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Using conditioning to elicit skin conductance responses to deception

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ABSTRACT

Lie detection research has focused on developing new methods of measuring physiological responses exhibited during deception. Little research has gone into understanding the contingencies that shape these physiological responses to deception. Using a conditioning procedure, participants' deceptive responses on a Cluedo-type game were paired with mild electric shock. The results suggest that such conditioning significantly increases the discriminative skin conductance response (SCR) exhibited during deception. Implications of these findings for interpretation of traditional lie detection tests are discussed, as well as how the above procedures can be practically implemented.

There has been much interest in developing and enhancing methods of lie detection (e.g., Sartori, Agosta, Zogmaister, Ferrara, & Castiello, 2008; Tsiamyrtzis et al., 2007; Vrij, 2008; Vrij, Granhag, Mann, & Leal, 2011; Walczyk et al., 2005). There are two major categories of approach to detecting deception: comparison question tests (CQT; American Polygraph Association, 2011; National Research Council, 2003; Raskin & Kircher, 2014), and the guilty-knowledge or concealed information tests (CIT; Rosenfeld, Ben-Shakhar, & Ganis, 2012; Verschuere, Ben-Shakhar, & Meijer, 2011; Vrij, 2008). Proponents of each of these approaches argue that they have a high and acceptable degree of accuracy of deception detection (Raskin & Kircher, 2014; Vrij, 2008). However, questions concerning the validity of such lie detection tests have been raised (Iacono, 2001; National Research Council, 2003) and fall in two broad areas: their theoretical underpinnings, and their actual degree of accuracy. In the light of these concerns, attention has been turned to procedures that may establish better links between deception and observable or measurable behaviours associated with this act which rely on strongly established links between underlying psychological states and the produced behaviours (see Tomash & Reed, 2013b).

The basic principles of many of these deception detection methods involve detecting physiological changes that are assumed to be produced by underlying psychological states, such as fear of detection, enhanced attention to cues, orienting responses, and increased arousal (Honts, 2014; Kleiner, 2002; Vrij, 2008). These psychological states are assumed to trigger a "flight or fight" response that, in turn, results in measurable physiological responses (e.g., increased skin conductance), and a number of theories have been proposed to accommodate this relationship (e.g., Handler & Honts, 2008; Kleiner, 2002). However, despite these efforts, there is still no accepted view that establishes such a psychological state-physiological outcome relationship in connection to deception (see Ben-Shakhar, 2008; Iacono, 2001; National Research Council, 2003, for reviews). Furthermore, there is a general consensus, even among deception-detection proponents, that there is a no specific "lie response" (Ben-Shakhar, 2008).

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In the light of these concerns, some have suggested a move to behavioural rather than physiological measures, such as reaction times (e.g., Seymour, Seifert, Shafto, & Mosmann, 2000), or even reliance on fMRI procedures (Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003). However, these approaches are not without their own problems (see Spence, 2008), and also do not have well-established links between their outcomes and the underlying psychology of deception. In addition, these methods do not increase the validity of lie detection procedures (National Research Council, 2003).

Other authors have attempted to produce stronger theoretical accounts of the relationship between the psychological causes and physiological correlates of deception (e.g., Handler & Honts, 2008; Kleiner, 2002). In many cases, these accounts have relied on some variant of a conditioning explanation to relate these responses to a psychological process (Handler & Honts, 2008). Skinner (1953) presented a simple explanation of how deception comes to elicit physiological responses. According to this theory (Skinner, 1953, p. 187), the physiological responses exhibited are a side-effect of the punishment individuals often receive in everyday life when their deception is detected. Tomash and Reed (2013b) corroborated this suggestion by showing that self-reports of previous punishment for swearing were associated with measures of autonomic activity in current situations where deception was practiced. However, despite claims that conditioning may offer a theoretical explanation for the deception–behaviour relationship, experimental evidence for this relationship is not abundant, especially when it is considered that the assumed stimulus or response in this case (lying in general) is an abstract and not a punctate physical stimulus (see Tomash & Reed, 2013b). One aim of the current study is to provide further evidence that such an association between an abstract event (deception) and an outcome can be conditioned.

The relationship between previous outcomes for deception and the physiological correlates of current deception have been studied using a variety of conditioning procedures. For instance, Jaffee, Millman, and Gorman (1966; see also Fleming, Grant, & North, 1968; Fleming, Grant, North, & Levy, 1968) classically conditioned an eyeblink response to instances of verbal deception, by pairing instances of deception with a corneal airpuff. Their results supported the notion that deception can serve as a conditioned stimulus, but there have been few, if any, attempts to expand upon this research. One such attempt was reported by Tomash and Reed (2013b), and involved the use of conditioning procedures to associate deceptive responses with a mild shock, in an attempt to increase subsequent levels of galvanic skin response (GSR) when deception was practiced.

The present experiment explored the conditioning of a skin conductance response (SCR) to instances of deception that were made true or false by the context of the experiment. An internally consistent context was developed in which participants could answer questions truthfully or deceptively, while, at the same time, minimizing the influence of personally relevant variables that would normally increase SCR. It was expected that deception within this contextually controlled setting could come to serve as a conditioned stimulus.

This experiment used a paradigm similar to the game Cluedo™. In this variation, participants had to deceive the computer regarding the identity of a murderer in a series of questions. Over the course of these trials, some deceptive answers were paired with mild electric shocks in order to see if this would impact on the SCR obtained from other examples of deception (i.e., to see if this procedure could enhance the physiological response seen in instances of deception while leaving other responses unaltered).

There are two aspects of the comparisons made in this experiment that need some comment. Firstly, rather than deliver no shock in a comparison condition (a condition employed by Tomash & Reed, 2013b), a parametric variation of the shock procedure was employed; one group received a strong shock, and one group received a weak shock. Conditioning should be greater in the strong shock group. Secondly, two variants of the conditioning procedure were employed: one using a continuous reinforcement schedule and one using a partial reinforcement schedule. In a classical conditioning eyeblink procedure, Fleming, Grant, and North (1968) and Fleming, Grant, North, and Levy (1968) found that better conditioning to the truth value of a statement was noted with a partial than a continuous reinforcement schedule. However, Tomash and Reed (submitted for publication) found the opposite results using a SCR procedure. As it is unclear which type of schedule will produce stronger conditioning to truth-value, the current study also compared a continuous with a partial schedule.

Method

Participants

Forty-eight Swansea University Psychology students (27 female) were tested, and had a mean age of 22.8 (±2.9 SD) years. They were recruited through Swansea University's Psychology Department's online subject pool, and they received course credits for their participation. All participants provided informed written consent prior to participating. The research, including permission to deliver shocks to participants, was approved by the Department of Psychology Ethics Committee, Swansea University.

Apparatus

Participant's SCR was measured using the ADInstruments© PowerLab 2/25 data acquisition system (ML825), which sampled continuously at 1 k/s. Finger electrodes were attached to the palmer surface of the first and third fingers of the