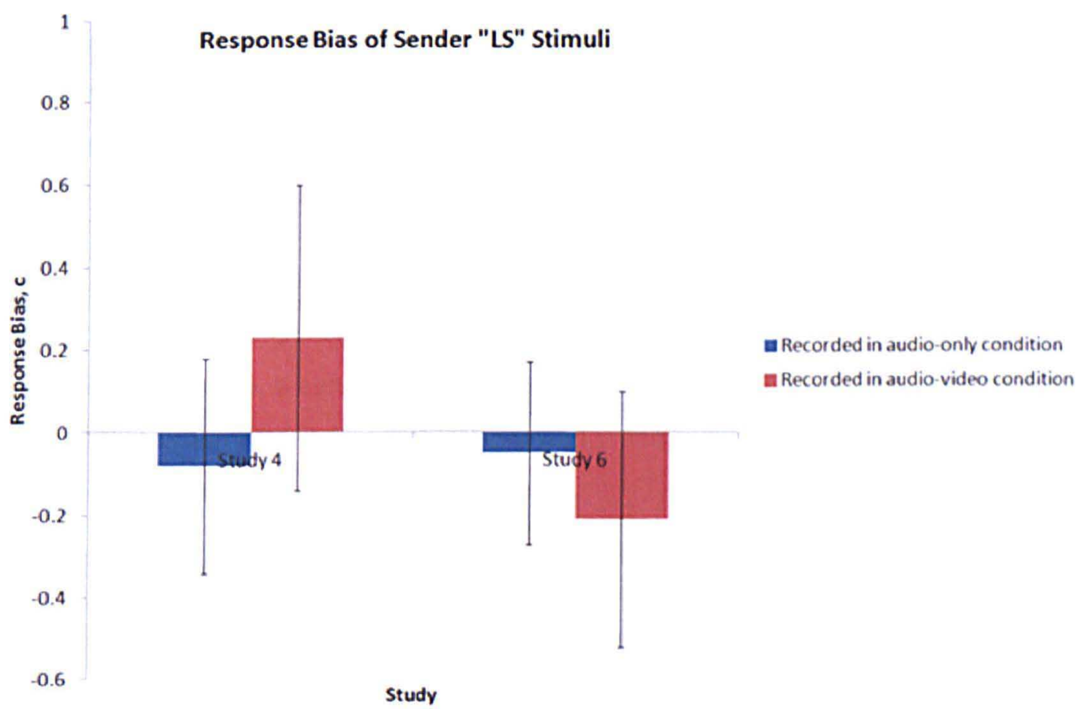

Figure 27 **Response Bias for Sender "*LS*" Stimuli**

A 2x2 ANOVA with recording media condition (R-AV or R-AO) as the within-subjects variable and presentation media condition (P-AV or P-AO) as the between-subjects variable revealed no significant main effect of the recording media condition, $F(1, 75)$ = 2.94, p = .091. There was a significant main effect of the presentation media condition (between-subjects effect), $F(1, 75) = 15.79$, $p < .001$. There was also a significant interaction between the mode of recording and the mode of presentation, $F(1, 75) = 28.86$, $p < .001$.

Post hoc comparisons were made using paired samples t-tests. A Bonferroni corrected value for alpha of .025 was used (.05/2). No significant increase was identified in the likelihood of judging stimuli as truthful when audio-only recorded stimuli (M = -0.07, SD = 0.30, N = 69) were presented as audio-video (M = -0.07, SD = 0.23, N = 76), $t(143)$ = 0.03, p = .487, 1-tailed.

Stimuli recorded as audio-video (M = 0.23, SD = 0.36, N = 52) and presented as audio-only (M = -0.12, SD = 0.37, N = 77) were significantly less likely to be judged as truthful, $t(127)$ = 5.19, $p < .001$, 1-tailed. We found evidence that the truth bias found in judgments made of the stimuli recorded in an audio-video condition was significantly reduced when the stimuli were presented as audio-only. A single sample t-test indicated that the response bias was significantly less than 0, revealing a tendency to judge the stimuli as deceptive when the video was removed, $t(76)$ = -2.73, p = .008. There was no significant change in the response bias when video was added to audio-only stimuli.

10.4.1.2 Response bias for sender "AM" stimuli

The descriptive statistics for receivers' response bias from Experimental Study 5 and Experimental Study 6, where stimuli recorded from an audio-only condition had video added, and stimuli recorded as audio-video had video removed are shown in Tables 84 and 85. Results are also shown in Figure 28.

We investigated whether the addition of the non-strategic visual cues, un-transmitted in the original audio-only communication context, had an effect on receivers' tendency to judge senders as honest.

Table 84

Adding Video to Audio-Only Stimuli: Sender AM

Media condition	**P-AO[R-AO] (Study 5)**			**P-AV[R-AO] (Study 6)**		
	M	*SD*	*N*	*M*	*SD*	*N*
Response Bias (c)	**0.08**	0.39	22	**-0.01**	0.35	52

We also investigated: if senders use visual cues in an attempt to reduce suspicion in receivers, does the removal of visual cues from audio-visual stimuli reduce any tendency to judge answers as truthful?

Table 85

Removing Video from Audio-Video Stimuli: Sender AM

Media condition	P-AV[R-AV] (Study 5)			P-AO[R-AV] (Study 6)		
	M	*SD*	N	***M***	*SD*	N
Response Bias (c)	**-0.01**	0.34	22	**-0.03**	0.34	52

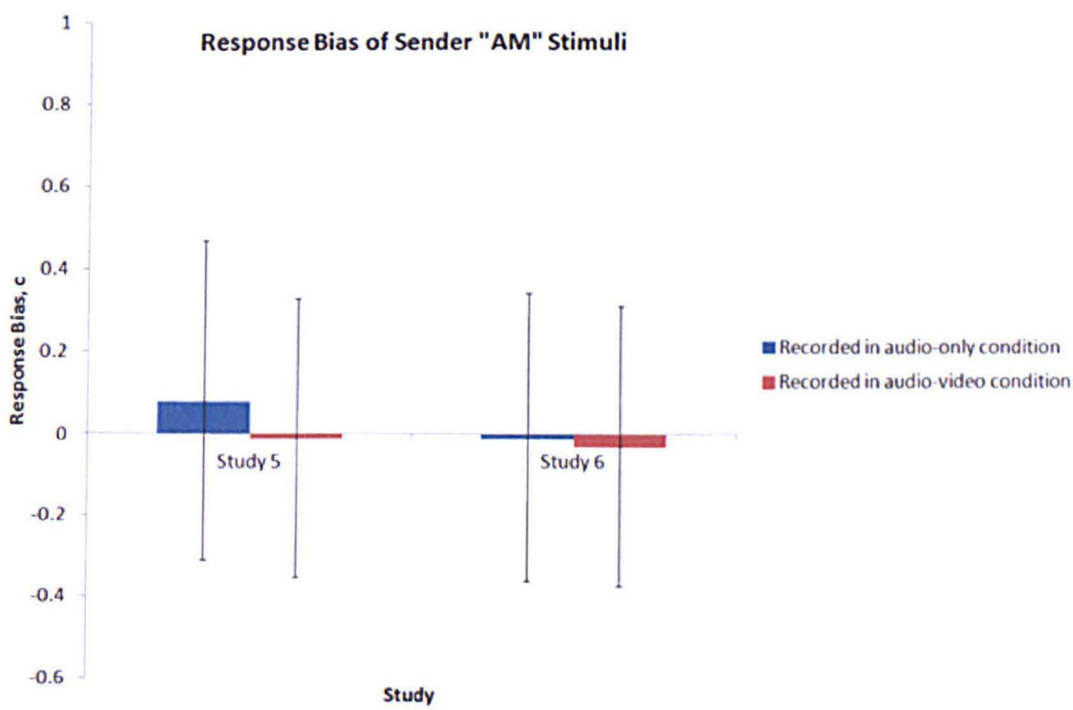

Figure 28 **Response Bias for Sender "*AM*" Stimuli**

A 2x2 ANOVA with recording media condition (R-AV or R-AO) as the within-subjects variable and presentation media condition (P-AV or P-AO) as the between-subjects variable revealed no significant main effect of the recording media condition, $F(1, 72) = 0.85$, $p = .091$. There was no significant main effect of the presentation media condition (between-subjects effect), $F(1, 72) = 0.04$, $p = .847$. There was no significant interaction between the mode of recording and the mode of presentation, $F(1, 72) = 0.22$, $p = .642$. There was no evidence with the *AM* stimuli that changing the presentation mode of recordings changed the response bias of receivers.

10.4.2 *Receiver behaviour : accuracy of deception detection*

The accuracy of veracity judgements was assessed through the signal detection theory discrimination sensitivity measure, *d'*.

*10.4.2.1 Detection accuracy for sender **LS** stimuli*

The descriptive statistics for receivers' lie detection accuracy from Experimental Studies 4 and 6, where stimuli recorded from an audio-only condition had video added, are shown in Tables 86 and 87. Results are shown graphed in Figure 29.

We questioned whether the addition of the non-strategic visual cues, not transmitted in the original audio-only communication context, have an effect on receivers' accuracy of lie detection.

Table 86

Adding Video to Audio-Only Stimuli: Sender LS

Media condition	P-AO[R-AO] (Study 4)			P-AV[R-AO] (Study 6)		
	M	*SD*	N	*M*	*SD*	N
Detection accuracy (*d'*)	**1.67**	0.43	34	**1.79**	0.42	41

We also asked if receivers use managed, distracting or non-diagnostic visual cues to judge deception in senders: Does the removal of visual cues from audio-visual stimuli increase detection accuracy?

Table 87

Removing Video from Audio-Video Stimuli: Sender LS

Media condition	**P-AV[R-AV] (Study 4)**			**P-AO[R-AV] (Study 6)**		
	M	*SD*	*N*	***M***	*SD*	*N*
Detection accuracy (*d'*)	**1.44**	0.42	34	**1.23**	0.70	41

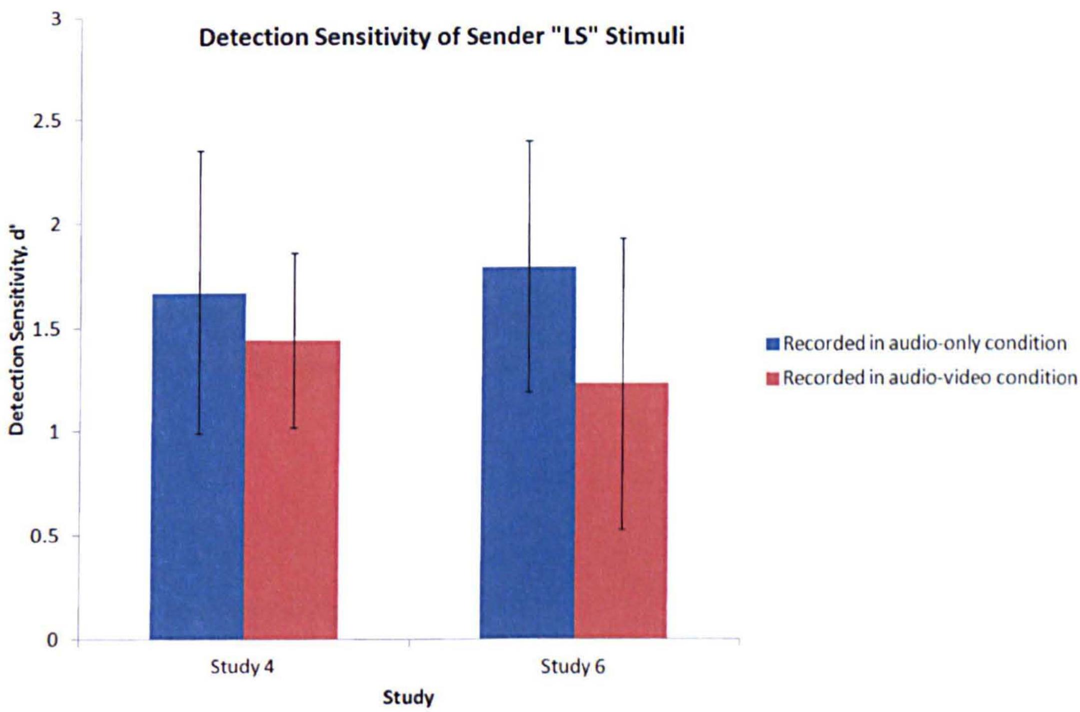

Figure 29 **Detection Accuracy for Sender "*LS*" Stimuli**

In Experimental Study 4, media clips from sender ***LS*** were recorded in either audio-video (R-AV) or audio-only (R-AO), and were judged for veracity to give *d'* scores for AV and AO recordings. In study 6, the AV clips were presented as audio only (P-AO) and the AO clips were presented with video added (P-AV). For example, a clip presented as audio-only which was recorded as audio-video is labelled as P-AO[R-AV].

A 2x2 ANOVA with recording media condition (R-AV or R-AO) as the within-subjects variable and presentation media condition (P-AV or P-AO) as the between-subjects variable revealed a significant main effect of the recording media condition, $F(1, 73)$ =

23.34, $p < .001$. There was no significant main effect of the presentation media condition (between-subjects effect), $F(1, 73) = 0.27, p = .607$. There was no significant interaction between the mode of recording and the mode of presentation, $F(1, 73) = 3.84, p = .054$.

The results indicate that regardless of the mode of presentation, accuracy for stimuli recorded as audio-only was higher than stimuli recorded as AV. The detection accuracy for the original stimuli was significantly greater for audio-only stimuli, so the results need to be treated with caution.

10.4.2.2 Detection accuracy for sender AM stimuli

Descriptive statistics for the lie detection accuracy for sender *AM* stimuli are shown in Tables 88-89. Results from Experimental Studies 5 and 6 are shown in Figure 30.

We questioned whether the addition of the non-strategic visual cues, not transmitted in the original audio-only communication context, have an effect on receivers' accuracy of lie detection.

Table 88

Adding Video to Audio-Only Stimuli: Sender AM

Media condition	P-AO[R-AO] (Study 5)			P-AV[R-AO] (Study 6)		
	M	*SD*	N	*M*	*SD*	N
Detection accuracy (*d'*)	**1.07**	0.65	21	**0.92**	0.64	52

We also questioned whether if receivers use managed, distracting or non-diagnostic visual cues to judge deception in senders, the removal of these visual cues from audio-visual stimuli increases detection accuracy.

Table 89

Removing Video from Audio-Video Stimuli: Sender AM

Media condition	P-AV[R-AV] (Study 5)			P-AO[R-AV] (Study 6)		
	M	*SD*	N	*M*	*SD*	N
Detection accuracy (*d'*)	**0.75**	0.68	21	**0.94**	0.60	52

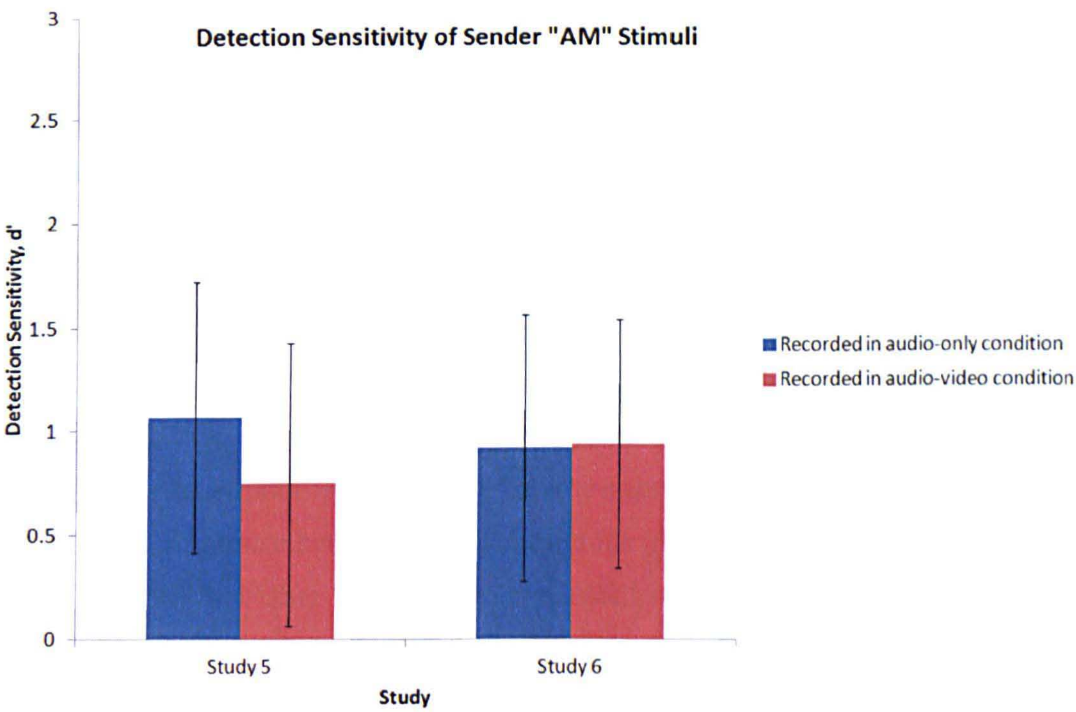

Figure 30 **Detection Accuracy for Sender *AM* Stimuli**

A 2x2 ANOVA with recording media condition (R-AV or R-AO) as the within-subjects variable and presentation media condition (P-AV or P-AO) as the between-subjects variable revealed no significant main effect of the recording media condition, $F(1, 71) = 1.79$, $p = .185$. There was no significant main effect of the presentation media condition (between-subjects effect), $F(1, 71)= 0.03$, $p = .876$. There was no significant interaction between the mode of recording and the mode of presentation, $F(1, 71) = 2.22$, $p = .140$. There was no evidence with the ***AM*** stimuli that changing the presentation mode of recordings changed the detection accuracy that receivers achieved.

10.5 Discussion

We conducted a study which was designed to separate the mode of media presentation from the mode under which stimuli were recorded and investigate the effect of visual cues on the response bias and lie detection accuracy that receivers displayed. Stimuli from two senders were presented to receivers in a different form to that when recorded. Stimuli recorded in audio-video conditions had video removed and were presented as audio-only. Stimuli recorded in audio-only conditions were presented to receivers as audio-video. Response bias and detection accuracy for the re-presented stimuli was compared with the data from Experimental Studies 4 and 5, where stimuli were presented in the same mode as they were recorded.

Response bias

We asked whether removal of visual cues from audio-visual stimuli would reduce the truth bias if, as previous research has argued, senders may use visual cues to reduce suspicion in receivers. The results indicated that receivers had a significant tendency to judge one audio-video stimuli set, those of sender ***LS***, as truthful when presented in their original mode. But when the video was removed and the stimuli were presented as audio-only, this truth bias disappeared and receivers were actually significantly likely to judge the stimuli as dishonest. With the stimuli set from sender ***AM***, there was no significant difference between media conditions in the tendency to judge stimuli as deceptive or truthful when stimuli were presented as recorded. The addition or subtraction of video had no significant effect on the response bias. The results from sender ***LS*** may support the hypothesis that visual cues are used strategically by deceivers to foster mutuality and to appear honest, which increases the tendency to judge senders as truthful when they can be seen. If visual cues are used strategically by senders in an attempt to reduce the suspicion of receivers, then removing them from stimuli recorded in audio-video condition were expected to reduce the truth bias. This reduction in truth bias was observed, and when visual cues were removed from the audio-video stimuli, receivers tended to judge the sender as deceptive. For sender ***AM***, there was no significant truth bias observed when the stimuli were presented in the mode that they had been recorded and this did not change when the presentation mode changed. We also investigated whether the addition of non-strategic visual cues (recorded in the audio-only condition, but not transmitted at the time) would affect the tendency to judge senders as truthful. We did not observe significant changes in the response bias when visual information was added to audio-only stimuli. This finding may lend support to the hypothesis that it is only those strategic visual cues which senders attempt to manage when they know that they are visible, which affect the receivers tendency to believe the answers they are given. This is a speculative interpretation of the results and other explanations are possible.

Accuracy of deception detection

We discussed the hypothesis that receivers may use managed, distracting or non-diagnostic visual cues to judge deception in senders, and if so, does the removal of visual cues from audio-visual stimuli increase detection accuracy? This hypothesis is a potential explanation for the evidence that detection accuracy was found in some circumstances to be higher in audio-only conditions compared to audio-video. We did not find any significant evidence that the removal of video from stimuli recorded in audio-video conditions resulted in better lie detection. There were no significant effects of the mode of presentation on receivers' detection accuracy. There was little support for the hypothesis that visual cues in audio-video conditions are distracting receivers from audio cues which might have proved to be more diagnostic of deception. We also asked whether the transmission of non-strategic visual cues, recorded but not transmitted in the original audio-only condition would either distract receivers or, as Krauss et al. (1976, cited in Zuckerman 1979) reported, give away deception. We found no evidence that detection accuracy was reduced or improved with the addition of visual cues to the stimuli recorded from the audio-only context. For sender ***LS***, detection accuracy remained greater for stimuli recorded in the audio-only condition compared to audio-video regardless of presentation mode.

10.6 Conclusions

We conducted a study where the presence or absence of visual cues was manipulated when presenting stimuli to receivers. The effect on the tendency to judge senders as truthful or deceptive with the addition and removal of visual cues from stimuli recorded as audio-video and audio-only was investigated. Previous literature had argued that senders strategically manage their appearance in an attempt to foster an honest demeanour (Burgoon et al., 2008). This is an explanation for the often reported bias toward judging senders as truthful. We have reported a truth bias in previous experimental studies. We found some evidence to support this theory, the truth bias of receivers was reduced when visual cues were removed from stimuli recorded in an audio-video communication condition. We also did not find any evidence of an effect on response biases of adding non-strategic visual information to audio-only stimuli. Of course, we are not suggesting that the lack of an experimental effect implies it does not exist. We found no effect on detection accuracy of removing video from audio-video, or adding it to audio-only stimuli. For one senders' stimuli, the detection accuracy remained greater for audio-only recorded answers than audio-video. The results need to be treated with caution as detection accuracy was not equivalent when presented as recorded, however, the results may suggest that visual cues did not have a significant effect on receivers ability to distinguish truth from deception. This may suggest that the difference in detection accuracy found between the media conditions is a product of senders' verbal behaviour differing between media conditions. This is a speculation which requires further investigation.

The next chapter reports a study which attempts to further unpack the influence of visual cues and verbal content on the tendency for senders to be judged as truthful or deceptive and the accuracy of receivers' attempts to detect deception. We report a study which presented the same corpus of media recordings of lies and truthful answers as video-only and as text-only transcriptions to receivers.

11. Judging Sender Veracity from Visual and Textual Cues: Experimental Study 7

Experimental Study 6 reported in the previous chapter was designed to investigate the influence of visual cues on the tendency to judge senders as truthful or not, and the accuracy of receivers' attempts to classify stimuli as truthful or deceptive. Video was removed from audio-visual stimuli which were then presented as audio-only. Video was also added to stimuli recorded in an audio-only context and were presented as audio-video and judged for veracity by a newly recruited group of receivers. We reported results for a set of audio-video stimuli that had video removed and receivers showed a significant reduction in the tendency to judge stimuli as truthful. We identified few other significant effects of removing or adding video on the accuracy of lie detection. The current chapter outlines the motivation, design and results of a study designed to continue the unpacking of the relative influence of visual cues and verbal content on the response bias and accuracy of receivers' veracity judgements of the same corpus of senders' answers as used in Experimental Study 6. Stimuli from senders ***LS*** and ***AM*** were presented as video-only stimuli and as text-only transcriptions. Before describing the study in detail, we review some relevant previous research.

Receivers' perceptions: response bias

There have been a number of studies reported which have investigated the tendency of receivers to judge statements as deceptive or truthful depending on the mode of message presentation. Bond and DePaulo (2006) reviewed studies and reported that messages are judged as less truthful in video-only presentation conditions compared to audio-video or audio-only. Vrij, Granhag and Porter (2010) suggest that an explanation for this finding is that people have stereotypical beliefs about the non-verbal cues that liars will display rather than how honest people will behave (e.g. Vrij et al., 2006b; Taylor & Hick, 2007). This means that they may judge senders as deceptive by observing some behaviour, but are attempting to judge people as honest from the absence of cues. They argue that people tend to respond to the presence of a signal rather than its absence, so paying excessive attention to visual cues is likely to lead to a tendency to judge senders as deceptive. In a video-only condition, receivers are forced to pay attention to visual cues and are likely to judge senders as more deceptive than when they can be heard. Mann et al. (2008) also argue that when judging honesty from only visual cues, receivers only have their stereotypical beliefs to rely upon and will tend to show a lie bias. They reported experimental findings which supported this hypothesis.

In a study by Stromwall and Granhag (2003), it was reported that receivers who watched an audio-video recording or listened with audio-only judged statements given by senders more positively than those who only read the statements. Lindholm (2005, cited in Landstrom, 2008) report that witness statements were judged as less credible when presented as transcripts compared to audio-video. Bond and DePaulo (2006) report in their review, that messages were also judged as less truthful in transcripts compared to audio-video. There was evidence that transcripts were judged as more truthful than video-only messages. Davis, Markus and Walters (2006) reported results that revealed a truth bias for transcripts of criminal suspect statements. This truth bias was greater than found in audio-video and audio-only modalities. The evidence for biases toward judging text-only stimuli as truthful or deceptive appears mixed. A possible explanation is that the response bias is dependent on the experimental context. Results have been reported form studies with very different stimuli and comparisons may be problematic. However, we may expect that tendency to judge senders as truthful or deceptive will be different when stimuli are text-only compared to both video-only and the original recording conditions. The first research question asks:

Will the response bias of text-only stimuli be significantly different to the media condition stimuli were recorded in?

If the evidence reviewed by Bond and DePaulo (2006) is representative, we might expect that stimuli presented as text-only will be judged as more truthful than video-only stimuli, but less truthful than either audio-only or audio-video.

In the previous chapter, we reported that stimuli from one sender, ***LS***, showed a truth bias when judged as originally recorded, as audio-video. When video was removed and stimuli were judged as audio-only, the truth bias disappeared and receivers showed a lie bias. We suggested that a possible explanation was that strategic visual cues were used by ***LS*** in the audio-video context to portray an appearance of honesty. No such change in response bias was observed in the audio-only stimuli from ***LS*** where the visual cues were not strategic. These results and previous literature suggest two research questions.

Is there a greater bias toward judging senders as dishonest when stimuli are presented as video-only compared to all other media conditions?

Is the bias toward judging video-only stimuli as lies less when the stimuli are from an audio-video recording condition?

If there is a lie bias found for video-only stimuli and the argument put forward by Vrij et al. (2010) is correct that it results from visual cues to deception being observed, then we hypothesise that this bias will be reduced when senders are attempting to manage their visual appearance in audio-video recording conditions compared to audio-only.

Receivers' behaviour, detection accuracy

Some previous studies have investigated the detectability of video-only messages and found that typically, only using visual information leads to poor success at judging deception. Bond and DePaulo (2006) reviewed a number of studies and reported that video-only detection was lower than audio-video and audio-only. They report that accuracy was equivalent in transcripts, audio-video and audio-only media conditions which all showed greater accuracy than video-only. Mann et al. (2002) asked police officers to judge the veracity of audio-video fragments of interviews with criminal suspects and describe which cues their decisions were based upon. The more accurate detectors mentioned features of the story content (vague replies, contradictions and so forth). The least accurate detectors mentioned visual cues, such as gaze aversion and posture. DePaulo et al. (1982) instructed receivers to attend to senders' tone of voice, words, visual cues, or were given no special instructions. They reported that participants who paid attention to tone of voice were significantly more likely to judge truthful answers as honest and this tendency improved their accuracy of veracity classification compared to those given no instructions. Mann et al. (2008) reported that classification accuracy for both lies and honest statements was lower in a video-only condition than audio-video and audio-only and was not better than expected by chance. The research suggests a further research question:

Will detection of deception be less accurate in a video-only condition than both audio-video and audio-only conditions?

If our results support the findings of a considerable body of previous research, we expect to find that detection accuracy is reduced by presenting stimuli as video-only compared to the results reported for audio-video and audio-only media conditions.

Accuracy of lie detection in a text-only context has been reported to be as good as face-to-face (Hancock et al., 2010), although, the deception was both produced and judged in a synchronous text-chat environment. DePaulo et al. (1983, cited in Davis et al., 2006) reported that when motivated liars were judged, greater classification accuracy was revealed in both audio-only and audio-video conditions compared to text transcriptions. Davis et al. (2006) argued that the low accuracy found in transcriptions was at least in part due to only content being recorded. They investigated detection accuracy using not only content transcriptions, but also a precise verbatim transcript including speech errors, word repetitions and other paralinguistic detail. They reported significantly lower detection accuracy in content-only transcript condition compared to verbatim transcripts, audio-only and audio-video conditions. The latter three conditions showed no significant differences from each other. The previous research suggests a final research question:

Are lies detected with the same level of accuracy when stimuli are presented as text-only compared to audio-video and audio-only media conditions?

If the results of Davis et al. (2006) and the reviewed research of Bond and DePaulo (2006) are supported we would expect to find that detection accuracy for text transcriptions of stimuli is equivalent to audio-video and audio-only stimuli.

In this study, stimuli recorded in audio-video and audio-only media conditions were converted to video-only and text-only stimuli. The study used the same stimuli as in Experimental Study 6 reported in the previous chapter. In the previous research reported, stimuli were recorded as audio-video and converted to other media formats. We extend our investigations from previous experimental studies reported here by using stimuli recorded in both audio-video and audio-only media conditions. We have identified a greater accuracy of lie detection in some of our audio-only media conditions compared to audio-video. If we find the same difference in detection accuracy between recording conditions, then we may be able to shed further light on whether the presentation mode or original recording context of stimuli has a greater influence on detection accuracy.

11.1 Method

11.1.1 *Participants*

Participants were recruited by emailing groups of students at the University of Nottingham, posting to mailing lists and by asking people to forward on the survey URL to anyone they felt might be interested in participating. Experimental Study 7a used sender ***LS*** recordings as stimuli and attracted 81 participants; Experimental Study 7b using sender ***AM*** stimuli had 82 participants.

11.1.2 *Materials and procedure*

Stimuli originally recorded in both audio-only and audio-video conditions in Experimental Study 1 were presented as video-only and text-only. The video-only presentations consisted of original recordings replayed with no sound. For the text only condition, a transcription of the receiver asking the question followed by the sender giving their answer was presented to show the complete sender and receiver interaction. The text-only transcriptions were similar to the precise verbatim transcripts used by Davis et al. (2006). An example is shown in Figure 31, Question #5, from the audio-only recording condition of sender ***LS.***

```
Q: Which famous person would you like to have lunch with?

A: err

A: Marilyn Manson that would be quite entertaining

A: *laughs*
```

Figure 31 **Example Text-Only Transcription**

The transcription of the entire question followed by the complete answer was presented with minimal punctuation. All utterances were transcribed including non-word pauses such as "uhm" and "err" and any laughing as "*laughs*, but without any non-speech auditory information such as loudness, emphasis, pitch or timings. Any significant pauses lead to new utterances on a separate line. Timing could only be inferred from the length of the utterance and the number of lines.

Media recordings were presented using an online survey system. Participants were informed that they would be presented with recordings in which people would be either telling the truth or lying and their task was to judge the truthfulness of each recording. Media recordings were shown individually in the order that they were recorded followed by a written question ***"Do you think the answer this person gave was true or false?"*** and had to check a box labelled either "true" or "false" before they could continue to the next question. There was nothing to stop participants replaying the clips, however, they were asked not to unless it had not played correctly the first time.

A 1x4 repeated measures design was employed. In common with Experimental Study 6, media conditions are labelled as presentation media condition abbreviation followed by the recording media condition abbreviation in square brackets. For example, stimuli recorded as audio-only and presented as video-only are labelled P-VO[R-AO]. Media conditions are: video-only (VO), text-only (TO), audio-only (AO) and audio-video (AV).

The order of media clip presentation was: #1: P-VO[R-AV]; #2: P-VO[R-AO]; #3: P-TO[R-AV]; #4: P-TO[R-AO]. This order was changed for approximately half the participants in order to counter balance presentation effects. The order was changed to #1: P-TO[R-AV]; #2: P-TO[R-AO]; #3: P-VO[R-AV]; #4: P-VO[R-AO]

11.2 Results

The veracity judgements from the set of recordings from individual senders (***LS*** and ***AM***) were analysed separately given the lack of equivalence between them. Results are presented in the following section with both senders' data for each media condition. The results are organised into response bias analyses followed by accuracy of veracity judgements. Again, comparing results between media condition in each study is problematic given that response bias and veracity classification was not identical for each set of stimuli. Therefore, results for each set of stimuli are compared between media presentation mode conditions from the previous studies. Analyses were conducted using only the data from participants who achieved detection accuracy scores greater than or equal to the median score. Alpha values of .05 were used for all statistical tests.

11.2.1 *Receiver perceptions : response bias*

Response bias of receivers was assessed by the signal detection response bias metric, *c*. As per previous studies using the ***LS*** and ***AM*** recording subsets, in each condition there were three truthful answers and two deceptive answers as stimuli.

*11.2.1.1 Response bias for sender **LS** stimuli*

Descriptive statistics for the response bias, *c* for the stimuli recorded in the audio-only and audio-video conditions from sender ***LS*** are shown in Tables 90 and 91.

Table 90

Response Bias for Stimuli Recorded in Audio-Only Condition

Media Condition	P-AO[R-AO] (Study 4)	P-VO[R-AO] (Study 7a)	P-TO[R-AO] (Study 7a)
N	69	41	42
M	**-0.07**	**-0.47**	**-0.05**
SD	0.30	0.57	0.41

Table 91

Response Bias for Stimuli Recorded in Audio-Video Condition

Media Condition	P-AV[R-AV] (Study 4)	P-VO[R-AV] (Study 7a)	P-TO[R-AV] (Study 7a)
N	52	47	41
M	**0.23**	**-0.04**	**-0.02**
SD	0.34	0.43	0.39

Four one-way ANOVA were conducted to compare Experimental Study 7a where sender ***LS*** stimuli were presented as video-only and text-only with Experimental Study 4 where stimuli were presented in their recorded format. Bonferroni corrected values for alpha of .0125 were used (.05/4).

We asked if the response bias of text-only stimuli would be significantly different to the media condition stimuli they were recorded under. The bias toward judging stimuli as truthful was significantly lower in the text-only condition than the audio-video condition, $F(1, 91) = 9.93$, $p = .002$. There was no significant difference in the response bias between text-only and audio-only, $F(1, 109) = 0.07$, $p = .790$. There was partial support for the hypothesis that presenting stimuli as text-only would lead to a reduction in truth bias.

We also asked if there would be a greater bias toward judging senders as dishonest when stimuli are presented as video-only compared to all other media presentation conditions. Stimuli were significantly more likely to be judged as deceptive when presented as video-only than in both the audio-only condition in Experimental Study 4, $F(1, 108) = 24.09$, $p < .001$ and audio-video condition, $F(1, 97) = 11.27$, $p = .001$

Six paired samples t-tests were conducted. A Bonferroni corrected value for alpha of .0083 was used (0.05/6). Tests revealed that stimuli were significantly more likely to be judged as truthful when presented as text-only (M = -.17, SD = 0.33) compared to video-only (M = -.62, SD = 0.46) when recorded in an audio-only condition, $t(23) = -4.29$, $p < 0.001$. The comparison between stimuli recorded as audio-video and presented as video-only (M = .02, SD = 0.39) compared to text-only (M = -.02, SD = 0.40) was not significant, $t(21) = 0.34$, $p = .734$.

Tests revealed no significant difference in the response bias in stimuli presented as text-only when recorded in the audio-only (M = -.04, SD = 0.42) condition compared to those recorded in the audio-video condition (M = .04, SD = 0.37), $t(23) = 0.67$, $p = .511$).

We also asked whether the bias toward judging video-only stimuli as lies would be less when the stimuli are from an audio-video recording condition compared to an audio-only condition. No significant difference was identified in the response bias between stimuli recorded as audio-only (M = -.43, SD = 0.54) and audio-video (M = -.22, SD = 0.41) when presented as video-only, $t(20) = 1.52$, $p = .145$.

Two further comparisons were included for completeness and revealed that the response bias for stimuli recorded as audio-video but presented as video-only (M = -.51, SD = 0.50) was not significantly different to those recorded as audio-only but presented as text-only (M = -.13, SD = 0.42), $t(22) = -0.04$, $p = .972$. The response bias was significantly more negative for audio-only stimuli presented as video-only (M = -0.51, SD = 0.50) compared to audio-video recorded stimuli, presented as text-only (M = -.002, SD = 0.44), $t(20)$ = -3.68, p = .001.

11.2.1.2 *Response bias for sender **AM** stimuli*

Descriptive statistics for the percentage of answers judged as lies and the response bias, *c* for the audio-only recordings from sender ***AM*** are shown in Table 92, and the audio-video recordings are shown in Table 93.

Table 92

Response Bias (c) for Stimuli Recorded in Audio-Only Condition

Media Condition	P-AO[R-AO] (Study 5)	P-VO[R-AO] (Study 7b)	P-TO[R-AO] (Study 7b)
N	40	44	46
M	**0.12**	**0.30**	**-0.06**
SD	0.40	0.56	0.39

Table 93

Response Bias (c) for Stimuli Recorded in Audio-Video Condition

Media Condition	P-AV[R-AV] (Study 5)	P-VO[R-AV] (Study 7b)	P-TO[R-AV] (Study 7b)
N	38	47	41
M	**-0.06**	**-0.24**	**0.31**
SD	0.37	0.25	0.43

Four one-way ANOVA were conducted to compare results from Experimental Study 7b where stimuli were presented as video-only and text-only with study 5 where sender ***AM*** stimuli were presented in their recorded format. Bonferroni corrected values for alpha of .0125 were used (.05/4).

We asked if the response bias of text-only stimuli would be significantly different to the media condition stimuli they were recorded under. The bias toward judging stimuli as truthful was not significantly different between text-only and audio-only presentation conditions, $F(1, 84) = 4.41$, $p = .039$. Stimuli from the audio-video condition were significantly more likely to be judged as truthful when presented as text-only, $F(1, 77) = 16.49$, $p < .001$.

We also asked if there would be a greater bias toward judging senders as dishonest when stimuli are presented as video-only compared to all other media presentation conditions. No significant different was found in response bias between stimuli presented as video-only and audio-only in study 5, $F(1, 82) = 2.83$, $p = .097$. Stimuli recorded in the audio-video condition were significantly more likely to be judged as deceptive when presented as video-only, $F(1, 83) = 7.19$, $p = .009$.

Six paired samples t-tests were conducted to compare the media conditions in Experimental Study 7b. A Bonferroni corrected value for alpha of .0083 was used (0.05/6). Tests revealed that stimuli which were recorded in the audio-only condition were significantly more likely to be judged as deceptive when presented as text-only (M = -.10, $SD = 0.38$) compared to video-only ($M = .28$, $SD = 0.70$), $t(24) = 2.57$, $p = 0.017$. Stimuli recorded as audio-video were significantly more likely to be judged as deceptive when presented as video-only ($M = -.24$, $SD = 0.29$) compared to text-only ($M = .22$, $SD = 0.42$), $t(24) = -5.21$, $p < .001$.

Tests revealed a significant difference in the response bias in stimuli presented as text-only when recorded in the audio-only ($M = -.15$, $SD = 0.36$) condition compared to the audio-video condition ($M = .31$, $SD = 0.51$), $t(19) = 3.35$, $p = .003$). A significant difference was identified in the detection accuracy between stimuli recorded as audio-only ($M = .34$, $SD = 0.65$) and audio-video ($M = -.22$, $SD = 0.26$) when presented as video-only, $t(27) = -3.92$, $p = .001$.

The results indicate that sender ***AM***'s audio-only stimuli are more likely to be judged as lies than the audio-video stimuli when presented as text-only. When presented as video-only this pattern is reversed and audio-video stimuli are more likely to be judged as deceptive.

Two further comparisons were conducted for completeness and revealed that the response bias for stimuli recorded as audio-video but presented as video-only (M = -.19, SD = 0.22) was not significantly different to those recorded as audio-only but presented as text-only (M = -.12, SD = 0.38), $t(22)$ = -1.00, p = .328. The response bias was not significantly more negative for audio-only stimuli presented as video-only (M = .28, SD = 0.59) compared to audio-video recorded stimuli, presented as text-only (M = .36, SD = 0.41), $t(19)$ = -0.50, p = .624.

11.2.2 *The behaviour of receivers: accuracy of deception detection*

The accuracy of answer classification was assessed using the detection sensitivity measure, d'. Results from sender ***LS*** stimuli are reported first, followed by results from sender ***AM*** stimuli.

11.2.3 *Detection accuracy for sender **LS** stimuli*

Descriptive statistics for the detection sensitivity, d' for the stimuli recorded in the audio-only condition from sender ***LS*** are shown in Tables 94, and for the audio-video condition in Table 95.

Table 94

Lie Detection Sensitivity, d' for Stimuli Recorded in Audio-Only Condition

Media Condition	P-AO[R-AO] (Study 4)	P-VO[R-AO] (Study 7a)	P-TO[R-AO] (Study 7a)
N	68	41	42
M	**1.61**	**0.42**	**1.37**
SD	0.42	0.53	0.43

Table 95

Lie Detection Sensitivity, d' for Stimuli Recorded in Audio-Video Condition

Media Condition	P-AV[R-AV] (Study 4)	P-VO[R-AV] (Study 7a)	P-TO[R-AV] (Study 7a)
N	52	47	41
M	**1.50**	**0.29**	**0.67**
SD	0.44	0.57	0.45

Four one-way ANOVA were conducted to compare the results from study 7a where stimuli were presented as video-only and text-only with Experimental Study 4 where stimuli were presented in their original recorded format. Bonferroni corrected values for alpha of .0125 were used (.05/4).

We investigated if detection of deception would be less accurate for stimuli presented as video-only compared to both audio-video and audio-only conditions. Detection accuracy for stimuli presented as video-only in Experimental Study 7a was significantly lower than when judged in Experimental Study 4 as originally recorded audio-video, $F(1, 97) = 140.43$, $p <.001$ or audio-only, $F(1, 107) = 165.11$, $p < .001$.

We also investigated whether lies would be detected with the same level of accuracy when stimuli were presented as text-only compared to audio-video and audio-only media conditions. Detection accuracy for stimuli presented as text-only in Experimental Study 7a was significantly lower than when judged in Experimental Study 4 as originally recorded audio-video, $F(1, 91) = 78.75$, $p < .001$ or audio-only, $F(1, 108) = 7.93$, $p = .006$.

Results indicated that detection accuracy was lower when stimuli were presented as either video-only or text-only compared to presentation in the original recording mode.

Six paired samples t-tests were conducted to compare detection accuracy between conditions in Experimental Study 7a. A Bonferroni corrected value for alpha of .0083 was used (0.05/6). Tests revealed that detection accuracy was significantly greater for stimuli recorded in both audio-video and audio-only conditions and presented as text-only compared to video-only. There was significantly greater detection accuracy with stimuli recorded as audio-video, but presented as text-only (M = 0.75, SD = 0.51), compared to video-only (M = 0.30, SD = 0.55), $t(21)$ = -3.65, p = 0.001. A significantly greater accuracy was also identified in stimuli recorded as audio-only, but presented as text-only (M = 1.44 , SD = 0.49), compared to video-only (M = 0.38, SD = 0.58), $t(23)$ = 6.00, $p < .001$.

The results indicated that detection accuracy under text-only conditions was greater than video-only regardless of the recording media condition.

Tests revealed a significantly greater accuracy in stimuli presented as text-only when recorded in the audio-only (M = 1.37, SD = 0.43) condition compared to the audio-video condition (M = 0.56, SD = 0.36), t(23) = -8.04, p < .001). No significant difference was identified in the detection accuracy between stimuli recorded as audio-only (M = 0.21, SD = 0.56) and audio-video (M = 0.54, SD = 0.12) when presented as video-only, $t(20)$ = -2.11, p = .048.

The results indicate that the difference in detection accuracy between media conditions shown in Experimental Study 4 are still apparent even when stimuli are presented as text-only.

Two further comparisons were performed for completeness of the analyses, and revealed that the detection accuracy of stimuli recorded as audio-video but presented as video-only (M = 0.23, SD = 0.48) was significantly lower than those recorded as audio-only but presented as text-only (M = 1.25, SD = 0.35), $t(22)$ = -10.27, $p < .001$. No significant difference was identified between stimuli recorded as audio-only and presented as video-only (M = 0.37, SD = 0.50), and those recorded as audio-video and presented as text-only (M = 0.73, SD = 0.49), $t(20)$ = -2.77, p = .012.

11.2.4 *Deception detection of sender **AM** stimuli*

Descriptive statistics for the detection sensitivity metric, d' for the stimuli recorded under the audio-only condition from sender ***AM*** are shown in Table 96 and for the audio-video condition are shown in Table 97.

Table 96

Lie Detection Sensitivity, d' for Stimuli Recorded in Audio-Only Condition

Media Condition	P-AO[R-AO] (Study 5)	P-VO[R-AO] (Study 7b)	P-TO[R-AO] (Study 7b)
N	38	43	46
M	**1.05**	**0.51**	**0.81**
SD	0.68	0.48	0.50

Table 97

Lie Detection Sensitivity, d' for Stimuli Recorded in Audio-Video Condition

Media Condition	P-AV[R-AV] (Study 5)	P-VO[R-AV] (Study 7b)	P-TO[R-AV] (Study 7b)
N	38	47	41
M	**0.90**	**0.22**	**0.52**
SD	0.66	0.74	0.45

Four one-way ANOVA were conducted to compare the results from Experimental Study 7b where stimuli were presented as video-only and text-only with study 5 where stimuli were presented in their original recorded format. Bonferroni corrected values for alpha of .0125 were used (.05/4).

We investigated if the detection of deception would be less accurate for stimuli presented as video-only compared to both audio-video and audio-only conditions? Detection accuracy was significantly lower when stimuli were presented as video-only for both audio-only stimuli in Study 5, $F(1, 79) = 17.95$, $p < .001$ and for audio-video stimuli, $F(1, 83) = 19.48$, $p < .001$.

Results were similar to the stimuli from sender ***LS***, detection accuracy was significantly lower when stimuli recorded in either condition were presented as video-only.

We also investigated whether lies would be detected with the same level of accuracy when stimuli were presented as text-only compared to audio-video and audio-only media conditions. Detection accuracy was significantly lower for text-only presentation compared to the original audio-video, $F(1, 77) = 9.02$, $p = .004$. No significant reduction in detection accuracy was identified for stimuli recorded as audio-only and presented as text-only, $F(1, 82) = 1.20$, $p = .065$.

Results were mixed, detection accuracy was significantly lower for stimuli recorded as audio-video and presented as text-only. However, detection accuracy for audio-only stimuli was not significantly reduced.

Six paired samples t-tests were conducted to compare conditions from Experimental Study 7b. A Bonferroni corrected value for alpha of .0083 was used (0.05/6). There was no significantly greater detection accuracy with stimuli recorded as audio-video, but presented as text-only ($M = 0.60$, $SD = 0.51$), compared to video-only ($M = 0.38$, $SD = 0.67$), $t(24) = -1.28$, $p = .213$. A significantly greater accuracy was identified in stimuli recorded as audio-only and presented as text-only ($M = 0.96$, $SD = 0.54$), compared to video-only ($M = 0.41$, $SD = 0.40$), $t(24) = -4.36$, $p < .001$.

The results reveal evidence that detection under text-only presentation might be better than video-only; however, these findings are not conclusive.

Tests revealed no significant difference in detection accuracy in stimuli presented as text-only when recorded in the audio-only condition ($M = 0.76$, $SD = 0.44$) compared to the audio-video condition ($M = 0.53$, $SD = 0.52$), $t(19) = -1.49$, $p = .153$. No significant difference was identified in the detection accuracy between stimuli recorded as audio-only ($M = 0.48$, $SD = 0.51$) and audio-video ($M = 0.18$, $SD = 0.81$) when presented as video-only, $t(27) = -1.51$, $p = .142$.

The results do not provide significant evidence for an effect of the media condition under which stimuli were originally produced, on the accuracy of detection when presented as video-only or text only.

Two final comparisons were conducted for completeness of the t-tests and revealed that the detection accuracy of stimuli recorded as audio-video but presented as video-only (M = 0.20, SD = 0.79) was not significantly lower than those recorded as audio-only but presented as text-only (M = 0.74, SD = 0.48), $t(29)$ = -2.82, p = .008. No significant difference was identified between stimuli recorded as audio-only and presented as video-only (M = 0.46, SD = 0.42), and those recorded as audio-video and presented as text-only (M = 0.52, SD = 0.38), $t(19)$ = -0.58, p = .567.

11.3 Discussion

A study was conducted using the same corpus of stimuli used in Experimental Study 6 and reported in the previous chapter. Stimuli recorded in audio-video and audio-only conditions in Experimental Study 1 from two senders were presented to participants as video-only and text-only. Receivers judged the veracity of the stimuli and response bias and accuracy of lie detection measures were calculated. In Experimental Studies 4, 5, and 6, receivers' judgements of the stimuli from senders ***LS*** and ***AM*** showed some significant differences and consequently are analysed separately. These apparent differences between receivers' judgements of the two senders continued in the current study and interpretation and generalisation from the results is not straightforward.

Response bias

The study investigated whether the tendency for receivers to judge stimuli as truthful or deceptive was systematically different when presented as text-only or video only. We also investigated whether these modes of presentation resulted in changes to any response biases that were observed when presented under the original recording conditions. Previous experimental results and reported findings in the literature suggested a number of research questions relating to the response bias that receivers might reveal.

The first research question asked: **Would the response bias of stimuli be significantly different when judged as text-only compared to the original recorded media condition?** For sender ***LS*** stimuli, there was a significant bias toward judging stimuli as truthful when stimuli were presented as originally recorded in Experimental Study 4. In the current study, the response bias was significantly lower when stimuli were presented as text-only, indicating less of a tendency to judge ***LS*** as truthful. There was no significant difference in the response bias between stimuli presented in their originally recorded format of audio-only and when judged as text-only. For sender ***AM***, stimuli from the audio-video condition were significantly more likely to be judged as truthful when presented as text-only, compared with when presented in their original format. The results provided limited consistent support for the hypothesis that stimuli presented as text-only would show a tendency away from being judged truthful to being judged as deceptive. However, when there was a significant truth bias observed when receivers judged stimuli presented in their original format, for one set of stimuli, there was a significant tendency for the truth bias to disappear when judging stimuli as text-only. There was limited consistent support for the hypothesis that presenting stimuli as text-only would lead to a reduction in truth bias. However, there was evidence that if stimuli were more likely to be judged as truthful in the original recording format, this truth bias was reduced or disappeared when presented as text-only. We did not find consistent support for Bond and DePaulo (2006), who reported that compared to audio-video stimuli, text-only stimuli would be judged as less truthful. Similar findings reported by Stromwall and Granhag (2003) and Lindholm (2005, cited in Landstrom, 2008) were not consistently supported. We did find this pattern of results for one set of stimuli, but also found evidence that receivers were more likely to judge stimuli as truthful when presented as text-only for a different set of stimuli. This result supported the findings of Davis et al. (2006) who reported a greater tendency to judge senders as truthful in a text-only condition. The results were mixed, and it is hard to draw firm conclusions from the current study.

We also asked if there would be a greater bias toward judging senders as dishonest when stimuli are presented as video-only compared to all other media presentation conditions.

Compared to the judgements made when presented in their recorded formats, three out of four of the stimuli sets showed a significant reduction in the tendency to judge stimuli as truthful when presented as video-only. The results predominantly supported the hypothesis that there would be a reduced tendency to judge stimuli as truthful when they were presented as video-only. Bond and DePaulo (2006) reviewed studies and reported that messages are judged as less truthful in video-only presentation conditions compared to audio-video or audio-only. Mann et al. (2008) also argued that when judging honesty from only visual cues, receivers only have their stereotypical beliefs to rely upon and will tend to show a lie bias. However, our results did not show negative values for all stimuli judged as video-only, and in one stimuli set, there was a significant tendency to judge senders as truthful. These results indicate that there may be a general tendency for senders to be less likely to be judged as honest in video-only media conditions than in other formats, but there also appears to be circumstances when this is not the case.

The results comparing the response bias of text-only and video-only judgements were mixed and few firm conclusions can be drawn. For some stimuli sets, text-only were judged as more likely to be true than video-only stimuli and the pattern was reversed for other stimuli sets.

We also asked whether any bias toward judging video-only stimuli as lies would be less when the stimuli are from an audio-video recording condition compared to an audio-only condition.

In one stimuli set (*LS*) we did not find any significant difference in the response bias between stimuli recorded in an audio-only condition and those recorded in an audio-only condition. In the stimuli set from sender ***AM***, those from the audio-only condition were significantly more likely to be judged as truthful as the audio-video stimuli. This result was in the opposite direction to that hypothesised. The hypothesis that visual cues produced by senders in an audio-video condition would be more managed and controlled in order to appear honest and would therefore be less likely to be judged when shown as video-only was not supported by the results of this study.

Detection accuracy

One of the aims of the study was to investigate whether the accuracy of lie detection was influenced by the mode of media presentation of stimuli. A research question asked whether the **detection of deception would be less accurate if stimuli were judged as video-only rather than in their original audio-video and audio-only condition.** For both ***LS*** and ***AM*** stimuli sets, the accuracy of detection was significantly reduced when judged as video-only. This reduction in accuracy of lie detection was found for stimuli recorded in both audio-only and audio-video conditions. The results were in agreement with the findings of previously reported in the literature (e.g. Mann et al, 2008; Bond & DePaulo, 2006). A number of studies have demonstrated that visual cues are frequently reported by both professional and lay detectors to be diagnostic of deception. Previous research has also reported that people attend to visual cues more than other modalities. Our results have supported the finding that when receivers attend to visual over verbal cues, their success at lie detection is significantly diminished.

We also investigated whether **lies would be detected with the same level of accuracy when stimuli are presented as text-only compared to the original audio-video and audio-only media recording conditions.** The results indicated that detection accuracy was significantly reduced when stimuli from both recording media conditions were judged as text-only for the sender ***LS*** stimuli set. For sender ***AM*** stimuli, the results were mixed. Detection accuracy was significantly lower for stimuli recorded as audio-video and presented as text-only. However, detection accuracy for audio-only stimuli was not significantly reduced. In the majority of the stimuli sets, the accuracy under text-only conditions was significantly greater than that found for video-only. The only exception was the audio-only stimuli of sender ***AM***, which did not show greater accuracy under text-only condition.. These results suggest that all visual cues can be removed, as can some of the verbal cues, such as tone of voice, and yet detection of deception may still be possible. For sender ***LS*** stimuli, the detection accuracy was better for stimuli recorded as audio-only compared to audio-video. Throughout the experimental studies using sender ***LS*** stimuli, detection has been found to be better for audio-only lies. The results from this study continue this trend, which may suggest that the verbal content is diagnostic of this sender's deception. The results from ***AM*** stimuli did not show this pattern of recording media differences. A difference in detection accuracy between media conditions has not been identified for sender ***AM*** in previous studies. For sender ***LS*** audio-video stimuli, we observed a reduction in response bias when presented as video-only, and also a reduction in lie detection accuracy. However, the response bias was similar for text presentation of both audio-video and audio-only recorded stimuli but detection accuracy was significantly different. These results suggest that a tendency to judge stimuli as truthful or deceptive may be largely unrelated to detection accuracy.

11.4 Conclusions

The final experimental study reported in this chapter aimed to continue to scrutinise the relative influences of visual and verbal cues on response bias of receivers and their accuracy at detecting deception. We conducted a study where stimuli were presented as video-only and text-only. There was little consistent support for the hypothesis that presenting stimuli as text-only would lead to tendency to judge stimuli as more likely to be deceptive. There was some limited evidence that if stimuli showed a truth bias when presented in their original format then this bias disappeared when judged as text-only. The results were not conclusive, but there was evidence that detection accuracy was reduced for the majority of stimuli when judged as text-only. Detection accuracy was significantly lower for all stimuli when judged as video-only. This result supported the findings from previous research suggesting that the use of visual cues for detection is limited. For the majority of stimuli, detection was greater for text-only than video-only, suggesting that lie detection is possible with a very limited range of verbal cues.

The final chapter summarises and discusses the main findings from the questionnaire and experimental studies reported in this work and attempts to position the findings within the greater body of work on deception and its detection.

12. General discussion

12.1 Introduction

The purpose of this chapter is to summarise the main aims and findings of the research presented in this thesis. The aims and findings of the studies will be discussed in terms of the perceptions and behaviours of people, the limitations and practical implications of the work and some suggestions for future research before some concluding remarks.

12.2 Research Aims

In general terms, this work aimed to build on previous work and investigate whether differences would be found in the perceptions and behaviours of people using a range of communication media. Specifically, it aimed to throw light onto the behaviour and perceptions of those people, termed receivers, attempting to detect deception when other people are attempting to deceiving them. The studies aimed to investigate the perceptions and behaviour of people, termed senders, who might deceive with various communication media. The research broadly uses an information transmission model of communication to understand the processes involved. A series of studies were conducted and reported here consisting of two questionnaire studies (Questionnaire Studies 1 and 2) which investigated people's impressions of a range of communication media and a set of possible lies which they might tell in real life. It also assessed their perceptions of which media they feel more or less uncomfortable deceiving with, most believable and likely to use if they were to tell these lies. Two live experimental studies (Experimental Studies 1 and 2) aimed to assess the frequency at which people would be prepared to deceive others while using each of three different communication media, and the confidence they had in the believability of their truthful and deceptive answers. Their communication partners, receivers, attempted to correctly judge when they were being lied to or told the truth and indicate how confident they were with their judgements. In order to tease out the media differences in response biases and detection accuracy that were found in these live studies, it was proposed to build a corpus of media recordings of senders being honest and telling lies. These recordings were replayed to new sets of receivers, as they were originally recorded and in modified formats in Experimental Studies 3 to 7. These studies aimed to assess the relative effects of interactivity, and a range of visual and speech cues on the tendencies of receivers to judge answers as truthful or not, and their ability to classify messages correctly as honest or deceptive.

12.3 Research Methodology and Main Findings

12.3.1 *Sender perceptions - media characteristics, preferences and choice for deception*

Researchers have become interested in whether individuals are more likely to lie using some communication media type than another and what drives any differences. The preferences people have for particular communication media types with which to deceive have been investigated by using hypothetical scenarios (Whitty & Carville, 2008; George & Carlson, 2005) and diary studies (DePaulo et al., 1996a; Hancock et al., 2004). Although diary studies have been important for the development of theories of media choice, they typically do not distinguish between whether media are chosen for planned deceptive purposes, or whether lies are told during an ongoing interaction. They merely ask people to record when they have told a lie and the media type which was being used. The diary studies do not tend to investigate which media people might prefer to use for deception, but which they actually use. As Vrij (2008) points out, there is a danger with diary studies that people cannot remember the lies they have told or might be unwilling to record them. We proposed to investigate the perceptions senders might have about a range of serious and trivial lies through the use of hypothetical scenarios. The frequencies with which people might actually use media types to deceive were investigated in later studies.

The questionnaire studies reported here used similar methods to Whitty and Carville (2008), where hypothetical scenarios of deception were shown to participants. The narrative varied according to the targets of the lies, how serious or trivial the deceptions were and whether the lies were self-serving or other-oriented. We extended the previous studies by employing some of the measures used in diary studies (DePaulo et al., 1996a) and asked participants to make a number of judgements about their perceptions of discomfort and believability if they were to tell these lies. Participants were also asked to indicate the frequency with which they use media types to communicate with various people, make judgements about some aspects of communication media and judge how likely they would be to use those media to deceive. The aims of this study were to describe some realistic contexts to people in which they might imagine themselves engaging in deception and to discover: whether they feel some lies are more serious than others; whether it matters if they get caught or not; whether they would feel comfortable and/or believable to different degrees if telling these hypothetical lies through a range of communication media. The media being: email; phone; live text chat; face-to-face; videoconferencing; and phone text (SMS).

Results from Questionnaire Study 1 indicated that people appeared to feel less comfortable and less believable with serious lies compared to trivial lies. They felt least comfortable and least believable when telling lies with face-to-face and audio-video and most comfortable with text-based media. The phone (audio-only) was intermediate. The degree of comfort and the ratings of believability appeared to measure the same factor, results clustered into three groups: textual media types; phone; and visual media. Analyses indicated that there was a strong relationship between the expected discomfort felt by participants and detectability. The relationship was highly significant for all media types. If participants felt uncomfortable telling a lie while using a particular media, they would also feel highly detectable. Results from Questionnaire Study 1 also indicated that the discomfort and detectability that people expect to feel varied between communication media. There were significant differences between some media types and the pattern of differences was almost identical between the degree of discomfort participants felt and the degree to which their lies would be detected. The media types clustered into three groups within which the majority of tests showed media were not judged to be significantly different from each other. These three groups were: the text-based media of email, SMS and text-chat; the visual media of videoconferencing and face-to-face; and the phone on its own. Participants felt less comfortable and believable with the visual and interactive face-to-face and videoconferencing media, and most comfortable and believable with text-based media types. The phone, an interactive but not visual media, fell between the two other groups. The results broadly supported the predictions of the social distance hypothesis (DePaulo et al., 1996a). The discomfort people expect to feel deceiving was related to the apparent distance of the medium (with visual media assumed to feel closer than the phone and textual media types). The more socially distant media were, the lower the discomfort felt while deceiving. The degree to which media afford the features which give rise to apparent social distance or media richness (Daft & Lengel, 1986) such as synchronicity, cue multiplicity, recordability and support for feedback are typically assumed a priori (Hancock et al., 2004, George & Carlson, 2005).

In Questionnaire Study 2, participants were asked to rate media types on a number of dimensions or characteristics in order to investigate whether some assumptions of media differences or similarities are justified. These were: how synchronous media are; the reviewability of messages; the degree to which messages could be planned; how close people felt to their communication partner and the degree of feedback a medium offered. Significant differences were identified between all the media in each of the characteristics. For each media type, the majority of characteristics were also perceived as being significantly different. However, a small number of comparisons did not identify significant differences. The analyses suggested that videoconferencing was perceived to be more similar to the phone than face-to-face in the support for message planning, closeness and feedback. Face-to-face was regarded as different to all other media conditions for all of the characteristics we investigated. It was regarded as displaying the greatest synchrony, closeness and feedback of any media. Face-to-face was regarded as having the lowest recordability and ability to plan messages (lower than phone and videoconferencing). The textual media tended to show the opposite degree of each characteristic, so textual media were regarded as recordable, distant, asynchronous, and low in feedback. Further analyses could reveal the nature of the relationship between the characteristics and impressions of discomfort and detectability. We found that feedback was judged to be greater face-to-face than the phone and videoconferencing which were both greater than text-chat. We also found that in terms of synchrony, all the media were regarded as different to one another. These results suggest that the categorical descriptions of media proposed by George and Carlson (2005) and Hancock et al. (2004) may not reflect the perceptions of senders. Hancock et al. (2004) suggest that face-to-face, phone, instant messaging and videoconferencing may all be regarded as synchronous, with email, letter and memo asynchronous. According to Hancock et al. (2004), face-to-face and videoconferencing can be regarded as not distributed and recordless. However, we found that videoconferencing was judged to be more distant than face-to-face and not different to the phone. Videoconferencing was also regarded as more recordable than both the phone and face-to-face.

In Questionnaire Study 2, we investigated the frequency which participants report using different media. We found significant differences in the numbers of interactions which take place with different media. The results were similar to those reported by diary studies (DePaulo et al., 1996a; Hancock et al., 2004; George & Robb, 2008) who found that face-to-face was used most frequently and more than the phone. However, our results showed that email, phone and SMS were used at similar frequencies, perhaps reflecting a growth in the ubiquity of these media types. All the media types were used at high frequencies (daily or more than once a day) by significant numbers of respondents apart from videoconferencing which was only used by only a small proportion of people. We also investigated the likelihood that people would use each medium to communicate with a range of target groups. Significant differences were identified in the likelihood to use each medium for communicating with: romantic partners; friends; work colleagues; the boss; and members of the family. Previous diary studies have typically only looked at the total frequency of interactions with each medium (George & Robb, 2008). However, results for the proportion of deceptions per interaction with each medium may be complicated if, for instance, particular media are preferred for deception but different media are preferred for interacting with some targets. Questionnaire Study 2 used a similar measure to Questionnaire Study 1 in order to investigate the discomfort people would feel deceiving with each medium. Results suggested that there was no significant difference in measures between the studies. Again, discomfort fell into three groups: highest for the visual media, lowest for the textual media and the phone was intermediate. We asked respondents to assess for each deception, depicting a range of targets, how likely they would be to use each medium. The analyses employed the likelihood of using a medium to interact with each target as a baseline measure to correct the likelihood of using a medium for deception. This procedure was employed to control for the general frequency of media use. After correcting for baseline likelihood of use, we found significant differences between media in the change of likelihood from baseline for deceiving each target group. Analyses indicated that for all deception targets; email, phone and face-to-face were reduced in likelihood from the baseline use and did not differ from each other. For all targets, text-chat and videoconferencing were judged to be more likely to be used than other media types. For the target groups of work colleagues and the boss, SMS was also more likely to be used than general use suggested. The likelihood to use each medium (corrected for deceptive and non-deceptive use) differed from the pattern of discomfort felt between media. These results may appear counterintuitive, however we can speculate that media preferences might exist where there are expectations of the target for a particular media to be used and any change might arouse suspicion. Alternatively, certain characteristics of the media mean that discovery in the future may be more likely even if immediate discovery might appear less likely. For instance, the visual media were regarded as engendering greater discomfort than the phone, however the phone and face-to-face did not appear to differ in the likelihood of using the media to deceive. The results from Questionnaire Study 1 indicate that discomfort felt by people is related to apparent detectability of deception. The results from Questionnaire Study 2 showed that the likelihood of using media for deception is not solely driven by how detectable people rate themselves as being. The analyses suggested a complex relationship between choice of media, the target of the lie, the general frequency of use and the discomfort telling the lie. Results indicated that respondents may be likely to change the media type for deceiving colleagues and the boss, but there is less evidence that they will change their general media use patterns for friends and partners. Hancock et al. (2004) argues that the phone would be preferred for deception over face-to-face, text chat and email because it is synchronous, recordless and distributed. Carlson and George (2004) argue that the media most preferred for deception should be face-to-face, followed by phone and email. They argue that deceivers should have the best chance of escaping detection in media which show higher levels of symbol variety, tailorability and rehearsability and lower levels of cue multiplicity and reprocessability (or recordability). Their reasoning may suggest that choice of media for deception is rational and depends exclusively upon the chance of escaping detection. This may be an unjustified assumption, for instance, people may choose a medium with which to lie because they are expected by their target to communicate in that way. There may also be other factors which drive media choice which may appear not to be rational. Results from the questionnaire studies indicated that after correcting for general use, face-to-face was not the most likely media to be used for deception.

The social distance hypothesis would indicate that the most apparently distant media would be preferred for deception, in our studies that would be (in order of highest distance): email; SMS; text-chat; phone and videoconferencing similar and finally face-to-face as least likely to use. Our results did not suggest this pattern of senders' likelihood to use media for deception. There were significant differences between uncorrected judgements of the likelihood to use each medium, however we did not perform analyses to identify the specific pattern of differences between media. A visual assessment of media differences might have suggested that face-to-face and phone were most likely to be used to deceive friends and partners, and face-to-face and email for deceiving people at work. However, after correcting for the general frequencies of use, these media did not appear to be the most likely chosen by senders. We found little evidence that the likelihood to use a medium for deception is directly influenced by how comfortable or detectable people feel. Respondents felt most uncomfortable and most detectable when face-to-face, but results did not show a reduced likelihood to use it for deception. Some comments from participants indicated that while they might feel more uncomfortable than using other media, they would still prefer to deceive face-to-face in order not to raise suspicion in the target. The descriptions from respondents regarding their media choices suggested that people might fall into different camps. Those who felt that their deception would be revealed through visual cues and would therefore avoid the richer, closer media types and those who felt that targets could be more easily convinced via rich media.

Why might text chat and video conferencing be more likely to be used for deception than for all interaction? The investigation into the perceived characteristics of each media type indicated that text chat was not regarded as significantly different to video-conferencing in terms of synchronicity, but both were higher than the highly recordable textual media and lower than phone and face-to-face. Synchrony was identified as an important media characteristic by George and Carlson (2005), and under some circumstances people would prefer synchronous media for deception. We may speculate that deceivers prefer a certain degree of synchrony. Media which showed a higher likelihood of use for deception were also the media types that were judged to have a low frequency of general use. There may be number of possible explanations for this finding. It is conjecture to suggest that perhaps people may prefer unusual media with which to deceive as they believe targets are also unfamiliar and cues to deception will be harder to assess. We did not find evidence that media richness predicts the likelihood of using a particular media for deception. We also did not find evidence to support Hancock et al.'s (2004) 3-factor model that the phone would be preferred for deception. A number of the studies with which we are comparing findings collected diary data of actual use, our data is from a survey asking people to judge descriptions of lies so a direct comparison of results may not be appropriate. Our findings may suggest that the receivers could be suspicious if they are contacted with an uncommon media.

Questionnaire Study 1 also investigated whether the patterns of detectability and discomfort felt lying with the different media types varied according to whether the lies were serious or trivial. With serious lies, results indicated that respondents felt less comfortable and more detectable. The relationships between media types remained comparable with the trivial lies, visual media were judged as most uncomfortable, textual media most comfortable and the phone intermediate. The lack of an effect of deception severity on media differences concurs with results reported by George and Carlson (2005) who also found little evidence for an influence of deception severity.

The narratives shown to participants also varied according to whether the lies were self-serving or other-oriented. According to DePaulo et al. (1996a) self-serving lies are those where the deceiver is perceived to benefit, such as when denying the (true) accusation of theft. Other-oriented lies are those told to apparently benefit someone else, such as telling someone that their suit is stylish when it's actually believed to be out of date. We investigated whether the relationships between media in detectability and discomfort would be different between self-serving and other-oriented deception. We found little evidence in our results to suggest that the relationships between media varied according to the subject of the deception. Whitty and Carville (2008) reported a difference in the likelihood of using particular media for telling self serving lies, but not for other-oriented lies. Questionnaire Study 1 investigated discomfort and detectability, not the likelihood of using media, and a direct comparison of findings may not be appropriate, and further analyses could be fruitful.

The questionnaire studies investigated the perceptions which senders had of their believability, discomfort and likelihood of using media in order to deceive various targets. The findings revealed significant differences between media for all these measures. A number of other methodological approaches have been taken in order to study actual frequency of deception rather than people's expectations of their feelings and behaviour. Diary studies are one such approach where typically people are asked to keep records of their interactions and when they have attempted to deceive (DePaulo et al., 1996a; Hancock et al., 2004; Serota et al., 2010). We proposed a experimental approach; Experimental Study 1, reported in Chapter 6. A significant limitation of diary studies is that the frequency which people use media cannot be controlled as people are in natural settings. This can lead to difficulties in interpreting results; are people choosing media with which to lie, or are they already using media and choosing to lie? Whether the total number of lies told is most important or the proportions of interactions which are deceptive (George & Carlson, 2005). Experimental Study 1 was designed to control for the number of interactions which participants engaged in and so help to resolve these interpretive difficulties. In our laboratory based study, participants acted as both senders and receivers. They communicated using three live, synchronous communication media; face-to-face; audio-video and audio-only. As senders, they chose whether to give honest or deceitful answers to a set of personal questions. Participants as receivers made judgements of the truthfulness of senders' answers. The study addressed some other limitations of previous research; the communication between participants was fully interactive, unlike the majority of deception studies which have used recordings as stimuli to be judged by receivers (see Vrij, 2008 for a review). In some previous studies participants were told when and sometimes what to lie about, even though there is some evidence that solicited lies may differ from unsolicited lies. In Experimental Study 1, participants could choose when, if and how to attempt to deceive. The ecological validity of the study was high as lies were both real and spontaneous. Ecological validity was also high as face-to-face was included as a media condition. This was important given the predominance of face-to-face in daily communications and the suggestion by some authors that it should be preferred for deception (Carlson & George, 2004). Some other reported laboratory studies as suggested by Mann et al. (2008) demonstrate little motivation for senders to escape detection or even for receivers to show accurate detection. The interactive experimental studies reported here were designed so that participants were motivated to succeed by using a points scoring system and prizes for being both believable as a sender and achieving accurate answer classification. Other drawbacks of much reported work may be that in some lie detection research investigating the relative influences of visual, auditory and textual channels, it has been assumed that answers produced in any modality are equivalent. Typically questions are asked face-to-face, recorded as audio-video and replayed to groups of receivers as for instance, video-only or audio-only (e.g. Mann et al., 2008). This doesn't take into account the possibility that the behaviour of people answering questions face-to-face may be qualitatively different from those communicating with audio-video or textually or using only audio. When using audio-video, the majority of work has not reported the technical quality without an apparent appreciation that the quality of the audio-video medium may significantly impact the behaviour and perceptions of users (e.g. O'Malley et al., 2001; Horn et al. 2002). For instance, Horn et al (2002) report that the spatial quality of video could reduced or enhance lie detection accuracy. In the experimental study, participants were required to both ask and answer ten personal questions in each of three media conditions: face-to-face; audio-video; and audio-only. The mediated conditions used a high quality videoconferencing system with video either on (audio-video) or off for the audio-only condition. After answering each question, senders were required to judge how believable they felt their answers were which allowed a comparison of results with the questionnaire studies. It was hypothesised that senders would feel less confident that they would escape detection in visual media conditions compared to an audio-only if the results agreed with findings from the questionnaire studies. We found little evidence for media differences in the confidence of senders that their answers would be believed. Senders were significantly likely to rate both their deceptions and honest answers as more believable than likely to be detected in all media conditions. This result was perhaps surprising for a number of reasons. The results from the questionnaire studies suggested that senders might feel more detectable and uncomfortable in the visual media conditions compared to audio-only. There is also evidence that senders may presume that their deceptions will be associated with increases in some visual behaviours, such as arm movements and self-manipulations, and decreases in eye-contact (Akehurst et al., 1996). However, there is also evidence that these behavioural cues to deception are those presumed to be associated with the nervousness expected of deceivers (Stiff & Millar, 1986, Akehurst et al., 1996). Akehurst et al. (1996) reported that these cues associated with nervousness were expected by participants in their study to be more apparent in the deception of *other* people rather than when judging their *own* behaviour. Taylor and Hick (2007) investigated the believed cues associated with trivial and serious deceptions in a questionnaire study. They found that for serious deceptions, there were a number of visual non-verbal behaviours which were expected to increase: eye contact, swallowing, biting lips, hand movements and tense posture. The majority of these behaviours are also those associated with nervousness. For trivial deceptions, these cues were not judged likely to increase. They found that in fact, some visual behaviours were expected to decrease in trivial deception contexts: facial twitching, shaking and self-manipulations. A possible explanation for our lack of significant media differences in the confidence of being detected is that participants did not feel particularly nervous when deceiving. Therefore, they did not presume that they were displaying visual cues associated with nervousness and did not feel more vulnerable to detection in visual media conditions. An alternative explanation is that people chose to deceive when they felt that their answers would be most believable. Variation in the detectability felt by senders might be revealed more effectively through the frequency of deception between media conditions. We shall discuss further experimental studies in more detail subsequently. However, a second experimental study was conducted in which participants were not free to deceive or be honest at will. Participants were instructed when to lie and when to tell the truth in their answers. They were required to deceive in 3/10 of their answers. We investigated senders' confidence that their deceptive and truthful answers would be believed. We found evidence that participants felt more confidence that their honest answers would be believed when face-to-face than in the audio-video condition. The study also investigated the frequencies of lies and honest answers which senders believed would be detected. There was evidence that the number of deceptive answers that were judged to be detected was greater when communicating with audio-video compared to face-to-face. There was also evidence that the number of honest answers that were expected to be believed was significantly greater in the face-to-face condition than in the audio-video condition. The proportions of lies that were expected to be detected when using audio-video were greater in this second study than in the first experimental study. These findings may suggest that when people are free to choose whether to lie or not, they may feel less detectable than instructed when and to which questions they may lie. To our knowledge this finding has not been reported in previous work.

Results from Questionnaire Study 2 indicated that people believed face-to-face to be closer, more synchronous and offer greater feedback than audio-video. Audio-video was regarded as more recordable than face-to-face. There is a possibility that the greater believability of honest answers shown in the face-to-face condition compared to audio-video condition of Experimental Study 2 are related to these to apparent greater impressions of closeness, synchrony and feedback. Also that the greater apparent detectability of lies when communicating with audio-video compared to face-to-face is related to the impression that videoconferencing is more recordable. These interpretations are at present speculation. In the experimental studies we did not measure participants' impressions of the characteristics of media conditions. The differences in methodology between the questionnaire and experimental studies would suggest caution in comparing findings. It was hypothesised in Experimental Study 1 that senders might overestimate the degree to which their deceptions would be detectable. The tendency for people to overestimate the degree to which their emotions are visible to others has been termed the *illusion of* transparency (Gilovich et al., 1998). Gilovich reported studies which found that people overestimated the extent to which their deception would be detected by senders in a face-to-face context. It was hypothesised that they believed their emotional states were more visible to observers than was actually the case. They also believed that they would be more likely to be detected because anxiety would be apparent to receivers. The findings from the questionnaire studies suggested that people felt more uncomfortable and detectable in visual media conditions than audio-only (phone) and we hypothesised that senders would both overestimate the extent to which their deception would be detected and also they might feel more detectable in visual media conditions compared to audio-only. The results from Experimental Study 1 indicated that senders believed approximately 25-33% of their deceptions would be detected. In Experimental Study 2, some 36-47% of lies were expected to be detected. In neither study were more lies expected to be detected than believed and there was little evidence for the illusion of transparency. As discussed earlier, there was some evidence that in the forced lie study, senders in the audio-video condition judged that more of their deceptions would be detected than face-to-face. It is possible that senders felt more vulnerable communicating with audio-video and this was a consequence of believing that their revealing, emotional states were more obvious. We did not directly investigate senders' hypotheses of their emotional state visibility and detectability which might have thrown light onto this speculation. The research investigating the cues which people believe reveal deception, to our knowledge has not focused upon possible media differences. Taylor and Hick (2007) demonstrated that a range of verbal and non-verbal cues were expected to both increase and decrease when people tell serious and trivial deceptions. They did not ask participants to identify which cues they believed might reveal their deception. Future studies could replicate the experimental studies reported here and require both senders to specify which verbal and non-verbal cues they believe themselves to be revealing under varying media conditions. Such a potential study could identify whether the range of cues are expected to be the same regardless of the media condition of production. This might reveal whether cues to deception are believed to be produced without conscious control, which might be expected if the cues are those associated with anxiety. Such a study might also ask receivers to specify which cues they used to make their judgements of veracity.

The questionnaire studies reported here were designed to investigate senders' perceptions of their discomfort, believability and likelihood to use media to deceive. Experimental Study 1 was designed to determine the frequency of lying when people were given the freedom to lie or tell the truth in an live, interactive context with another person. Participants were motivated to avoid detection and to be believed at all times by the use of a points scoring system. They achieved points for avoiding detection of lies and being believed when telling the truth. They lost points when they were disbelieved. Receivers were motivated to successfully judge the truthfulness of answers and lost points when they incorrectly judged honest answers as lies and also when they incorrectly believed deceptions they were told. Senders in Experimental Study 1 were found to deceive face-to-face in 40% of their answers; when using audio-video in 39% of their answers and when communicating with audio-only, in 47% of their answers. There were significantly more lies told when communicating audio-only than in other media.

The results are important because they concern real lies, albeit produced in a controlled experimental context. The frequency of interactions was controlled as was the choice of media conditions. The frequency of lies recorded in diary studies has revealed similar proportions of lies per interaction. DePaulo et al. (1996a) reported 20-32% lies per interaction, A higher proportion of phone interaction were found to involve deception than face-to-face. Hancock et al. (2004) reported approximately 26% of interactions involving deception. They found that approximately 27% of face-to-face interactions and 37% of phone conversations involved deception. In both diary studies the highest absolute count of lies occurred face-to-face but the greatest proportion of lies were found on the phone. George and Robb (2008) reported a diary study investigating the frequency of deception in face-to-face, phone, text-chat, SMS and email. They also reported proportions of lies per interaction of 20% for face-to-face and 33% for the phone, however they found no significant differences between face-to-face and other media. The results from Experimental Study 1 tend to support Hancock et al. (2004), the multidimensional approach which predicts that the phone would be preferred for deception. They argued that synchronous, recordless and distributed media would be preferred. They argue that synchronous media are preferred as lies tend to be unplanned and emerge spontaneously from conversation. All of the media conditions in the Experimental Study 1 were synchronous, however results from Questionnaire Study 2 suggested that respondents may regarded audio-video as less synchronous than face-to-face and audio-only. Video was also regarded as more recordable than face-to-face and audio-only. Results suggested that the phone was regarded as similar to audio-video in terms of closeness. Assessing the questionnaire results with Hancock et al.'s (2004) predictions, we might have expected the phone to be preferred as it is distributed, and less recordable than audio-video. Synchronicity was greatest in face-to-face, however all the media could be regarded as high in synchrony. The results also could be regarded as partially supporting the social distance hypothesis (DePaulo et al., 1996a). Questionnaire Study 2 results suggest audio-only is regarded as more distant than face-to-face, and more deception would be expected. However, the lower levels of deception found in audio-video suggest that the social distance hypothesis is no sufficient to explain the findings. We found little support for media richness theory (Daft & Lengel, 1986) which predicts that face-to-face would be the preferred media for deception as lying is regarded as an equivocal task.

An alternative and perhaps simpler explanation is that people believe themselves to be revealed predominantly through visual cues and consequently lie less in the visual media conditions, The popular notion that deception is revealed through non-verbal behaviour has been well documented in the literature (Akehurst et al., 1996; Anderson, DePaulo, Ansfield, Tickle & Green, 1999; Mann et al., 2002). Typically, visual behaviours associated with nervousness are those mentioned such as fidgeting, self-manipulations and gaze aversion. This belief in the importance of visual cues in revealing deception has also been identified within professional lie detectors such as the police and customs officers (Akehurst et al., 1996; Vrij, 2004), and within the research community (Lewis, 2009). The results from the questionnaire studies reported here also support the notion that people believe themselves to be more likely to be detected lying when they are communicating with visual media. Our results indicated that people felt both more detectable and more uncomfortable lying with audio-video and face-to-face media than the phone.

12.3.2 *Receiver perceptions and response biases*

Throughout the experimental studies reported here we investigated whether the perceptions of receivers were influenced by the media condition under which they communicated and judged the honesty of senders. We specifically looked at whether receivers were biased toward judging receivers as truthful or honest, and whether these biases varied according to communication media. We first considered whether there was a bias toward judging senders' answers as truthful in Experimental Studies 1 and 2 where participants engaged in live, interactive communication and acted as both senders and receivers. In Experimental Study 1 results as measured by the number of answers judged to be deceptive and also with the signal detection measure *c* indicated that there was a bias toward judging senders' answers as truthful; there was a truth bias. In Experimental Study 2 senders and receivers were instructed that they would be required to lie to 3/10 of the questions they were asked. We investigated whether receivers were biased towards judging senders as more honest than dishonest. Results indicated that receivers were significantly biased towards judging answers as truthful in all media conditions. In both live experimental studies receivers tended to judge the answers they were given as honest. There were no significant differences between Experimental Studies 1 and 2 in the degree of bias toward judgements of honesty. The observation of a powerful truth bias has been reported extensively in the literature (Riggio, Tucker & Throckmorton, 1987a; Levine et al. 1999; Millar & Millar, 1997; Boyle

& Ruppel, 2005; Burgoon et al., 2008). A number of explanations for the truth bias have been proposed. O'Sullivan, Ekman and Friesen (1998, cited in Millar & Millar, 1997) suggest that it arises from the *availability heuristic*, people are more often faced with the truth than deception and are consequently more inclined to believe other people. Burgoon et al. (2005) have argued that the truth bias is a cognitive shortcut or heuristic, they state that "truth judgments must often rely on stereotypical knowledge that is detached from the assessment of authentic cues" (p. 2). Kraut and Higgins (1984, cited in Millar & Millar, 1997) proposed that the "assumption of truthfulness in a conversational partner is a fundamental part of most conversations" (p. 2). Hartwig et al. (2002) suggest that an assumption of truthfulness is part of general conversational maxims. Truth biases have been reported in receivers' judgements even when the relative frequencies of truth and deception have been variable (Levine et al., 2006). Burgoon et al. (2008) reported evidence for a truth bias in their investigation of media differences in biases. However, this truth bias was only evident for judgments of senders who were deceptive in an audio-video condition. They argued that the intensified bias towards judging deceptive receivers as truthful in their audio-video condition was a result of a visual bias. In the experimental studies, we also investigated whether there might be media differences in judgment biases. No significant evidence was found for media differences in response biases in either Experimental Study 1 or 2. We had hypothesised that receivers' judgements might be more biased towards honesty when the communication media were visual (face-to-face and audio-video) compared to when audio-only. The bias towards judging senders as more truthful in visual media conditions has been reported in previous literature (Burgoon et al., 2003, Burgoon et al., 2008). It has been suggested that people appear to trust each other more when face-to-face than when using other media (Valley et al., 1998). Our studies had also investigated whether a visual truth bias might be more pronounced in the face-to-face condition compared to audio-video as, to date, there appears to be no studies reported which have directly compared face-to-face and audio-video conditions. The findings from the live, interactive experimental studies suggest that a truth bias can operate independently of a visual bias. Other authors have suggested that suspicion, or a tendency to disbelieve senders might be greater in richer media conditions (Boyle & Ruppel, 2005) as richer media afford more opportunity for the leakage of incongruent cues which induce suspicion. The experimental studies reported here did not find evidence to support this hypothesis.

12.3.3 *Receiver behaviour - classification success and lie detection*

In Experimental Study 1, where senders were able to choose when they might lie, no significant differences in the classification accuracy of lies and truthful answers were identified between media conditions. We identified that the overall classification accuracy of receivers was negatively related to the frequency of lies told by senders in all media conditions. Classification accuracy was not significantly different to that predicted by Levine et al. (2006) who reported evidence from a number of studies, that the greater the frequency of lies judged, the lower the overall lie and truth classification accuracy. They argue that this finding is a consequence of the veracity effect, receivers tend to judge answers as truthful and sender veracity is the most important predictor of classification accuracy. We proposed that as a consequence of the relation between frequency of lies and overall classification accuracy, the methods of signal detection theory would be used to analyse detection data. Analyses indicated that the lie detection accuracy measure of sensitivity, d' was not significantly different between media conditions. The relationship between the frequencies of senders' lies and lie detection accuracy was investigated. A significant negative relationship was found in the face-to-face condition, but not in the mediated conditions. The results indicated limited support for the veracity effect (Levine et al., 2006) and confirmed that analysis of lie detection accuracy separately from overall classification accuracy with signal detection metrics is methodologically sound. Lie detection accuracy as measured by d', was not found to be significantly more accurate than would be expected if there is no sensitivity to the deception stimulus. Results showed a high degree of individual variability in detection accuracy. Approximately 25%-33% of participants achieved negative values for d', which may indicates that they were more likely to judge deception as truthful. There were however, participants in each media condition who achieved values for d' of greater than 1.5 which suggested that they were successfully detecting deception. Results indicated that individual variability in detection accuracy was high. Individual variability may mask any media effects that might have been operating. The behaviour of senders may also introduce variability. If the proportion of senders' answers which are deceptive are extreme, it may be difficult for receivers to achieve high levels of detection success as they have fewer opportunities to observe and compare both truthful and deceptive answers. Vrij (2008) reported evidence that indicated that detection of deception is likely to be more accurate when receivers have opportunity to observe both truthful and deceptive messages. Lie detection may be enhanced by having a baseline of truthful messages to compare with deceptive answers.

The individual questions (60 in total) were analysed over the whole data set, to determine if there were some questions more or less likely to be answered truthfully. There was a very few questions that were particularly easy to detect as a lie to or be believed when they were given a truthful answer.

We argued that the variability in senders' frequency of lies (some senders did not lie at all, others lied in every answer they gave) may have contributed to the variability in receivers' detection accuracy. Experimental Study 2 aimed to reduce variability in signal detection measures by instructing participants when they should lie, and when to tell the truth. Participants were both senders and receivers in the study. As senders, as each question was asked, they were given instructions to either lie or answer honestly. Vrij (2008) suggested that lie detection is likely to be more accurate when lies are spontaneous rather than planned. Experimental Study 2 was designed such that senders had no time to plan their answers; they had no prior warning of either the questions they would be asked, or when they would be required to lie. Senders were instructed to lie in 3/10 of the questions in each media condition. No significant media differences were observed in detection accuracy. Detection accuracy in the audio-video condition was not significantly greater than that expected for those showing no sensitivity to deception. However, detection accuracy in both the face-to-face and audio-only conditions was significantly greater than 0. We found evidence of media differences in detection accuracy, lies were detected with significant accuracy in the face-to-face and audio-only conditions, but not in the audio-video condition. Vrij (2008) argued that evidence indicates detection accuracy should be better when receivers pay attention to what senders say, rather than how they behave. This might indicate that detection should be more accurate in audio-only media conditions compared to the face-to-face and audio-video conditions. Maier and Thurber (1968) found that classification accuracy was higher in audio-only conditions compared to audio-video, but evidence for significant differences between audio-only, face-to-face and audio-video have been rare in the literature. We may speculate that our results indicate that detection accuracy might be worse under audio-video media conditions compared to audio-only, but that communicating face-to-face does not confer the same disadvantage. We might also speculate that the unfamiliarity of the media and/or that receivers pay more attention to visual cues when communicating with audio-video than they do when face-to-face contribute to this disadvantage. The lack of studies which directly compare face-to-face and audio-video does not allow us to draw any firm conclusions.

In Experimental Study 1 response bias and detection accuracy scores showed a high degree of individual variability. There was a significant potential that media effects on the tendencies to judge senders as honest or deceptive and lie detection accuracy would be obscured by this variability in individual receiver behaviour. In Experimental Study 2, we controlled for variation in senders' propensity to deceive and instructed participants to lie in 30% of their answers. The change in experimental design was intended to reduce variability in receivers' responses. Evidence of media effects on the accuracy of lie detection was identified; however individual variability appeared to remain high and may have again obscured media effects. Variability in detection measures was not significantly different between the experimental studies. We determined that there was sufficient evident to warrant further investigation but that a modified experimental approach might be required in order to reduce the variability. Further studies were undertaken to increase receiver numbers and reduce the variability in stimuli. In order to achieve an increase the size of the receiver discrimination data sets, we proposed to use recordings of deceptive and truthful interactions. The following sections discuss the studies which were conducted in order to develop and use a corpus of truthful and deceptive media recordings as stimuli. A corpus of media recordings of senders being truthful and attempting to deceive had the advantage that studies could be conducted with a greater degree of control than the live experiments allowed, the numbers of participants could be increased, and judgements could be made of fewer senders. All these modifications were intended to reduce the variability in receivers' responses. Some research has suggested that detection metrics may vary between participants and observers of deception (Vrij et al., 2006a) or between live and recorded stimuli. Interpersonal deception theory (Buller et al., 1998) makes the claim that detection of deception will be higher with recorded stimuli. We investigated whether detection metrics were significantly different between live interactions and recorded stimuli through Experimental Study 3. Recordings of a subset of senders communicating in the audio-video and audio-only conditions of Experimental Study 1 were replayed to new participants who judged their truthfulness.

We investigated whether receivers were more or less biased towards judging senders as honest in a passive context compared to an interactive context. According to Hartwig et al. (2002), an assumption of truthfulness is part of general conversational maxims which might lead to greater bias towards judgements of honesty in a conversational context compared to a passive, non-interactional context. We have no significant evidence for an effect of interactivity on the measure of receivers' tendency to judge answers as honest or deceptive.

We compared data from receivers judging deceptions produced by senders in a fully interactive experimental context with data from receivers who judged the same stimuli as recordings to investigate whether accuracy of lie detection would vary according to the degree of interactivity. Results indicated that there were no significant differences in detection accuracy when receivers judged answers in a non-interactive context compared to the judgements of receivers in the original, interactive context. Interpersonal deception theory suggested that lower lie detection accuracy was likely to be found in an interactive context because senders are able to use feedback to modify their appearance and behaviour to appear more credible and also that cognitive and behavioural effort is greater in a conversational context. They argue that receivers have fewer resources to devote to detection (e.g. Burgoon et al., 2008). The results from Experimental Study 3 replicated those reported by Hartwig et al. (2002) who found no evidence for an effect of conversational involvement on detection accuracy. We did not find evidence for an effect, but in common with the previous experimental studies reported, results showed a high degree of variability. Variability in the detection measures from the non-interactive study were comparable to those found in the interactive study. Results of analyses of both the original interactive data set and the non-interactive data indicated that detection of deception was significantly better in the audio-only condition compared to audio-video. Detection accuracy was significantly better in the audio-only condition than that expected by chance discrimination. Accuracy in the audio-video conditions was no different to that expected if participants were guessing. Poor detection performance in the audio-video condition may suggest that even in a passive role, participants' attempts to discriminate lies from truths are disrupted by visual cues or they are not paying the same attention to the audio cues as receivers in audio-only conditions. Alternatively, this finding may be explained by significant variation in the behaviour of senders. The lack of significant effects of interactivity on response biases or detection accuracy suggested that we were confident that using recorded answers from senders as stimuli would not unduly affect interpretation of results.

Experimental Studies 4 and 5 (and subsequent studies) used the answers from two senders recorded in the audio-video and audio-only conditions during Experimental Study 1 as stimuli. The stimuli were presented in the order and media mode in which they were recorded to larger sets of receivers. The two senders, ***LS*** and ***AM***, were selected as they gave both lies and honest answers in both media conditions. There were variations in the proportions of lies told between the senders. ***LS*** gave 3/10 deceptive answers in both media conditions. ***AM***, gave 5/9 deceptive answers in the audio-video condition, 4/10 in the audio-only condition. Experimental Studies 4 and 5 were designed to investigate whether the limited evidence for media differences in detection accuracy would be supported by a larger set of receiver judgements. They were also designed to collect detection metrics in order to develop a corpus of truthful and deceptive stimuli which are reliably judged as truths or lies. Results indicated that for one sender, ***LS***, there was a bias toward judging audio-video stimuli as truthful which was not observed in the audio-only stimuli. Lie detection accuracy was significantly greater for audio-only stimuli compared to those recorded in an audio-video condition. Detection accuracy was also better than would have been expected by chance. For sender ***AM***, both audio-video and audio-only stimuli were significantly likely to be judged as truthful. No significant difference in lie detection accuracy was observed between media conditions, and receivers did not achieve greater accuracy than would be expected if they had been guessing. The response bias was compared between the studies and was found to be significantly more positive with the audio-only stimuli from the ***AM*** sender compared to the sender, ***LS***. There are a number of possible explanations for the difference in response bias between senders. One explanation is that senders differed in their appearance of honesty. Burgoon et al. (2008) suggest that some communicators may evoke general impressions of honesty regardless of their actual truthfulness. This is termed the demeanour bias (Zuckerman, Larrance, Spiegel & Klorman, 1980). Bond, Kahler and Paolicelli (1985) found evidence for a demeanour bias in a study where participants judged audio-video recordings of senders. Some senders were judged as dishonest when they were honest, and others judged as honest when dishonest. Kraut (1978) found that senders were consistently good or poor liars. A number of cues were reported to have been used by receivers to make judgements of honesty or deception, but were not predictive of deception including: amount of smiling, postural shifts and self-manipulation. Receivers also used plausibility, vagueness, consistency and latency of answers to judge truthfulness, which were predictive of deception. Riggio, Tucker and Widaman (1987b) content analysed audio-video recordings of truthful and deceptive presentations and found that socially skilled senders were consistently judged as truthful regardless of their actual veracity. Analyses indicated that ratings of truthfulness were positively related to verbal fluency.

One of the aims of the single sender studies was to reduce the variability in receivers' veracity judgments by increasing the numbers of receivers and reducing variability in sender behaviour. Results of lie detection accuracy measures suggested that variability was equivalent between the live experimental studies and the single sender studies. A significant proportion of receivers achieved negative scores for the signal detection measure *d'*, a measure of sensitivity to the deceptions stimuli. This finding suggests that a significant proportion of receivers were worse at classifying truthful and deceptive answers than would be expected if they judged by tossing a coin. In a further attempt to reduce the variability in detection measures, we determined that a median split of the data would be employed for subsequent analyses. Data from participants in each media condition were included in analyses if they scored equal to or above the median value of detection accuracy for the whole data set. The intention of this procedure was to reduce the variability in response data. Results were re-analysed using only a subset of the data and showed the same relationships between media conditions as the full data set. However, variability as determined by standard deviation from the mean was reduced and all subsequent analyses used this procedure.

An additional aim of the single sender Experimental Studies 4 and 5 was to collect data on receivers' judgements of truthfulness and deception for each recorded answer given by the senders. This was in order to select stimuli for use in further studies which were somewhat reliably judged as truthful or deceptive, and reliably judged correctly and incorrectly. It was determined that increases or decreases in detection accuracy for individual stimuli (a single question and answer interaction) could only be observed if stimuli were judged correctly by significantly more than 50% of receivers. The intention was to avoid stimuli which appear to be unlikely or even impossible for receivers to judge correctly. We also wished to avoid stimuli which were judged correctly by, or almost 100% of receivers as ceiling effects might be present. It was determined that an accuracy of some 60-70% would be appropriate as this is significantly greater than would be expected if receivers were guessing. The variability in detection accuracy between individual stimuli was high for both senders in Experimental Studies 4 and 5 and it was not possible to choose a set of stimuli which showed identical detection accuracy scores. However, we were able to select recordings of two deceptive and three honest answers from each sender in each of the audio-video and audio-only conditions from Experimental Study 1 to form a corpus of stimuli. The corpus of stimuli was used in further studies designed to investigate the relative impact of visual and auditory cues on response bias and lie detection accuracy.

Findings from the live experimental studies, the investigation of interactivity in Experimental Study 3 and the results from Experimental Study 4 provided evidence that detection of deception was less accurate in audio-video media conditions compared to audio-only. Differences in detection accuracy between audio-video and audio-only have been only rarely investigated in previous work. Mann et al. (2008) reported no significant difference in detection accuracy between audio-video and audio-only in their study of professional and lay persons' detection of real criminal confessions. Heinrich and Borkenau (1998) did not identify differences in credibility between deceivers presented as audio-video, audio-only and video-only. Burgoon et al. (2008) predicted that lie detection would be greatest in an audio-only condition compared to text-only and audio-video. They failed to identify significant differences between media conditions in detection accuracy, although the pattern of means conformed to their predictions. Davis et al. (2006) compared the classification accuracy of lies and truthful utterances made in criminal confessions. They compared presentation modes of audio-only, audio-video, verbatim transcriptions and content-only transcriptions. They reported that detection of lies was significantly lower in content only transcriptions than the other media conditions. They did record that audio-only showed the highest accuracy of lie detection, but reported no significant differences between verbatim transcriptions, audio-video and audio-only conditions. A number of decades ago, Maier and Thurber (1968) reported lower lie detection accuracy in an audio-video condition compared to audio-only. Kassin et al. (2005) recently reported that fragments of truthful and false criminal confessions were more accurately judged in an audio-only condition than in an audio-video condition.

Although experimental results identifying differences in detection accuracy between audio-video and audio-only have been relatively hard to find, there is a considerable body of work which suggests that such differences might be expected.

Experimental Study 6 investigated the effects of adding video information to stimuli originally recorded and presented as audio-only, and also the effects of removing video from stimuli originally recorded and presented as audio-video. Experimental Study 7 took the same stimuli, recorded as audio-video and audio-only and presented them to new participants in video-only and text-only modes. The results from Experimental Study 6 may throw some light on whether the behaviour of senders is crucial for their detectability (for instance, senders may capitalise on visual cues and/or modify their behaviour depending on receivers apparent suspicion) or it is the behaviour of receivers (for instance, receivers are distracted by visual cues) that most impacts detection.

We hypothesised that senders might use visual cues in an attempt to present an honest demeanour to receivers. A bias toward judging senders as honest in visual media conditions could be a consequence of this management of cues. For sender ***LS***, we found a significant change in response bias when video was removed from stimuli recorded as audio-video and they were judged as audio-only. For sender ***AM***, there was no significant change in the response bias when video was removed from audio-video stimuli. The results from sender ***LS*** may be explained by the hypothesis that visual cues are used strategically by deceivers to foster mutuality and to appear honest which increases the tendency to judge senders as truthful when they can be seen. Some theoretical and experimental work investigating the role of interactivity in deception (e.g. Buller et al., 1998; Burgoon et al., 1999; Burgoon, et al., 2003; Burgoon et al., 2005) argues that deceivers approach deception in a strategic manner. Schweitzer et al. (2002) reported evidence that receivers' ability to detect the deception was impaired by visual cues. This implies that senders modified their behaviour to reduce detection. Burgoon et al. (2008) argue that strategic communication is synonymous with the demeanour bias and senders will attempt to manage their appearance with non-verbal cues to appear honest. If these visual cues are removed then we hypothesised that any truth bias might also be reduced or removed and our results demonstrated this effect. If participants in the audio-video conditions reported here attempted to manage their visual behaviour in order to appear more honest, we might have expected that the removal of visual cues from audio-video stimuli would improve lie detection. We did not find evidence to support this hypothesis. We hypothesised in Experimental Study 6 that senders in an audio-only condition would not attempt to manage their appearance and subsequent addition of this visual information would not assist deceivers. We argued that if the difference in detection accuracy observed between audio-video and audio-only media conditions is a consequence of visual cues being used strategically by senders, then we might expect an improvement in detection accuracy when video was removed from audio-video, but no change when added to audio-only.

There is a considerable body of work that indicates that, rather than senders' behaviour being of primary importance, any media difference may be a consequence of receivers performing poorly in visual media conditions. Maier and Thurber (1968) found lower accuracy in audio-video compared to audio-only and argued that visual cues distracted receivers. Mann et al. (2002) asked police officers to make veracity judgements of criminal suspects and report which cues they used to make the judgements. Some 78% of the cues mentioned were non-verbal, even though non-verbal cues have been shown to be unreliable indicators of deception. Vrij, Granhag and Porter (2010) report work which suggests that when non-verbal behaviour and speech content are discrepant, they typically rely on the non-verbal behaviour to make judgements. Meta-analyses have shown that non-verbal cues tend to be less diagnostic of deception than many speech related cues (DePaulo et al., 2003). Zuckerman et al. (1982a) reported that classification of lies and truths was most successful when using tone of voice compared to other cues. Maier and Thurber (1968) argued that visual cues may distract receivers from attending to verbal cues perhaps more diagnostic of deception. These visual cues may not result in a bias toward judging senders as truthful, but merely distract receivers from focussing on verbal content and judging stimuli more often as deceptive. Stiff et al. (1989) did not find evidence for the distraction hypothesis but did report that receivers relied primarily on visual cues to make their judgments. In a second study, they investigated the effect of situational factors on the cues which influenced judgments of deception. In an unfamiliar context, receivers primarily relied upon non-verbal cues. In a familiar context, verbal content of stimuli was relied upon for making judgements. Although the experimental contexts were very different to those employed here (actors were used as senders, context was manipulated by location), perhaps familiarity with media has an influence on receivers' judgments. We might speculate that videoconferencing is a more unfamiliar media compared to audio-only and in such contexts receivers are more likely to attend to visual cues. A reduction in truth bias was observed for sender ***LS***, when visual cues were removed from the audio-video stimuli, we found that receivers tended to judge the sender as deceptive. The addition or removal of visual cues resulted in no significant change in response biases for sender ***AM*** stimuli. Receivers may be distracted by visual cues (Maier & Thurber, 1968; Kassin et al., 2005) or over-attend to visual cues (Vrij, Granhag & Porter, 2010) to the detriment of verbal cues which may be more diagnostic of deception. If this were the case, then we might have expected detection accuracy to be reduced when we added video to audio-only, and improved when we removed video from audio-video stimuli. Some research has indicated that we might expect lie detection to be improved when visual cues were added to audio-only recordings. Zuckerman, Driver and Koestner (1982b, cited in Heinrich & Borkenau, 1998) suggest that cross modal inconsistencies may reveal deception. The additional visual cues might have been expected to increase the chance of cross modal inconsistencies. This effect was reported by Krauss et al. (1976, cited in Zuckerman et al., 1979) who found that facial expression tended to reveal senders' deception, but only when senders were not aware of being watched. We did not find evidence for this improvement in accuracy in Experimental Study 6 when video (which senders had known at the time of recording was not being transmitted to receivers) was added to audio-only recordings.

Results indicated that the accuracy of deception detection was not found to be significantly different when video was removed from audio-video recordings and presented as audio-only for stimuli from senders ***LS*** or ***AM***. There was little evidence that detection accuracy was significantly different when video was added to stimuli originally recorded as audio-only and presented as audio-video. For sender ***LS***, results indicated that regardless of the mode of presentation, detection of deception was better for stimuli recorded as audio-only was better than for those recorded as audio-video. The detection accuracy was significantly greater for audio-only stimuli when presented in their original format so the results need to be treated with caution. For sender ***AM*** stimuli, both adding and removing visual cues appeared to have no significant effect on the likelihood of detecting the lies.

A possible explanation for media differences is that more lies tend to be told under audio-only conditions and therefore there are more opportunities to detect lies. We found no significant relationship between the frequency of lies told by senders and lie detection accuracy in the audio-video and audio-only conditions of Experimental Study 1, so we may tend towards rejecting this hypothesis.

Why did we not find adding or removing video to have an effect on lie detection accuracy? There are a number of speculative explanations for the lack of significant effects. Firstly, the results of measures of response biases and detection accuracy have shown a high degree of variability throughout the studies reported here. There appears to be high variation in the perceptions and behaviour of both senders and receivers. This variability may have tended to obscure media effects. Secondly, the detection accuracy and response biases, may fail to show significant effects of adding and removing visual cues because contrary to predictions from previous work, receivers are basing their judgements on the verbal cues which were available in all media conditions. Experimental Studies 7a and 7b investigated the experimental effects of removing all verbal information and presenting stimuli from senders ***LS*** and ***AM*** as video-only and removing the auditory aspects of speech and all visual cues by presenting stimuli as text-only. For text-only stimuli, we transcribed the full question and answer from senders and receivers in Experimental Study 1. Transcription included all words spoken. There was some representation of prosodic aspects of speech such as laughs or coughs, non-word and backchannels such as "uh huh". Significant pauses in speech were represented by new lines in the transcription. Aspects of speech such as pitch or loudness were not represented. The transcriptions were similar to those termed precise verbatim transcripts by Davis et al. (2006).

Considering response biases when stimuli were presented as video-only; Stimuli from Sender ***LS*** recorded in both the audio-video and audio-only conditions were more likely to be judged as deceptive compared to their original presentation mode. For sender ***AM***, stimuli recorded as audio-video were significantly more likely to be judged as deceptive when presented as video-only. Considering lie detection accuracy when stimuli were presented as video-only; for both senders ***LS*** and ***AM***, detection accuracy was significantly lower for stimuli recorded and judged in both audio-only and audio-video conditions when judged as video-only. A body of research has investigated response biases and lie detection accuracy of receivers judging honest and deceptive messages in both video-only and text-only conditions. Bond and DePaulo (2006) meta-analysed a series of studies and reported that messages are judged as less truthful in video-only presentation conditions compared to audio-video or audio-only. Mann et al. (2008) found experimental support for their argument that when judging honesty from only visual cues, receivers only have their stereotypical beliefs to rely upon and will tend towards judging senders as deceptive. Our results supported both their findings of a reduction in truth bias and also a reduction in lie detection accuracy when stimuli were judged as video-only. Bond and DePaulo (2006) also concluded that lie detection under video-only conditions was lower than audio-video and audio-only. Their analyses indicated that accuracy was equivalent for transcripts, audio-video and audio-only media conditions which all showed greater accuracy than video-only. Mann et al. (2002) found that more accurate lie detectors in a police officer sample, reported using cues from message content (vague replies, contradictions and so on), the least accurate reported attending predominantly to visual cues such as gaze aversion and posture. DePaulo et al. (1982) also found that receivers who were instructed to pay close attention to senders' tone of voice were more accurate detectors than those paying attention to visual cues or given no instructions. Our results support the typically reported finding that receivers tend to judge senders more suspiciously when they only have visual cues upon which to base their judgements. Their judgements are also significantly more inaccurate. Although a commonly held belief appears to be that deceivers are revealed by visual cues, the experimental evidence suggests this is not correct. It has been suggested in previous research that poor lie performance at lie detection may be a consequence of the truth bias so often also identified (Boyle & Ruppel, 2005; Burgoon et al., 2008). This hypothesis might suggest that when truth bias is reduced, detection accuracy would improve. Our results do not support this explanation for poor detection accuracy. The results may support the hypothesis put forward by Vrij et al., (2010). They argue that in the absence of other cues, receivers are forced to base their judgements on the stereotypical visual cues such as self-manipulations and gaze avoidance which are unlikely to assist accurate detection. In addition, these cues are likely to encourage judgements of deception because the presence of a stereotypical deception cue is likely to be noticed rather more than the absence of cues which are being looked for. The reduction in both truth bias and accuracy which we identified in video-only modes contrasts with the lack of experimental effects when video was added to audio-only stimuli. This may suggest that receivers made their veracity judgments of audio-only and audio-video stimuli using predominantly using non-visual information. Experimental Study 7 also investigated the response biases and detection accuracy of receivers' judgements of text-only stimuli. Although text-only media is less able to communicate much of the verbal information associated with speech such as changes in pitch, hesitations, and volume, it is able to communicate content. Our text-only stimuli were designed to capture as much verbal information as possible while still being in a form which non academic judges would find easy to comprehend without training on conversation analysis or other such discipline. The results from Experimental Studies 7a and 7b were mixed regarding response biases. For sender ***LS***, stimuli recorded in an audio-only condition and presented as text-only were no more likely to be judged as dishonest as when presented in their original recording format. Stimuli recorded as audio-video were less likely to be judged as truthful when presented as text-only. For sender ***AM***, stimuli recorded as audio-only were significantly more likely to be judged as dishonest when judged as text-only. However, stimuli recorded as audio-video were significantly more likely to be judged as truthful when presented as text-only. There was a significant truth bias found for the audio-video stimuli. Any interpretation of this complex pattern of results is speculative. However, Lindholm (2005, cited in Landstrom, 2008) report that witness statements were judged as less credible when presented as transcripts compared to audio-video. Bond and DePaulo (2006) report in their review, that messages were also judged as less truthful in transcripts compared to audio-video. Our results provide partial support for these findings. There is evidence from the literature that transcripts may be judged as more truthful than messages presented in other modalities. Davis et al. (2006) found a truth bias for transcripts of criminal suspect statements. This truth bias was greater than found in audio-video and audio-only modes. The results from the audio-video stimuli from sender ***AM*** supported these findings. Given the variability in experimental contexts, use of full statements and short fragments of conversation, laboratory based and studies of real criminals, it is perhaps not surprising that results have been mixed.

Regarding the detection accuracy for text-only presentation of stimuli: for sender ***LS***, results suggested that detection accuracy was better for text-only than video-only for stimuli recorded as audio-video or audio-only. Detection was also better for those answers recorded from the audio-only condition compared to the audio-video. Detection accuracy for sender ***AM*** stimuli was lower than when judged as the original audio-video mode, but not for the audio-only stimuli. Detection accuracy was lower than when judged in the original format, however, the results indicated that lie detection was possible when stimuli were stripped of visual and auditory speech information. The ability for lies presented as text-only to be detected, may have been greater for those detected at higher levels in the original conditions. Sender ***LS*** was consistently more likely to be detected than sender ***AM*** throughout the studies. That finding may indicate that ***AM*** was more competent at disguising deception than ***LS***. Alternatively, the senders may have differed in the cues they produced with no attempts at control. The results may also suggest that judgements of deception are being made with a combination of cues, but certainly content of senders' answers is being used successfully by receivers for detection. For the majority of stimuli, detection was better for text-only presentation than video-only. Davis et al. (2006) and Bond and DePaulo (2006) indicated that the detection accuracy may be expected to be equivalent between text transcriptions and stimuli with auditory information. Hancock et al. (2010) reported that detection could be as accurate in text-chat media as face-to-face, but it may be problematic to compare reading static transcriptions of questions and answers with synchronous text-chat communication. Burgoon et al. (2008) also argued that detection under textual modes could be better than audio-visual modes because text is both detached and thus not subject to the trust-building non-verbal behaviours of senders and also contains the verbal content clues which may reveal deception. Burgoon et al. (2008) argue that textual detection is likely to be attenuated as untrained detectors lack familiarity with linguistic clues to deception, also the linguistic clues to deception may vary according to context (Zhou, Burgoon, Nunamaker & Twitchell, 2004; Newman, Pennebaker, Berry & Richards, 2003). Fuller, Biros and Wilson (2009) achieved some 74% lie detection accuracy using automated linguistic analysis techniques which indicates that detection is quite possible using textual features. Linguistic features of deceptive communication have been investigated by a number of researchers. DePaulo et al. (2003), and Vrij (2000) both report that deceivers tend to reduce their overall word count. Newman et al. (2003) reported that deceivers use first person pronouns such as "I" and "me" less frequently than those telling the truth. They also found that liars tended to provide less complex stories which were characterised by greater negativity.

Although there was a degree of variability, results from the experimental studies suggested that there may be a hierarchy of media in which lie detection is more or less successful. Some results from Experimental Studies 4-7 which used recorded senders as stimuli provided evidence that receivers may be most likely to detect lies under audio-only conditions, less with audio-video, still less accuracy with textual media and least likely under video-only conditions. The presentation modes used in these studies were designed to remove cues in order to assess their relative influence on lie detection. There was little evidence that visual cues assisted receivers in detection, so we might speculate that any difference in accuracy between text-only and audio-only (and perhaps audio-video) is a consequence of receivers using vocal cues which accompany speech. The evidence that such paraverbal cues are diagnostic of deception has been mixed. Paraverbal cues are vocal cues which accompany speech such as pitch and response latencies. Zuckerman et al. (1981) and Zuckerman and Driver (1985) reported meta-analyses which identified a number of cues positively associated with deception;

speech errors, hesitations and pitch and one cue negatively associated, namely: response length. DePaulo et al. (2003) also identified pitch and vocal tension to be positively associated with deception and negatively associated was the length of deceivers' responses. Sporer and Schwandt (2006) meta-analysed paraverbal cues to deception and reported that a decrease in message duration was related to deception about facts (but not lying about feelings and facts). They reported a positive association between deception regarding facts and feelings and a significant increase in vocal pitch and response latency. Comparing sanctioned and unsanctioned lies, they found that sanctioned lies showed little relationship with paraverbal cues, only response latency. For unsanctioned lies (which provided the majority of our experimental stimuli) message duration, speech rate, filled pauses and response latencies were all associated with deception. There is convincing evidence that there are a number of paraverbal cues which may be used successful by receivers to detect deception. We may speculate that the most successful lie detectors in our studies used speech and verbal non-speech cues to classify senders' answers as truthful or not. That is not to discount the effects of demeanour, truth biases, the proportions of lies and truthful answers, individual differences in both receiver and senders' deception skills and a range of other influences including media condition. Of course, we also cannot discount the possibility that a combination of cues (discrepancies between visual and verbal cues for instance) may also be used by receivers to successfully detect deception.

There was evidence that, in addition to any media differences that resulted from presentation mode, differences in detectability also were evident between senders. There was also evidence that likelihood of detection was also influenced by the recording mode of stimuli. This finding may have implications for experimental design and as noted, many studies investigating media differences have recorded senders in audio-visual conditions and subsequently modified stimuli. We found evidence to suggest that senders' deceptions recorded as audio-video were less detectable than those recorded as audio-only even when presented in very different formats.

All studies revealed a considerable degree of variability in response bias and detection accuracy. In the questionnaire studies and in Experimental Study 1, we also found high individual variability in the frequency of actual lies, and participants' perceptions of discomfort and detectability. The design of the series of experimental studies was in part a process of attempting to reduce variability in receivers' detection accuracy and response bias. We attempted to keep variability to a minimum in Experimental Study 1 by controlling the frequency with which participants used media conditions and also the numbers of answers which they answered. A relationship was identified between the number of lies told by senders and the overall classification accuracy which suggested that by controlling the frequency of deceptive answers we might reduce receivers' variability in detection success. Variability in the frequencies of dishonest and honest answers which were given by senders was controlled in Experimental Study 2 by instructing senders to lie to 3/10 answers in each media condition. Variance was compared between the experimental studies and was not found to be significantly reduced in Experimental Study 2. We determined that the design used in the first experimental studies where individual senders were judged by single receivers might be a source of variability. The numbers of receivers judging senders could be increased if individual senders' recordings were used as stimuli. Greater numbers of participants would potentially reduce variability in detection metrics. Tests comparing the variance between the live experimental studies and those using single senders showed no significant reduction in variance. We determined that a form of median split of the data reduced variance in detection measures and was employed for all further analyses. A motivation for developing a corpus of media recordings of senders being truthful and attempting to deceive was that studies could be conducted with a greater degree of control. This control included: choosing senders with equal or approximately equal proportions of truthful and dishonest answers in all media conditions; using stimuli which had been reliably judged as truthful or deceptive; and through receivers judging few senders to reduce variability in sender behaviour.

Bond and DePaulo (2006) meta-analysed studies of deception detection and report that overall classification accuracy of honest and deceptive messages was approximately 53%, which was reported to be significantly greater than 50%. The observed standard deviation in mean percentage correct was reported as 6%. Analysed separately it was discovered that 61% of truthful messages and 48% of deceptive messages were correctly classified. The analysis revealed truth judgements were approximately 56%; evidence for a truth bias in receivers' judgements. The majority of their analyses used data from studies where stimuli consisted of 50% lies and truths. They argue that discrimination accuracy may depend heavily upon the baseline frequencies of truthful and deceptive messages. In the experimental studies reported here, the proportions of deceptive stimuli were never exactly 50%. The proportion of lies which receivers judged was variable in Experimental Study 1, 30% in Experimental Study 2 and varied between 30-55% in the single sender studies. This variability may have been a factor both reducing overall classification accuracy and also complicating the comparison of results between studies and media conditions. We contest that using signal detection analyses may address some of these analytic problems. However, results for detection accuracy exhibited consistently high variability.

Kraut and Poe (1980) suggested that people do not vary in their ability to detect deception. In a previous study, Kraut (1978) found no relationship between a receiver's accuracy in judging one person and that same person's accuracy in judging a second person. Kraut (1980) asserted that people judged as truthful by one person tend to be judged in the same manner by others. These findings may indicate that variability in receivers' veracity judgements would be expected to be low in our single sender studies. In an meta-analysis by Bond and DePaulo (2008) they found little evidence that individuals vary more than by chance in their ability to detect deception. They report that the fewer judgements receivers make, the greater the individual variability in discrimination accuracy. From their analysis, we would expect that our studies would show standard deviations of overall classification accuracy of approximately 5-10%. In Experimental Study 1, we found standard deviations of approximately 20%. However, analysing 115 samples where separate lie and truth classification accuracy were available, mean standard deviations were approximately 18% for both. The meta-analysis revealed that the range of accuracy between individuals was not different to that expected if judges had no discrimination ability. There were significant differences identified in sender credibility, some individuals were consistently judged as truthful, others as deceptive. Significant differences between individual senders were also identified in their detectability. They found little evidence that the ability to accurately discriminate messages varied significantly between individual receivers. Previous studies which have identified individuals who appear highly skilled at detection (e.g. O' Sullivan & Ekman, 2004 cited in Leach et al., 2009) was suggested to be no more than expected by chance variation. The high variability in our live experimental studies was therefore, perhaps not surprising, given the variability in senders' behaviour and possible credibility, and the relatively low number of judgements which receivers made. Variability in detection accuracy found our single sender studies is perhaps more surprising given that some factors which might have introduced variability were more controlled, such as sender credibility. We might speculate that to reduce the variability, the number of judgements made by receivers may be increased beyond that possible with only single senders, or the number of stimuli from individual senders could be increased beyond the 10-20 used in the studies reported.

12.3.4 *Conclusions*

We conclude by reiterating the main significant findings identified, followed by some limitations of the work and a range of suggestions for future research.

12.3.4.1 Significant findings

In the introductory chapter 3, we asked the following questions:

- Are lies and truthful statements classified by receivers more or less successfully under different media conditions? We identified evidence in the experimental studies that accuracy of lie detection was most accurate under audio-only media conditions, least accurate with video-only, and significant detection accuracy was identified in both text-only and audio-video conditions.

- Do people perceive some communication media as "easier" to lie with, that is, less likely to be detected? We found evidence from questionnaire studies that senders perceive their discomfort lying and their detectability to vary between media. Senders judged their detectability and discomfort to be greater in visual media, less in audio-visual media and least in textual media.

- Are the communication media that are chosen for deception the ones perceived to be "easiest" to lie with? The media with which senders were most likely to lie were typically the media with which they use most frequently. There was some evidence that unfamiliar or infrequently used media may be chosen for deception more than general use would suggest.

- Do the general perceptions about deception and communication media impact on the behaviour of senders, that is, does the frequency of deception change with the mode of communication? If so, how and why? We found significant evidence that the frequency of deception was greater in an audio-only condition compared to visual media types in an experimental study.

- Are receivers trusted to varying degrees when they are communicating under different media conditions? Consistent evidence that judgement biases were related to communication media was not identified.

We conducted two questionnaire studies which investigated some of the perceptions which senders hold regarding deception and communication media. The studies used descriptive scenarios depicting a range of deceptions and found evidence that the degree of discomfort and believability which participants felt telling lies varied for media types. Discomfort and detectability were related and are perhaps equivalent. Discomfort and detectability were greatest for visual media types, least for text-based media and was intermediate for the phone. We investigated but did not find evidence that media differences were affected by the seriousness of lies or whether they were self-serving or other-oriented. Results from a second questionnaire study indicated that media vary on a range of characteristics. The results suggested that there are subtle variations in media characteristics which may impact on media choice and sender behaviour. For instance, video conferencing was judged to be significantly different to face-to-face in a number of characteristics, and more similar to the phone, This suggested that the factors which made visual media similar to each other and yet dissimilar to the phone in terms of detectability and discomfort were perhaps not those of feedback and apparent distance. Media types showed differences in the likelihood that they will be used to communicate with different groups of people which influence the likelihood that they would be used to lie to those targets. However, the results were complex and the discomfort felt lying, the target of the lies and the general frequency of media use all appeared to impact upon media choice for deception. Media types used at low general frequency: SMS, text-chat and videoconferencing appeared to be more likely to be used for deception, especially for work colleagues, than would be expected by their low frequency of general use.

Two experimental studies were conducted in which senders and receivers told, and judged the truthful and deceptive answers which they gave to a series of personal questions. In Experimental Study 1, senders could choose whether to lie or not, in Experimental Study 2, they were instructed when to lie and when to tell the truth. In each study, participants asked and answered ten questions in each of three media conditions: face-to-face, audio-video and audio-only. The first study was novel in that in a truly interactive context, results indicated that given free choice, participants' frequency of deception was greater in an audio-only condition compared to audio-video. The result lend support to predictions that audio-only would preferred to visual media (Hancock et al., 2004: DePaulo et al., 1996a). Results did not support conceptualisation of media richness theory that richer media are preferred by deceivers. Significant media differences in overall classification accuracy and lie detection accuracy were not found. Media differences were not identified in response biases, although there was a tendency to judge all senders as truthful: a truth bias. Media effects were possibly obscured by the high degree of variability found in: the frequency of lies told; tendencies to judge answers as truthful or deceptive; and classification accuracy. In Experimental Study 2, media differences in response bias and lie detection accuracy were again, hard to identify. There was some evidence that detection accuracy was poor in the audio-video condition compared to face-to-face and audio-only. There was also evidence that in the audio-video media condition, senders expected more of their deceptions to be detected than in the first study where they could *choose* when to lie.

We aimed to address to variability in response bias and accuracy of detection by conducting studies which used recorded stimuli from Experimental Study 1 and presented them in various formats to larger groups of receivers. To test some predictions that detection accuracy would be improved when receivers were passive judges, we conducted a study to compare detection and response bias of receivers from Experimental Study 1 and receivers who watched recordings of senders. We found no evidence to indicate that the degree of interaction affected response bias or detection accuracy. The detection accuracy was found to be greater in the audio-only condition compared to audio-video.

In two further studies (Experimental Studies 4 and 5) receivers' response bias and detection accuracy was calculated from judgements of two senders chosen from Experimental Study 1. For one sender, ***LS***, accuracy was significantly greater for audio-only stimuli compared to audio-only when judged by a large set of receivers. The studies intended to collect detection data in order to select stimuli for later studies which were designed to investigate the relative influences of visual, auditory and textual cues on detection accuracy and response bias. Stimuli were chosen if they were reliably judged as detectable if deceptive, and judged as believable if they were honest. In Experimental Study 6 the originally not shown video was added to audio-only stimuli and video was removed from audio-video stimuli. The detection accuracy was not significantly affected by the modification of stimuli to add or remove visual cues. The result was perhaps surprising, but individual variability in detection accuracy was again found to be high. The results suggested that detection accuracy remained similar to that found when stimuli were judged in their original format. This finding may perhaps indicate that the influence of visual cues was minimal. Detection accuracy was still higher for the audio-only stimuli of one sender even when visual cues were added and remained low for audio-video stimuli when visual cues were removed. In the final Experimental Studies 7a and 7b, stimuli were presented as video-only and text-only to further investigate the influence of visual and auditory cues on detection accuracy and response bias. There was little consistent evidence that presenting stimuli as text-only lead to a change in the tendency to judge stimuli as more likely to be deceptive. Some limited evidence that if stimuli showed a truth bias when presented in their original format then this bias disappeared when judged as text-only. There was evidence that detection accuracy was reduced for the majority of stimuli when judged as text-only. Detection accuracy was significantly lower for all stimuli when judged as video-only.

The experimental studies identified significant media differences in the frequency which senders lied when given free choice. We also identified some media differences in detection accuracy, although results were not conclusive, Results which identified less accurate identification of deception under audio-video media conditions compared to audio-only were found. The results, although variable, indicated that even in laboratory based experimental studies, communication media can be shown to have effects on the perceptions and behaviour of both senders and receivers. This suggests that media effects may be significant even in experimental contexts where: participants do not know each other, limited or no interaction between senders and receivers; moderate levels of motivation by all parties; relatively trivial lies with few if any consequences of being caught.

12.3.5 *Limitations of the research*

Although studies were designed to address limitation of previous research, choose the correct dependent variables to investigate and collect data with the most effective measures, there were some limitations with the reported studies.

The limitations of the questionnaire study are both general and specific. In general, the questionnaire studies may suffer from the problem that data collected rely on senders imagining themselves: using media to tell deceptions, making a series of judgements regarding the seriousness of the deception and how comfortable they might feel telling the lie. There is evidence that people may vary in their likelihood to deceive. Serota et al. (2010) reported that the majority of people told very few lies, and a few told very many. We found evidence in Experimental Study 1 that the frequency of lying varied considerably between individuals. This means that for some individuals, we were asking them to make judgments about activities they would be unlikely to engage in. We perhaps might have conducted an investigation as part of the studies to determine people's tendencies toward deception and analysed our questionnaire data using propensity to lie as a factor. The same limitation could perhaps be levelled at the experimental studies. Propensity to lie may be a factor impacting on media choices as practised liars may prefer to choose different media to the majority (if the findings of Serota et al., 2010 generalise to our participants). We did not investigate demographic factors as part of our questionnaire or experimental studies. We are unaware of any studies which have demonstrated differences in cues to deception in between ethnic groups (Vrij, 2008; Bond, Omar, Mahmoud & Bonser, 1990) however, our participants came from a range of cultural backgrounds and we might have investigated and/or controlled for the possible impact of ethnicity.

A general limitation of both the questionnaire studies and the experimental studies is that we did not assess or control for participants' prior experience with different communication media. As the questionnaire studies indicated, the majority of participants may have been inexperienced with videoconferencing. In the questionnaire studies this may impact upon the both the judgements of media characteristics, but also the perceived detectability and likelihood of using the media for deception. It may conceivably be harder for participants to imagine how they will feel if they have to imagine a communicative context rather than remember a similar occasion. We ensured that participants in Questionnaire Study 1 had at least some short experience with videoconferencing, but not for respondents of Questionnaire Study 2 which was conducted online. The audio-video condition of the experimental studies may have been the first time participants had used a videoconferencing system. Those unfamiliar with the media may have behaved differently to those who were familiar with it. King and Xia (2007) reported that the appropriateness of media was positively related to participants experience with the media. They also found that perceptions of appropriateness changed over time as media were used more frequently. They did not specifically examine appropriateness of media for deception. Furner and George (2012) found that media choice was influenced by cultural background. Participants from China and USA judged the appropriateness of media for deception. Espoused collectivism was greater for Chinese respondents and was related to a preference for text-based media for deception over richer media.

In order to compare findings between the questionnaire studies and experimental studies, it would have been preferable to have included text-based media conditions in the experimental studies. Experimental design may have become more complex and demanding as with only three media conditions, pairs of participants typically took approximately an hour to complete the task.

Also, in order to compare findings between studies, it would have been advantageous to ensure that perceptual measures were equivalent throughout the questionnaire and experimental studies: measures of discomfort telling lies; believability; confidence that senders would be believed varied in scale types between studies.

Vrij (2008) reported evidence that a baseline of honest behaviour to compare deception with is an important factor in predicting detection accuracy. The participants in the experimental studies were unacquainted with each other. This was necessary to ensure receivers could not independently verify answers. However, there may not have been a baseline of honest behaviour demonstrated by some senders. We might have familiarised participants with each other with a communicative task which encouraged honesty before the experiment proper.

Results of receivers' detection judgements of stimuli from the two senders ***LS*** and ***AM***, significantly differed from each other on a number of measures. This difference in findings may have resulted from variation in the stimuli which might have been controlled for in a larger stimuli set. Stimuli were chosen because both senders had lied and told the truth in each media condition with other attributes. However, a stimuli set response bias and detection accuracy were further controlled for each media condition might have made interpretation of the results less problematic when presented in different formats.

There are a number of statistical analyses which we would wish to conduct. In particular, the discomfort and detectability in Questionnaire Study 1 could be further analysed with multi-factorial ANOVA to investigate whether there are significant interactions between the discomfort felt telling lies and other factors. These factors including: the seriousness of the deceptions; and whether lies were self-serving or other-oriented. Separate analyses have been conducted for main effects but interactions may reveal further relationships. Further analyses could also be conducted with the data from Questionnaire Study 2 to investigate the interaction between the discomfort felt telling lies and ratings for the media characteristics.

12.3.6 *Further research*

The results of the work (and also the limitations) presented here suggest a number of further studies that we argue would be valuable to undertake. We reported that there were differences in some perceptions and behaviours of both senders and receivers between face-to-face and audio-video media. Experimental studies to vary the technical characteristics of both face-to-face and audio-video to determine the impact of a number of characteristics including: perceived distance, feedback, and recordability. These may be operationalised by controlling the physical proximity of participants and modifying the visual and auditory quality of media conditions. Horn et al. (2002) reported some differences in detection accuracy when spatial quality of video was varied, we would aim to extend these findings to incorporate variation in a number of technical and characteristics.

Evidence for media differences in both deception and detection were found. It is unclear which behaviours both verbal and nonverbal were used by receivers to make judgements of veracity for individual stimuli. It is also unclear whether behaviours systematically varied between senders and media conditions which were diagnostic of honesty and deception. Detailed unpacking of these behaviours could valuably be undertaken as the cues associated with deception have not to our knowledge been investigated between media conditions. An analysis of cues produced under varying media conditions, may indicate whether senders were differentially attempting to control cues. The corpus of truthful and honest recordings may be extended to include messages which are not only consistently judged as honest or deceptive, but also vary systematically in the presence of visual, verbal and nonverbal behaviours. The cues believed by receivers to be associated with deception have been extensively reported in the literature (e.g. Taylor & Hick, 2007). The cues associated with deception have also been extensively investigated (e.g. DePaulo et al., 2003). However, an investigation of the cues produced by individual senders and their relationship to veracity judgements has to our knowledge not been investigated. The fine grained analysis of verbal and nonverbal behaviours will also point towards practical methods of lie detection, particularly automated analyses focused upon media types.

In terms of building upon studies reported here, an extension of the laboratory work to include other media conditions would allow a comparison of results with our questionnaire findings. Comparison of the findings between questionnaire and experimental studies would be assisted by measuring senders' perceptions of media conditions when they have the opportunity to deceive in the laboratory. For instance, the face-to-face media condition appeared to be a special case in some ways. Evidence from the questionnaire and experimental studies suggested that is the preferred media for deception by some people even though it displays all the cues which are perceived to reveal deception. Further studies to investigate why this apparent contradiction may exist could consist of examining the perceptions of senders and receivers in the face-to-face condition in a live experimental context. The extension of the experimental studies to include further media conditions may also allow the verification of recent studies which have investigated deception and aspects of personality, culture or ethnic background (e.g. Furner & George, 2012), These extra media conditions to investigate could valuably include media types which systematically vary on dimensions identified as in questionnaire studies, in addition to including completing the set of media currently in use.

Diary studies in the literature have tended to confuse people's preferences for media with which to deceive, with the tendencies to lie while using a particular media (e.g. Hancock et al., 2004). Field studies have also frequently been very short-term. A longitudinal diary study which can discern the relationship between choice of media for deception and, deception which spontaneously emerges from conversation may be investigated with an automated diary/questionnaire triggered by communication on smart phones.

12.3.7 *Concluding remarks*

Some studies have looked at deception with different media, but few have varied both production conditions *and* reception conditions. The vast majority of studies have used recorded stimuli which have been replayed to groups of receivers; very few studies have used live interactions.

The questionnaire and experimental work suggests that senders feel that their lies are more detectable when they can be seen, perhaps even more so when using high quality audio-video conferencing. In general, this finding fits with social distance theories in that, people will feel more uncomfortable and detectable with lying if there are channels that appear to them (whether true or not) to transmit their deception cues. These channels would seem to be those related to the visibility of non-verbal signals. Senders appear more likely to lie when they cannot be seen which may be a consequence of apparent social distance. However, when attempting to detect deception, receivers may achieve greater success in detection when they cannot see their communication partner. Our results perhaps indicate that detection accuracy might be worse under audio-video media conditions compared to audio-only, but that communicating face-to-face does not confer the same disadvantages. This apparent contradiction may change as videoconferencing or other media become more commonplace and familiar and behaviour of senders and receivers undergoes evolution. Perhaps receivers pay more attention to visual cues when communicating with audio-video than they do when face-to-face as a result of novelty. The lack of studies which directly compare face-to-face and audio-video does not allow us to draw any firm conclusions.

If any practical recommendations can be offered, they would be that the interactions we have with familiar people are unlikely to be significantly more or less filled with deception regardless of the means by which we communicate. But if work colleagues make an unusual choice of media we might be wise to attend carefully to what they say. If we want to be believed when telling the truth, then face-to-face may be the best means to convince someone. Strangers may be more inclined to lie to us if they cannot be seen, but we are more likely to detect any deception if we again, attend carefully to what they say and the way they say it. Watching what they do is probably fruitless unless it's their media choice that we are watching and not their smiles, eye contact or apparent lack of any visible signs of nervousness, anxiety or guilt.

Understanding the media preferences senders have for deception and the detection accuracy that receivers are likely to achieve will assist: human resource managers, security and forensic professionals and the judiciary who may wish to ensure that job applicants are honest during interviews, to develop communication systems which hinder deception, assist detection of criminals and facilitate honest communicators to be believed.

13. References

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14. Appendix - Questions asked in Experimental Studies 1 and 2

Question 1 – What is the name of your first School?

Question 2 – What is your mother's maiden name?

Question 3 - How many brother's and sister's do you have?

Question 4 – What is the name of the place where you grew up?

Question 5 – What is your father's first name?

Question 6 – What was your favourite subject at school?

Question 7 – What is the name of a book or cd that you recently bought?

Question 8 - Where was the last place that you went on holiday?

Question 9 – What kind of toothpaste do you usually use?

Question 10 – What is your favourite leisure pastime?

Question 11 – If you admire a famous person, who would it be?

Question 12 - What was the last movie that you watched?

Question 13 – What is the subject that you least liked at school?

Question 14 - What is the name of one of your best friends?

Question 15 - Which is a sport or game that you like playing?

Question 16 - What do you most like about Nottingham?

Question 17 - What do you least like about England?

Question 18 - If you could choose any, which car would you buy?

Question 19 - What do you do if you want to get some exercise?

Question 20 - Which shop have you recently bought clothes from?

Question 21 – What did you have for dinner last night?

Question 22 – When did you last go to the cinema?

Question 23 – What is your favourite drink?

Question 24 - If you could have anything as a pet, what would it be?

Question 25 - Name an ambition that you have?

Question 26 - What have you watched on television recently?

Question 27 - What are you studying, or have studied at university?

Question 28 - Which newspaper would you buy?

Question 29 - Which magazine do you like to read?

Question 30 - Which programmes would you never watch on TV?

Question 31 - Who is a movie star that you don't like?

Question 32 - What is your most prized possession?

Question 33 - Name a drink that you don't like?

Question 34 - Who or what really makes you laugh?

Question 35 - What irritates you?

Question 36 - What would you do to have a relaxing evening?

Question 37 - What will you do with your friends this week?

Question 38 - What do you think of first if someone mentions the USA?

Question 39 - Where would you like to visit that you've not been to before?

Question 40 - Where will you be next weekend?

Question 41 - Where do your parents live?

Question 42 - Which radio station do you listen to most?

Question 43 - What would you do if you won the lottery jackpot?

Question 44 - What is your favourite colour?

Question 45 - How old were you when you passed your driving test?

Question 46 - Name a country outside of the UK that you have visited?

Question 47 - Which is your favourite comedy programme on TV?

Question 48 - Is there a food that you find disgusting?

Question 49 - What is your favourite food?

Question 50 - If there were a general election tomorrow, who would you vote for?

Question 51 - What is the name of a band or singer that you like?

Question 52 - What is a job that one of your parents does?

Question 53 - How many pairs of shoes do you own?

Question 54 - Which is the website that you most frequently visit?

Question 55 - When was the last time that you read a newspaper?

Question 56 - Have you ever been caught speeding, if so how many times?

Question 57 - Which famous person would you like to have lunch with?

Question 58 - What is the most beautiful thing you can think of?

Question 59 - Where were you born?

Question 60 - What was the last book you borrowed from the library?