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Review

Experimental public speaking: Contributions to the understanding of the serotonergic modulation of fear

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ABSTRACT

Public speaking is widely used as a model of experimental fear and anxiety. This review aimed to evaluate the effects of pharmacological challenges on public speaking responses and their implications for the understanding of the neurobiology of normal and pathological anxiety, specifically panic disorder. We also describe methodological features of experimental paradigms using public speaking as an inducer of fear and stress. Public speaking is a potent stressor that can provoke significant subjective and physiological responses. However, variations in the manners in which public speaking is modelled can lead to different responses that need to be considered when interpreting the results. Results from pharmacological studies with healthy volunteers submitted to simulated public speaking tests have similarities with the pharmacological responses of panic patients observed in clinical practice and panic patients differ from controls in the response to the public speaking test. These data are compatible with the Deakin and Graeff hypothesis that serotonin inhibits fear, as accessed by public speaking tasks, and that this inhibition is likely related to the actions of serotonin in the dorsal periaqueductal grey matter.

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1. Introduction

Public speaking is an important social skill that is related to the ability to interact with other people in a manner that is both appropriate and effective (Spitzberg and Cupach, 1989). Giving a speech involves the challenge of being observed and scrutinised by others, which can be a source of stress. Psychological stress can be threatening due to how it is perceived by the individual, as a risk of social embarrassment and humiliation, despite the lack of objective risk of physical danger.

Indeed, the experience of public speaking causes significant discomfort in the vast majority of people. The fear of public speaking

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has been described as the most prevalent fear among students (Geer, 1965), and further studies in general populations have demonstrated that approximately one-third to one-half of the studied populations fear public speaking (Stein et al., 1994; Furmark et al., 1999).

Public speaking has been explored experimentally in different ways. Some studies investigated the influence of psychological stress on a broad range of physiologic mechanisms, including cardiac, immune system, and hormonal function. Brain regions involved in the processing of stressful stimuli can be structurally and functionally evaluated through public speaking paradigms. Another line of research is the assessment of stress-associated disease vulnerability and the effects of psychological stress on general medical conditions. This experimental model can also be used to test hypotheses regarding the neurobiology and psychopathology of many mental disorders, particularly those related to anxiety.

In this review, we explore the effects of pharmacological challenges on public speaking paradigms and their implications for the understanding of the neurobiology of normal and pathological anxiety, specifically panic disorder. The face validity of experimental models of public speaking is nearer to social phobia than panic disorder. However, the rational underpinning the relationship between public speaking paradigms and panic disorder is based on the hypothesis that the experimental model mobilises some of the brain structures allegedly involved in the neurobiology of panic disorder, what will be deeper described in further chapters. Aiming a better understanding of the data provided by pharmacological challenges, we initially explored the main methodological features of public speaking paradigms and discussed the main results regarding subjective, physiologic and hormonal responses of healthy volunteers submitted to experimental models of public speaking.

2. Modelling public speaking

Several variations in the modelling of public speaking as an experimental paradigm exist. Across these various models, there are differences in the numbers of speeches in the same section, the times allotted for speech preparation and the times allotted for speech performance. In general, the speech is recorded, and the participant is told that an expert will evaluate his/her performance (e.g., Monteiro-dos-Santos et al., 2000), but some paradigms use a real audience composed of members of the staff (e.g., de Paris et al., 2003) or other volunteers who also perform the speech (e.g., Abrams et al., 2002). In a few studies, the participant has been told that, depending on his/her performance, he/she will receive a monetary reward (e.g., Panknin et al., 2002). The topics of the speech are diverse and, among other topics, may include academic knowledge, personal experiences, resolving an assigned moral dilemma, the most anxiety-provoking episodes of the subject's life, the subject introducing himself or herself, and controversial issues such as transgenic food, homosexuality, racism or abortion.

The most frequently used models of public speaking are the simulated public speaking test and the Trier Social Stress Test, which are described in more detail below.

The simulated public speaking test (SPST) was developed by McNair et al. (1982) and later modified by Guimarães et al. (1989) and basically consists of performing a speech in front of a video camera and while viewing one's own image on a TV screen. Before, during and after the speech, physiological and subjective measures are taken. Each volunteer participates in only one experimental session to maintain the novelty of the experimental situation. In studies involving pharmacological challenges, after a period of adaptation to the laboratory, baseline measurements are taken and then a capsule with drug or placebo is swallowed. After a time sufficient for drug absorption, pre-test assessments are performed, and the participant receives instructions about the public speaking task itself. The subject is allowed 2 min to prepare a speech and 4 min to perform it in front of a video camera. The speech is recorded, and the participant is told that the speech will be subsequently analysed by a psychologist. In early studies, the content of the speech was an academic issue, such as a topic in the discipline of physiology, which was randomly chosen from among twenty possibilities (e.g., Zuardi et al., 1993). Later, the theme of the speech was "episodes that caused the subject the most anxiety during his/her life" (e.g., Del-Ben et al., 2001). More recently, some studies have attempted to offer more neutral content, such as commenting on the transportation system in the region (e.g., Garcia-Leal et al., 2005), with the aim of limiting the aversive stimulus to the public speaking task itself. The subject takes preparatory measures just before the beginning of the speech, which is interrupted halfway through for the evaluation of performance measures. During the speech, the volunteer sees his/her own image on the monitor screen, and the researcher watches the presentation while being completely unresponsive to the speaker. After the conclusion of the speech, post-test measurements are made, and the session is then ended.

The Trier Social Stress Test (TSST) (Kirschbaum et al., 1993a) consists of a speech that generally lasts 5 min followed by a mental arithmetic task that also lasts around 5 min; both are performed in front of unknown evaluators. Participants are given 10 min to prepare a simulated job interview. The audience wears white lab coats, takes notes and is instructed to not provide any signs of positive reinforcement. The speech is recorded, and the participants are informed that experts will further analyse their performances. The volunteers are instructed to talk about their personal strengths and qualifications during the 4-min mock job interview. If the subject stops talking, he/she is first prompted to continue his/her speech before a standardised set of questions are asked. After the job interview, the arithmetic task is introduced. If the participants make a mistake, they are asked to start again from the beginning. Some researchers have utilised modified versions of this test, altering the topic of the speech (Kleyn et al., 2008), the time for preparation and the duration of the speech (Bouma et al., 2009), or using a video camera recording rather than an auditorium, that will supposedly be analysed later by an expert group (Quirin et al., 2011). Some paradigms remove the mental arithmetic task, which makes this task an approximation of the SPST (Kleyn et al., 2008).

The main difference between the two models is that the SPST involves only public speaking while the TSST combines two stressors: public speaking and a mental arithmetic task. Furthermore, the rationales behind the development of these two models were different. While the SPST was developed with the specific aim of testing the effects of potentially anxiolytic drugs on subjective states (McNair et al., 1982), the TSST was specifically developed to induce robust endocrine and cardiovascular responses in the majority of participants as a broader model of psychological stress (Kudielka and Wüst, 2010). For the purpose of standardisation, in the TSST, there is a clearly defined cut-off for a cortisol increase available, defined as an increase in plasma cortisol of at least 27.6 nmol/l or in salivary cortisol of 2.5 nmol/l over the baseline measures (Kirschbaum et al., 1993a).

3. Measuring the responses to public speaking

Both the SPST and TSST can provoke significant subjective and physiological responses. In general, subjective responses are assessed with validated scales, such as the Visual Analogue Mood Scale (VAMS) (Norris, 1971) and the Profile of Mood States (POMS) (McNair et al., 1992). Physiological responses involve autonomic