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Keeping your distance: attentional withdrawal in individuals who show physiological signs of social discomfort

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ABSTRACT

Being in close social proximity to a stranger is generally perceived to be an uncomfortable experience, which most people seek to avoid. In circumstances where crowding is unavoidable, however, people may seek to withdraw their attention from the other person. This study examined whether social discomfort, as indexed by electrodermal activity, is related to a withdrawal of attention in 28 (m=8, f=20) university students. Students performed a radial line bisection task while alone or together with a stranger facing them. Physiological arousal was indexed by a wrist monitor, which recorded electrodermal activity. Correlational analyses showed that individuals who displayed physiological discomfort when together showed a withdrawal of the perceived midpoint of the line towards them (and away from the stranger). Conversely, individuals who showed no discomfort exhibited an expansion of the perceived midpoint away from them. We propose that participants shift their attention away from the stranger to increase interpersonal distance and reduce anxiety/arousal.

1. Introduction

Being in close proximity to a stranger is generally perceived as an uncomfortable experience, which many people seek to avoid. As a result, when commuting to work in public transport, passengers opt to stand instead of sitting between two other people (Fried and DeFazio, 1974). Similarly, when standing in an elevator, people arrange themselves so that they are as far away from each other as possible (Lockard et al., 1977).

Exposure to crowding and personal space invasion triggers a number of physiological reactions. Commuters on public transport, for example, show elevated self-report stress levels, increased salivary cortisol and performance after effects when sitting in close proximity to other commuters (Evans and Wener, 2007). McBride et al. (1965) measured electrodermal activity while interpersonal proximity and orientation were manipulated in a laboratory setting. Electrodermal activity (EDA) is a reliable physiological indicator of heightened arousal and distress (Boucsein, 2012) and is related to other indices of stress, such as salivary cortisol (Reinhardt et al., 2012). McBride et al. (1965) observed elevated levels of EDA when participants stood 300 mm or 900 mm apart face-to-face compared to when they stood 2700 mm apart. The EDA response to proximity was greatest when participants stood face-to-face, was reduced when they stood side-to-side, and was the least when participants stood front-to-back. It therefore appears that standing face-to-face in close proximity with someone else is more arousing and therefore less comfortable than other orientations.

The physiological response to anxiety is mediated via the sympathetic nervous system and efferent input from brain structures such as the hypothalamus and the amygdala. The amygdala, in particular, appears to play an important role in personal space regulation. Kennedy et al. (2009) examined the personal space of a woman with bilateral amygdala damage. When asked to approach the experimenter until a point at which she felt uncomfortable, they found that her preferred chin-to-chin distance was substantially smaller compared to controls. When she rated her comfort when a confederate stood very close front-on, she rated the experience as comfortable whereas the confederate found it unpleasant. The role of the amygdala in personal space regulation was confirmed in an fMRI study, which showed that activation of the amygdala increased when the participant knew the experimenter was closer (Kennedy et al., 2009).

Individual differences in social discomfort can affect the physiological response to crowding. For example, Aiello et al. (1977) determined the distance at which a number of healthy participants started to feel uncomfortable. Participants were then

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classified as preferring either 'far interpersonal' or 'close interpersonal' distances. When exposed to a situation in which participants were in close proximity to strangers, the participants with a far interpersonal distance preference showed a marked elevation of EDA (i.e. distress) compared to the participants with a close interpersonal preference. In an EEG study, Perry et al. (2013) found that individuals that prefer far interpersonal distances also rated higher on the Liebowitz Social Anxiety Scale (LSAS). Moreover, they found that socially anxious individuals showed a decline in early N1 ERPs suggesting that less attentional resources are allocated to social stimuli. Perry et al. (2013) therefore argued that socially anxious individuals experience social discomfort earlier than others and, as a consequence, direct their attention away from social information.

Individual differences in social discomfort also affect cognition in crowded situations. Individuals who report that they feel uncomfortable in crowded environments perform worse on tests of creativity after they have been exposed to a crowded situation (Aiello et al., 1977). Similarly, Rawls et al. (1972) found that psychomotor performance deteriorated in close interpersonal situations for individuals who reported that they preferred to interact with others at a distance. The performance of participants who reported that they felt comfortable when interacting at close range, however, was relatively unaffected by manipulations of interpersonal distance (Rawls et al., 1972). While the above studies support the idea of individual differences in responses to crowding, it is important to note that the reported effects were small and in some instances ambiguous (Rawls et al., 1972, Exp.2).

Unpleasant as it might be, sometimes close social proximity cannot be avoided—especially on public transport. In order to cope with these situations, individuals employ strategies to feel more comfortable when confronted with the uneasiness of a personal space invasion. On public transport, such strategies might involve engaging in activities such as reading, playing with smartphones or listening to music over headphones (Evans and Wener, 2007; Hirsch and Thompson, 2011; Lloyd et al., 2009; Tajadura-Jiménez et al., 2011). A common strategy to deal with social proximity is therefore to withdraw attention to the wider outside environment and retreat into an attentional space confined to peripersonal space.

While withdrawing attention from the outside world using devices such as a smartphone is a strategic response, there is also evidence which suggests that withdrawal is a product of the physiological arousal itself. Tracy et al. (2000) manipulated arousal while participants performed a letter discrimination task where the targets were presented centrally or peripherally. Brain activity was measured using fMRI and arousal was measured using EDA. The results demonstrated that arousal was associated with a narrowed attentional focus, reflected in heightened thalamic activity, which may act as a gate to peripheral visual input. A narrowed focus of attention may also reflect the effect of cognitive load (Mackworth, 1965; Wood, 2006). For example Pomplun et al. (2001) demonstrated that visual span, as indexed by a visual search task, was substantially reduced with increasing task difficulty (see: Callaway and Dembo, 1958; Weltman et al., 1971). Therefore, for individuals who feel anxious in a situation of close social proximity, increased arousal and/or high cognitive load may lead to a withdrawal of their attentional space.

Individual differences in the effect of social proximity could have important implications for how we perceive and attend to the space that surrounds us. To explore this issue, we measured attention and arousal in an experiment which manipulated social proximity. Attention in radial space was measured using a perceptual line bisection task. Line bisection tasks are frequently used in clinical (Bonato et al., 2008; Loetscher, et al., 2012) and non-clinical (Hach and Schütz-Bosbach, 2012; McCourt, et al., 2001; McCourt and Garlinghouse, 2000) settings and provide a reliable index of shifts in spatial attention (McCourt, 2001). For lines that extend radially from proximal to distal space, a distal bisection bias is typically observed (Barrett, et al., 2002; Heilman et al., 1995). Arousal was measured using EDA, which is a reliable index of anxiety and arousal (Boucsein, 2012) and is affected by social proximity (McBride et al., 1965).

Spatial attention and arousal were measured while participants completed a line bisection task while standing: (a) alone or, (b) together so that they faced one another at an uncomfortably close distance. Given that close proximity with a stranger may cause anxiety and participants will want to withdraw from this situation, higher levels of EDA and a withdrawal of the subjective midpoint might be predicted for the 'together' condition. It is well known, however, that individual differences in reactions to social proximity exist (Aiello, 1987; Aiello et al., 1977; Rawls et al., 1972). These individual differences are bi-directional and can range from particularly negative reactions to close social proximity (Aiello et al., 1977; Rawls et al., 1972) to people who actually seek out and enjoy crowded situations where they identify with others (Novelli et al., 2013). Individual differences also exist in the way spatial attention is distributed and are affected by central dopaminergic function in normal individuals (Slagter et al., 2010) and levels of mid/frontal activation of the right hemisphere (Simon-Dack et al., 2013). These differences have the potential to override any overall difference between the conditions. To incorporate individual differences into the analysis, a correlational analysis examining the relation between individual differences in arousal and shifts in attention may be more revealing. For individuals who found close proximity unpleasant, as indexed by an increase in EDA in the together condition, the perceived midpoint of the line was expected to withdraw towards them. In contrast, for individuals who found close proximity pleasant, as indexed by a fall in EDA in the together condition, the perceived midpoint of the line was expected to expand towards the other person.

2. Methods

2.1. Participants

Sixteen pairs of unacquainted university students ($m=10$; $f=22$) participated in the experiment in exchange for AUD$10. Their ages ranged between 18 and 38 years old ($M=23.97$) and all had normal or corrected-to-normal visual acuity. Thirty-one participants were right-handed according to criterion set out in the FLANDERS handedness survey (Nicholls et al., 2013). Participants gave informed consent prior to the start of the experiment and the study was approved by the Human Research Ethics Committee at Flinders University. Two participants' data were excluded from the analysis because the participants did not follow the instruction requiring them to use one hand on each button (they used one hand for both buttons). Another participant was excluded because the electro-dermal sensors temporarily malfunctioned and no data were recorded. This left 29 participants in the sample ($m=8$, $f=21$). All participants were questioned about their relationship at the end of the experiment to ensure that participant pairs did not know each other.

2.2. Apparatus

Stimulus presentations were controlled with a PC running Windows XP and displayed on a LCD screen (2921 mm long and 5182 mm wide). The LCD screen was mounted in a tabletop so that the screen was facing upwards (see Fig. 1). The table was 790 mm high, 1200 mm long and 600 mm wide. E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA) was used to run the experiment and record responses. Each participant responded using a numeric keypad, which was placed within a black cardboard box to obscure their responses from the other participant. Electro-dermal activity (EDA) was monitored using the Affectiva Q-sensor. Closed-circuit audio/visual surveillance was used to oversee participants when the experimenter was outside the testing room.