

Hemispheric Dominance for Deception: A Dual-task Performance Study

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Abstract

The vast majority of previous research on deception intended to investigate deception detection not the deceptive process per se. This study attempted to investigate the role of left and right hemispheres in deception. Thirty-two (15 males and 17 females) undergraduate students responded to 20 questions truly, and 20 questions deceptively, while finger-tapping with their right/left hand. Results of the study showed greater interference for deception than for truth telling. This main effect was qualified by a significant hand by condition interaction showing more right-hand interference during the deceptive process, implicating more left-hemisphere involvement in deception.

Keywords: deception, hemispheric dominance, finger-tapping, dual-task performance.

1. Introduction

Deception is a common aspect of human social interaction. People admit to lying twice a day, on average (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996), and to using deceit in 14% of emails, 27% of face-to-face interactions and 37% of phone calls according to Hancock (as cited in Brinke, MacDonald, Porter, & O'Connor, 2011). While these acts of deception typically are minor, white lies of little consequence, lies accompanied by powerful emotions and false emotional displays can have major consequences at individual and societal levels (DePaulo et al., 1996). Deception could be defined as the purposeful misleading of another by using false signals to modify the behavior of a receiver in a way that benefits a sender, at some cost to the receiver (Kozel, Padgett & George, 2004; Semple, & McComb, 1996). Blakemore & Frith (2004) consider deception in the context of a more general ability to infer intentions in the action of others, an ability that is fundamental to the survival of most animals. Gneezy (2005) classifies lies on the base of the consequences that the lie produces into four major categories: lies that help both sides, or at least do not harm anyone, lies that help the other person even if it harms the liar, lies that do not help the liar but can harm both sides or, at the very least, the other person and finally, lies that increase the payoff to the liar and decrease the payoff to the other party.

Ekman (1997) talks about two criteria for distinguishing lies from other kinds of deception; the liar intention and the target's information about this intention. On one hand the liar deliberately chooses to mislead the target, he may actually tell the truth, but that is not his intent, and on the other hand, the target is not notified about the liar's intention to mislead. The ability to correctly detect truths and lies is of crucial importance in many applied settings, and is an important task for professionals such as jurors, judges, police officers, lawyers, and psychologists in their daily work (Forgas & East, 2008). Therefore, in recent years, much effort has been devoted to developing methods of measurement that can accurately depict the act of deception, and various approaches to psychophysiological detection of deception have been developed (National Research Council, 2002). Most lie detection tools used to date are arousal-based protocols. The majority of these protocols are based on the assumption that, because of their fear of being caught, liars will be more aroused when answering key relevant questions than when answering comparison questions (Vrij, Fisher, Mann, & Leal, 2006).

Methods of detecting deception include the polygraph that measures changes in skin conductivity and variations in the heart rate and respiration rate, methods of physiological measurement, such as biofeedback and electroencephalography, psychological instruments (pencil and paper tests), analysis of facial expressions and other body movements, and evaluation of handwriting and voice (Lee, 2007). Other methods of studying deception detection have focused on the brain role during the deception process. These methods include blood oxygen level-dependent (BOLD) (Kozel et al., 2004), functional magnetic resonance imaging (fMRI) (Spence, Kaylor-Hughes, Farrow, & Wilkinson, 2008), hemispheric laterality (Malcolm, & Keenan, 2003; 2005). Understanding the brain basis of deception could lead to both a method in which deception is accurately detected and to a better understanding of disorders in which deception is a prominent component (Kozel et al., 2004).

In this study it was examined the laterality of truth and lie telling using dual task performance method. There are various ways to study laterality, ranging from neurosurgical testing by way of sodium amygdala injections into the carotid, electroencephalography, to dichotic listening and the dual-task or time-sharing paradigm (Lambert, 1989). It is a well-known empirical phenomenon that carrying out two tasks simultaneously is more difficult than performing either task by itself (Toga, Narr, Thompson, & Luders, 2010). The dual-task or time-share paradigm requires a subject to tap a key as rapidly as possible while simultaneously performing another task (e.g. speaking, reading, semantic decision making, etc.). This key is connected to a digital counter which records the exact number of finger taps produced by the subject. During the experiment, subjects are instructed to press the key as quickly as possible, first with their right index finger for example, (the right hand being controlled by the left hemisphere), then with their left index finger (controlled by the right hemisphere). At the same time, subjects are asked to perform another concurrent cognitive task. As a control, subjects are also asked to finger tap while remaining silent. The number of taps recorded when the cognitive task is present is then compared to the number of taps recorded when the subject is silent, as well as the number of taps produced by the left finger vs. the right finger. Any disruption in the finger tapping rate or any large discrepancy between the number of finger taps by the left finger compared to the right finger indicates that some type of interference occurred and tells which hemisphere was involved during the cognitive activity (Lambert, 1989).

Thus, greater right- than left-hand interference associated with a cognitive task implicates more left-hemisphere involvement, whereas more left- than right-hand interference indicates more right-hemisphere activity, since the finger-tapping of each hand is programmed primarily by the contra lateral cerebral hemisphere and two tasks should interfere with each other more if they involve the same hemisphere as opposed to different hemispheres (Yeary, Patton, & Kee, 2002). The purpose of this study was to examine the role of left and right hemispheres in truth and lie telling by using the dual task performance paradigm, since the vast majority of studies about deception intended to study deception detection, by using various methods not the deception process per se. Some of these studies reported that deception detection was correlated with the right hemisphere areas (Kozel et al., 2004; Malcolm, & Keenan, 2003; 2005; Stuss, Gallup, & Alexander, 2001), others (Mohamed, Faro, Gordon, Platek, Ahmad, & Williams, 2006) found more left hemisphere areas implicated in deception, while, Spence et al., (2008) found that deception is bilateral distributed.

2. Methods

In this study, the dual task performance paradigm (finger-tapping) was used to examine the role of right and left hemispheres in deception and truth telling.

2.1. Participants

Thirty-six undergraduate students enrolled in psychology classes from Yarmouk University (Jordan), volunteered to participate in this study. Handedness for participants was assessed by using the Edinburgh Handedness Inventory (Oldfield, 1971). Four of these participants didn't satisfy the criterion (80% right-handedness), so they were excluded. The final sample consisted of thirty two right-handed participants (15 men and 17 women ranging in age from 19 to 24 years).

2.2. Materials

Participants were interviewed individually, and were given an informed consent form and survey to complete. The survey contained 40 questions about general personal information, (e.g., age, marital status, number of brothers and sisters, daily income, having a driving license, having a car, etc.), and about academic status (e.g., GPA, major, semester credit hours matriculated, etc.). These questions were randomly distributed into four blocks: A, B, C and D, each contains 10 questions. Upon completion, they were given both oral and written instructions.

2.3. Procedures

Participants were comfortably seated in a separate room which contained a desk and a computer. They were asked to perform six finger-tapping (FT) tasks as follows:

1. Tapping with their right index fingers while looking at a white screen positioned 80 cm in front of them (right-hand baseline).
2. Tapping with their left index fingers while looking at a white screen positioned 80 cm in front of them (left-hand baseline).
3. Tapping with their right index fingers while answering the block A questions truthfully.
4. Tapping with their right index fingers while deceiving in their answers about the block B questions.

5. Tapping with their left index fingers while answering the block C questions truly.
6. Tapping with their left index fingers while deceiving in their answers about block D questions.

In all tasks, the participants were required to press a button, with their index finger, as fast as possible for a period of 30 seconds. The participants were told that they would hear a beep to signal that they should begin tapping with the required index finger. They were to continue this until they heard a second beep, 30 seconds later. The presentation order of blocks was counterbalanced so that no block was always administered first or last. The type of finger tapping task (right vs. left) was then alternated throughout the experiment. Responses on questions were recorded by audiotape for later verification during scoring.

3. Results

The primary-dependent measure analyzed was a percentage change score calculated according to the following formula: $[(TO-TC) / TO] \times 100$, where TO is tapping performance in the tapping only condition and TC is tapping performance with concurrent condition (i.e., deception or telling truth). A positive percentage change score reflects a reduction or “interference” in finger-tapping. A 2 (right/left hand) x 2 (deception/truth telling) repeated-measures ANOVA was conducted on the percentage change scores. A significant condition main effect indicated greater finger-tapping interference for deception ($M = 10.84$) than telling truth ($M = 6.53$), $F(1, 31) = 16.64$; $p < .001$. This main effect was qualified by a significant Hand X Condition interaction, $F(1, 31) = 14.28$; $p < .001$. As seen in Fig. 1, the deception condition was associated with more right-hand ($M = 14.77$) than left-hand ($M = 6.91$) finger-tapping interference, whereas the truth-telling condition showed no significant differences between left- ($M = 6.70$) and right-hand ($M = 6.35$) finger-tapping interference. Thus, the dual-task finger-tapping results show greater left-hemisphere involvement when participants deceive in answering at the experiment questions, while bilateral hemispheric involvement was observed when participants responded truly about the questions.

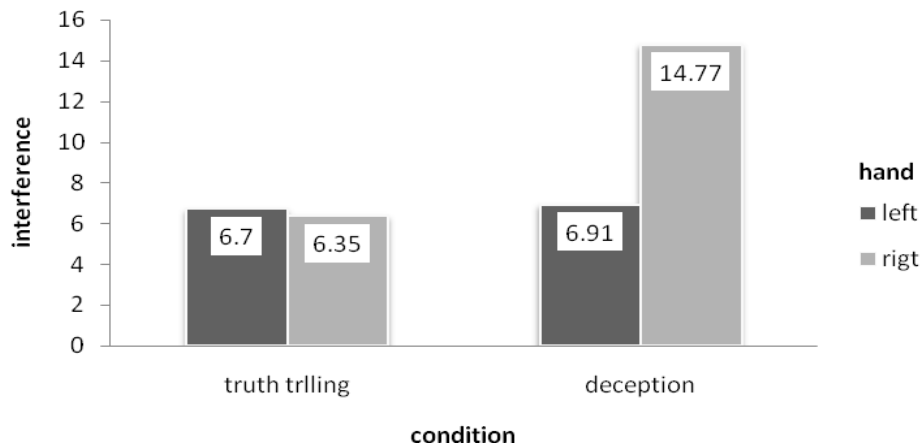


Fig. 1. Interference in finger-tapping as a function of condition.

4. Discussion

This study was conducted to examine the role of right and left hemispheres in deception and telling truth using the finger-tapping paradigm. Significant condition interference during deception was found, such that deception was associated with more interference than telling truth. This main effect was qualified by a significant Hand X Condition interaction. Participants tapped with their right hand (left-hemisphere dominance) during deception less than when they told the truth. This pattern of dual-task interference shows that deception is lateralized to the left hemisphere. This result presents evidence that the left-hemisphere plays an important role in lying. Taking in account that the vast majority of studies conducted about deception examined deception detection and related it to the right-hemisphere (Kozel et al., 2004; Malcolm, & Keenan, 2003; 2005; Stuss et al, 2001), but none of them examined the deception process per se; the results of the present study don't seem to be surprising. Many study results indicated that deception is an executive and cognitively demanding task, evoking the contribution of higher brain regions and cognitive processes (Kaylor-Hughes, Lankappa, Fung, Hope-Urwin, Wilkinson, & Spence, 2011; Vrij, et al., 2006), and that it requires many complex planning steps (Wimmer, & Perner, 1983).

Vrij et al. (2006) indicate that during the deceptive process, liars have to engage in additional tasks: inferring what others are thinking, and monitoring and controlling their behavior so they avoid creating the impression of lying, and that this will cause an extra cognitive demand. Most of the higher order cognitive processes are related to the left hemisphere, since this specializes in processing information that is analytic, linear and successive, while the right one specializes in functions that are synthetic, configurational, parallel and holistic in nature (Borod, 1992).

In conclusion, there was a right-hand tapping interference during the deceptive process than truth telling. These data support the hypothesis that left hemisphere is involved in deception. Further, they extend the literature on the possibility of using finger-tapping as a measure of hemispheric involvement.

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