A Game Theory Perspective on Social Cognitions in

Non-Clinical Paranoia

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Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature:

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Date: 22.06.2018

Overview

This thesis explores experiences of individuals experiencing paranoia. Part one presents a systematic literature review of current research of behavioural strategies for managing paranoid experiences in the clinical and non-clinical populations. Results suggest that individuals engage in a range of coping and safety-seeking behaviours in response to experiences of paranoia. There is some evidence to suggest the impact of these behavioural strategies on paranoid experiences, distress and other factors relating to mental health. Overall, research in this area is limited, and further studies are required.

Part two presents an empirical paper investigating social cognition in non-clinical paranoia using an online Prisoner's Dilemma Game task. Participants' beliefs and expectations of the other player predicted behaviour during the task. Results suggest that the Prisoner's Dilemma Game is an effective tool in exploring social cognitive processes underlying non-clinical paranoia during a dyadic interaction.

Part three presents a critical appraisal of the research presented in the empirical paper. It reflects on the process of research, as well as the benefits and limitations of internet-mediated research.

Impact statement

Persecutory delusions (PDs) are core experiences of psychotic disorders. They are associated with a range of factors that impact upon quality of life, and mental and physical wellbeing, particularly if left untreated. Current guidelines suggest prevention, early detection and intervention. Recommended psychological interventions are Cognitive Behaviour Therapy (CBT) and Family Intervention. An essential component of CBT is understanding how behaviour can exacerbate or alleviate symptoms. Research presented in this thesis develops understanding of how behavioural strategies employed by individuals to manage paranoid experiences impact on the persistence of these experiences, the amount of distress experienced, and ultimately, the person's wellbeing. The findings suggest that people who experience paranoia engage in a wide range of behaviours in attempts to reduce threat and cope with distress. However, there does not appear to be consensus on the impact of individual behaviours as this is bound to context and intentions for use. Overall, the findings highlight the need for further study into this area. They also highlight the need for more precisely defined constructs of coping and safety-seeking behaviours. Clarity in these areas would help to identify adaptive or protective behaviours that help individuals who experience paranoia to keep well, which can be introduced to existing CBT programmes, as well as identify unhelpful behaviours to be targeted in treatment. It also emphasises the need for individualised and comprehensive assessment and formulation in treatment, as the context and intentions for behaviours appear key in determining their impact. In additional, coping and safety-seeking behaviours are transdiagnostic factors present in a range of mental health difficulties; clarity in constructs will benefit research and clinical intervention across these other areas.

It is recognised that self-report measures are subject to a range of explicit and implicit biases that can compromise the validity of the data collected. Research

in paranoia has attempted to overcome this by using 'live' social interactions in the form of strategic games to explore paranoia and underlying social cognitive processes. The finding in this thesis suggests that a Prisoner's Dilemma Game task allows for the investigation of individuals differences in how people approach, make sense of, and behave during a social interaction. This thesis recommends further studies to continue developing the task into an effective tool for use in the paranoia and psychosis research community. This will allow researchers and clinicians to better understand how people with paranoia experience social interactions and contribute to the development of treatment programmes for unhelpful social cognitive biases. The findings of this thesis can be disseminated through presentations to fellow researchers and to clinical teams working with people experiencing paranoia, and through publications in relevant research journals.

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Part 1: Literature Review

A systematic review of behavioural strategies for coping with paranoia

Abstract

Aims: This systematic literature review aimed to examine the current literature on the use of behavioural responses to manage paranoid experiences. It sought to determine associations between behaviour, paranoid experiences, distress and mental health, and other factors that affect wellbeing.

Method: A systematic search was conducted using PsycINFO and MEDLINE, alongside citation searches in October and November 2017. Studies were included if they met inclusion criteria and were assessed for validity of their data using the Critical Appraisal Skills Programme-Case Control Study Checklist (CASP, 2017). The studies were synthesised qualitatively.

Results: 14 studies were included in the final synthesis. The quality of the studies were rated as overall strong, however a large number of measures used and inconsistent results require cautious interpretation. Individuals employ a wide range of behavioural strategies to manage paranoia. There is some evidence to suggest associations with paranoia, distress, and factors relating to wellbeing, such as social integration.

Conclusions: The current literature in this area is limited. The findings suggest that behavioural strategies impact upon paranoia, distress and other factors, however further research is necessary to clarify associations and establish causal relationships. The findings also highlight a conceptual overlap between coping and safety-seeking behaviours that will require further clarification.

Introduction

1.1 The paranoia spectrum

Increasingly, psychosis has been viewed as existing along a continuum, with psychotic-like phenomena on one end of the spectrum in the general population, and more severe psychotic experiences on the other (Elahi, Perez Algorta, Varese, McIntyre, & Bentall, 2017; Freeman, Pugh, Vorontsova, Antley, & Slater, 2010; Hanssen, Bak, Bijl, Vollebergh, & Os, 2005; Johns et al., 2004; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). Evidence suggests a dimensional model, where many people in the general population experience mild, transitory symptoms and could be considered more vulnerable to psychosis, however only a relatively small number of these individuals cross the threshold and present with clinically significant distress and impairment, through further interactions with relevant risk factors (Johns et al., 2004; van Os et al., 2009). Of the remaining individuals, most do not experience persistent symptoms, or continue to experience them at a sub-clinical level (Hanssen et al., 2005) and do not present a 'need for care'.

Cognitive models of positive symptoms of psychosis note the importance of negative interpretations of unusual experiences (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001; Morrison, 2001). In the context of biopsychosocial risk factors, a person may experience an anomalous event. For example, an internal cognitive event, such as a thought, may be experienced as external, i.e. coming from someone other than the person. This leads to changes in affect, which influences both the interpretation of the anomalous experiences and the content of the experiences. Negative beliefs, behavioural responses, cognitive and affective biases are also incorporated into a search for an explanation for the original event, leading the person to develop a belief that is considered 'abnormal' in the person's cultural

context, and the associated levels of distress. Within these models, whether a person transitions from fleeting psychotic-like experiences to clinical symptoms depends on the extent of their negative interpretations, negative affect, and cognitive and behavioural responses.

Single-symptom approaches have been increasingly adopted for investigating psychotic disorders (Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017; Owen, O'Donovan, Thapar, & Craddock, 2011). Persecutory delusions are one of the core symptoms of psychotic disorders. It is regarded as a firmly held threat belief comprised of two main factors: 1) harm has occurred or will occur to the person, and 2) harm will be deliberately carried out by an external persecutor (Freeman & Garety, 2000). Current understanding of persecutory delusions suggests that it lies on the severe end of the paranoia spectrum, with suspicious thinking on the other, milder end (Elahi et al., 2017; Freeman, 2006). Paranoid experiences have been found to be associated with a range of risk factors, including victimisation experiences, alcohol dependence, stressful life events, less social cohesion, poor social functioning and suicide ideation (Freeman et al., 2011; Johns et al., 2004).

Current cognitive understandings that encompasses the spectrum of paranoid experiences suggests six main factors that contribute to the formation and maintenance of persecutory delusions: worry, negative self-beliefs, anomalous experiences, sleep dysfunction, reasoning biases and safety-seeking behaviours (SSBs). A person may shift from suspicious thinking to persecutory delusions along the paranoia spectrum as they begin to experience more worry, anomalous experiences and engage in more SSBs in a context of activated negative self-beliefs, reasoning biases and sleep dysfunction (Collett, Pugh, Waite, & Freeman, 2016; Freeman, 2016; Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002; Freeman, Pugh, & Garety, 2008; Koyanagi & Stickley, 2015; Reeve, Sheaves, &

Freeman, 2015; Ross, McKay, Coltheart, & Langdon, 2015). The presence of each of these factors alone may not lead a person to develop persecutory delusions when these threat beliefs are unfounded, however in the event of a sufficient level or sufficient combination of these factors, they may move further along the spectrum and experience associated distress and impairment. We may expect to see increasing intensity and frequency of these factors as people move along the paranoia spectrum, increasing the person's perception of threat. Freeman (2016) proposed that the main goal in treating persecutory delusions is to help people regain their sense of safety.

Though the content of persecutory delusions may be specific, the maintenance processes driving the formation of these threat beliefs are often transdiagnostic. For example, cognitive and reasoning biases, negative beliefs, and sleep dysfunction are all processes involved in anxiety disorders. Our understanding of how these processes can be addressed in treatment of other conditions can inform the development of targeted treatment programmes for people with persecutory delusions. There is evidence to show beneficial effects in Cognitive Behaviour Therapy (CBT) targeting negative self-evaluations (Freeman, Waller, et al., 2015), CBT for insomnia (Freeman, Waite, et al., 2015; Myers, Startup, & Freeman, 2011), CBT for worry (Worry Intervention Trial; Freeman, Dunn, et al., 2015) and reasoning biases (Emotional Processing and Metacognitive Awareness, Hepworth, Startup, & Freeman, 2011; Metacognitive Training, Moritz & Woodward, 2007; 'Thinking Well', Waller et al., 2015). Despite these developments, there appears to be limited research into working with safety behaviours in the context of paranoia.

1.2 Paranoia and anxiety

At the heart of anxiety disorders, a person holds the expectation of danger and threat (i.e. social, physical or psychological). There is a clear overlap with the

expectation of threat in persecutory delusions, particularly in social anxiety, where fear arises from perceived threat from interactions with others in a social setting. In an investigation of the structure of paranoia in the general population, Freeman and colleagues (2005) proposed a hierarchical model, where the most common presentation of paranoia is 'social evaluative concerns', sharing worries most commonly seen in social anxiety. Whether a person goes on to develop social phobia or paranoia depends on the presence of anomalous experiences (Freeman, Gittins, Pugh, Antley, Slater, & Dunn, 2008). Anxiety also has an important role in the persistence of persecutory delusions, propelled by the process of worry and the lack of disconfirmatory information. Negative affect not only makes it more likely that a person will interpret anomalous experiences more negatively, the content of those experiences is also more likely to be threatening. Given the overlaps between the two disorders, we may look toward the literature on SSBs in anxiety disorders to further our understanding of how they contribute toward persecutory delusions.

1.3 Safety behaviours and anxiety

Safety-seeking behaviours are defined as actions that are taken by a person to reduce harm and protect themselves in a context of perceived (not actual) threat (Salkovskis, 1991). They can be used in anticipation of the feared event (e.g. avoidance), after the person has entered the feared situation (e.g. escape) or during the feared event (e.g. in-situation safety behaviours).

They are present in a range of anxiety disorders, such as panic (Salkovskis, 1991), health anxiety (Tang et al., 2007), and social phobia (McManus, Sacadura, & Clark, 2008). Whilst SSBs are reinforced by an immediate decrease in anxiety, they can maintain the perception of threat and distress over time as the person associates the lack of the feared consequence with the use of the SSB. This leads the person to over-estimate the likelihood of the feared event in the absence of the SSB. SSBs also prevent the person from gaining disconfirmatory information (i.e.

evidence that the fears are unfounded), habituating to anxiety, or developing more effective coping strategies to manage their anxiety. In some cases, the use of SSBs may increase the likelihood of the feared outcome (Clark, 1999; Helbig-Lang & Petermann, 2010; Piccirillo, Taylor Dryman, & Heimberg, 2016).

Paradoxically, safety behaviours prevent the person from achieving their desired sense of safety in the long term and instead maintain perceived threat. Therefore, treatments for anxiety disorders have included efforts to decrease or eliminate the use of these behaviours for a person to relearn safety. Evidence suggests that a reduction in safety behaviours significantly reduces anxiety, for example, in social anxiety disorder (Morgan & Raffle, 1999; Schmidt et al., 2012; Schreiber, Heimlich, Schweitzer, & Stangier, 2015), panic disorder, and generalised anxiety disorder (Schmidt et al., 2012).

1.4 Safety behaviours and paranoia

Given the similar processes proposed in the cognitive models of persecutory delusions, we may expect that SSBs act upon paranoid beliefs in similar ways to anxious beliefs, i.e. that they maintain threat and prevent the person from gaining a sense of safety. There is evidence to suggest that the use of SSBs is associated with increased frequency of psychotic-like phenomena in a student sample, as well as associated levels of distress (Campbell & Morrison, 2007). There has also been evidence to show that engaging in SSBs is associated with other factors that can impact upon quality of life, or exacerbate paranoia, such as lower self-esteem (Bentall et al., 2008; Kesting & Lincoln, 2013). A recent meta-analysis of the existing literature (Tully, Wells, & Morrison, 2017) found that people respond with a range of behaviours to cope with psychotic experiences. There was also an overall association between SSBs and distress in psychosis, as well as perceptions of threat, however the review noted that results from individual studies were inconsistent.

Understanding how SSBs are involved in maintaining persecutory ideas specifically is essential in developing targeted treatment programmes with the aim to reduce delusional distress by helping a person relearn safety and, in recovery, be able to cope with continued anomalous events in more effective ways. It would also provide information for use in psychoeducation (i.e. in high risk and vulnerable populations) to prevent exacerbation of transitory persecutory ideas. Exploring how people respond to paranoia in the general population can also help to identify more adaptive behaviours that may be used to increase resilience and wellbeing and prevent transition over to a 'need for care'. There is a clear conceptual link to the area of behavioural coping strategies. Coping behaviours may be seen as behaviours employed with the aim to manage and reduce distress in general. Depending on the context within which they are used, coping and safety-seeking behaviours may reduce distress (adaptive) or prolong distress in the long term (maladaptive). It might be reasonable to expect some overlap in the literature. To ensure all relevant literature is included, this paper will review both coping and safety-seeking behaviour in a broader category of behavioural strategies.

1.5 Aims and research questions

This review aims to systematically examine the existing literature on the relationship between coping and safety-seeking behaviours and paranoia. The term paranoia will be used to encompass the range of paranoid experiences, from non-clinical suspiciousness to clinical persecutory delusions. The following questions are addressed:

1. What behavioural strategies do people use to manage the experience of paranoia?
2. Is there evidence for associations between coping and safety-seeking behaviours, and changes in a) paranoid experiences, b) distress, and c) other factors that influence wellbeing?

3. Are there differences in coping and safety-seeking behaviours between the clinical and non-clinical study populations?

Methods

2.1 Search strategy

A systematic search of the literature was conducted between October 2017 and November 2017 using the databases PsycINFO and Medline. Further studies were identified through manual searches of reference lists and citation searches.

Two groups of keywords were generated: 1) those relating to psychotic experiences and specifically to the paranoia spectrum, and 2) those relating to coping and safety-seeking behaviours. Terms relating to general psychosis were included to capture studies that contained sub-sections relating to paranoia. Table 1. presents the complete list of terms.

Table 1.

Final keyword search terms

Psychosis/Paranoia-spectrum	Coping
Psychosis	Coping behav*
Psychotic	Coping strategy*
Schizo*	Safety behav*
Suspicious*	Safety seek*
Hostility	Safety seeking behav*
Paranoi*	
Paranoid ideation	
Paranoid delusion	
Persecutory belief	
Persecutory ideation	
Persecutory delusion	

2.2 Inclusion and exclusion criteria

Studies were included if they:

1) Recruited participants over the age of 18

2) Were in the English language

3) Were published in peer-reviewed journals

4) Included a measure of symptoms along the paranoia-spectrum

5) Included a measure of behavioural responses – coping or safety-seeking behaviours

6) Looked at the relationship between 4 and 5.

Studies were excluded if they:

1) Focused only on caregivers, or family members of individuals experiencing paranoia

2) Only included measures of cognitive responses to symptoms of paranoia

3) Were solely qualitative studies, as these would not allow for statistical analyses of associations

All search results were screened in two stages. Firstly, they were screened by title and abstract to ensure relevance to the research questions. Secondly, the full texts of the remaining studies were reviewed according to the inclusion and exclusion criteria

Results

3.1 Study selection

After removing duplicate results, the database search identified 1666 records. A further four articles were identified through reference lists. Following the title and abstract screen, 1498 records were excluded. Of the remaining 168, 14 studies were found to meet all inclusion criteria. The complete selection process is outlined in Figure 1. A randomised selection of the records was reviewed by one

other researcher (supervisor, VH) against the criteria, with 90% agreement. Discrepancies were discussed until an agreement was made.

3.2 Study characteristics

There were 6845 participants in total across all studies (3451 male, 3321 female; data not reported for 73 participants). Eight studies employed a case-control design and recruited non-clinical control populations. Of these eight studies, four also recruited clinical controls. Six studies recruited single populations without recruiting controls (four with non-clinical participants, two with individuals experiencing persecutory delusions). Twelve studies took place in Europe, one in Asia and one in South America. One study used a longitudinal design, whilst 13 were cross-sectional.
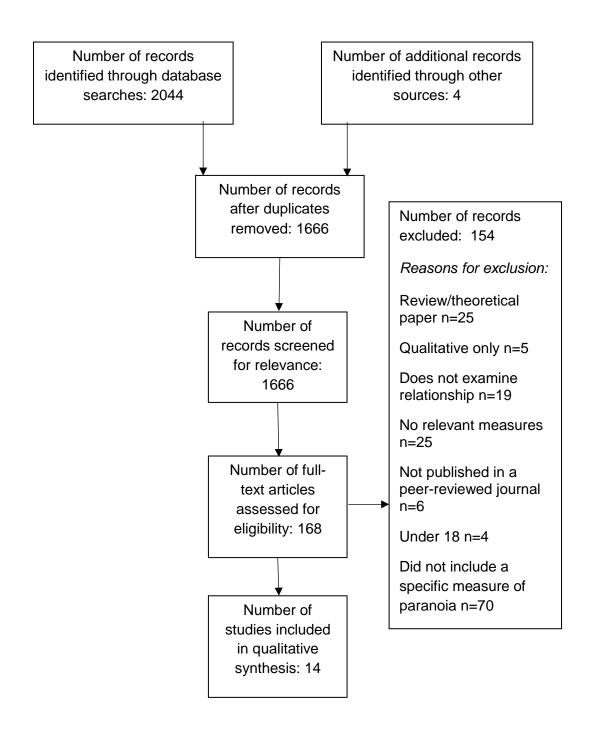
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│identified through   │        │ records identified  │
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              │     Number of       │        │                          │
              │  records screened   │        │ Qualitative only n=5     │
              │   for relevance:    │        │                          │
              │        1666         │        │ Does not examine         │
              └──────────┬──────────┘        │ relationship n=19        │
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                         ▼                   │ n=25                     │
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              │   Number of full-   │        │ Not published in a       │
              │   text articles     │───────▶│ peer-reviewed journal    │
              │   assessed for      │        │ n=6                      │
              │  eligibility: 168   │        │                          │
              └──────────┬──────────┘        │ Under 18 n=4             │
                         │                   │                          │
                         │                   │ Did not include a        │
                         ▼                   │ specific measure of      │
              ┌─────────────────────┐        │ paranoia n=70            │
              │     Number of       │        └──────────────────────────┘
              │  studies included   │
              │   in qualitative    │
              │   synthesis: 14     │
              └─────────────────────┘
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Figure 1. Flowchart of the review process

Table 2.

Characteristics of included studies

Study	Country	Participant characteristics	N	Measure: Paranoia	Measure: Behaviour	Results	Measure: Other
Case-control studies							
Lincoln et al. 2014	Germany	Schizophrenia-spectrum Non-clinical controls	32 34	PC	RePT	Clinical participants engaged in a range of responses, and differed significantly from controls in: normalising, depressed, physical and devaluating responses. Mediating factors: social integration, externality, and CAPE depression	CAPE, BCIS, FSozU, CCQ/FFK
Melo & Bentall 2013	UK	Persecutory delusions ('poor me' and 'bad me') Non-clinical controls	45 25	PDP, PaDS, SCAN, DS-PSYRAT	RTNE, RSQ	Clinical participants used distraction coping more than healthy controls. Association between different coping styles and levels of self-esteem.	RSE
Moritz, Ludtke et al. 2016	German	Psychosis Depression Non-clinical general population	75 100 1100	CAPE (paranoia subscale)	MAX	Positive associations between paranoia and maladaptive coping, avoidance and suppression. Negative associations between paranoia and adaptive coping	PHQ-9,
Ponizovskey et al. 2013	Israel	Schizophrenia Depression Non-clinical control	51 70 61	PANSS	CID, CISS	Positive associations between threat-related persons and comfortable interpersonal distance in patients experiencing suspiciousness/persecution.	BDI
Schoretsanitis et al. 2016	Switzerland	Schizophrenia-spectrum Non-clinical controls	64 24	PANSS, BPS	VAS, Distance in meters	Paranoid-threat patients had significantly higher minimum tolerated interpersonal distances than other patients and controls. Also experienced more comfort as interpersonal distance increased, compared to controls.	
Taylor & Stopa 2013	UK	Persecutory delusions Social phobia Panic disorder controls Non-clinical controls	48	PS	SBS	No difference in SSB use between persecutory beliefs and control groups.	HADS, SCQ, SAQ-R, EBS, SCS-R, CPI-R, SIAS, SPS
Veling et al. 2014	The Netherlands	FEP Non-clinical controls	17 24	GPTS, SSPS	DACOBS	FEP group engaged in significantly more SSBs than non-clinical controls. FEP kept significantly shorter distances to avatars than controls.	SIAS, SERS, SSQ, subjective

							distress ratings
14. Wusten & Lincoln 2015	Chile	Schizophrenia-spectrum	36	PC	RePT	Patients engaged in range of behavioural responses to paranoid thoughts. Specifically, engaged in more depressive, concealing and physical responses compared to controls. Cognitive insight significantly predicted physical, communicative and normalising responses.	BCIS
		Non-clinical controls	39				

Clinical samples only

1. Freeman et al. 2001	UK	Persecutory delusions	25	(Clinical interview), DoT	SBQ	All participants reported using SSBs over the past month. SBQ-total and SBQ-avoidance associated with anxiety, SBQ-compliance associated with lower self-esteem.	BDI, BAI, STAXI, RSE, ATI-meta, MCQ
2. Freeman et al. 2007	UK	Persecutory delusions (SAPS mild or above)	100	SAPS, SANS, PSYRATS,	SBQ, MADs,	96% of participants reported using SBs in past month. SBQ-total associated with anxiety. Avoidance associated with emotional distress and anxiety. Positive-SB use associated with greater intensity of distress (not avoidance).	BDI, BAI

Non-clinical samples only

4. Melo & Bentall 2010	UK, Portugal	Non-clinical students	UK 318 Portugal 290	PaDS	COPE, RSQ	Venting of emotions and denial all positive predictors of persecution. Social support for emotional reasons as negative predictor. Engaging in dangerous activities used to cope with negative mood as result of paranoia	BDI
6. Moritz & Van Quaquebeke 2014	Germany	Non-clinical general population	1935	PC	'What if' delusion scenario	Engagement in behaviours increased with level of paranoia. Behavioural responses influenced by gender, age, education level and delusion conviction.	
8. Moritz, Jahns et al. 2016	German	Non-clinical general population	2200	PC	MAX	Positive associations between paranoia and maladaptive coping and avoidance. Negative association between paranoia and adaptive coping. Positive association between number of coping styles employed and psychopathology.	PHQ-9, OCI-R,
11. Simpson et al. 2012	UK	Non-clinical students	133	FPS	PSBQ	Associations between paranoia and SSBs, and SSBs and negative mood. Avoidance as main factor explaining variance in paranoia.	PANAS

Measures of paranoia: BPS, Bern Psychopathology Scale; CAPE, Community Assessment of Psychic Experiences; DoT, Details of Threat questionnaire; DS-PSYRATS, delusions subscale of the Psychotic Symptoms Rating Scales; GPTS, Green *et* al.'s Paranoid Thoughts Scale; FPS, Fenigstein Paranoia Scale;; PaDS, Persecution and Deservedness Scale; PANSS, Positive and Negative Syndrome Scales; PDP, The Perceived Deservedness of Persecution Analogue Scale; PSYRATS, Psychotic Symptoms

Rating Scales; SANS, Scale for Assessment of Negative Symptoms; SAPS, Scale for the Assessment of Positive Symptoms; SCAN, Schedule for Clinical Assessment in Neuropsychiatry; SSPS, State Social Paranoia Scale;

Measures of behavioural responses: CIDS, Comfortable Interpersonal Distance Scale; CISS, Coping Inventory for Stressful Situations; COPE Inventory; CSQ, Coping Style Questionnaire; DACOBS, Davos Assessment of Cognitive Biases Scale; MADS, Maudsley Assessment of Delusions Schedule; MAX, Maladaptive and Adaptive Coping Style Questionnaire; PSBQ, Paranoid Safety Behaviours Questionnaire; RePT, Response to Paranoid Thoughts Scale; RSQ, Response Style Questionnaire; RTNE, Response to Negative Events Checklist; SBQ, Safety Behaviours Questionnaire; SBS, Social Behavioural Scale; VAS, Visual Analogue Scale

Measures of distress/other: ATI-meta, Anxious Thoughts Inventory; BCIS: Beck's Cognitive Insight Scale; CCQ/FFK, German Competence and Control Questionnaire; CPI-R, Cognitive Profiling Interview-Revised; EBS, Evaluative Beliefs Scale; FSozU, Fragebogen zur Sozialen Unterstützung (German social support questionnaire); MCQ, Metacognitions Questionnaire; PHQ-9, Patient Health Questionnaire; RSE, Rosenberg Self-Esteem Scale; SAQ-R, Social Attitudes Questionnaire-Revised; SCQ, Social Cognitions Questionnaire; SERS, Self-esteem Rating Scale; SIAS, Social Interaction Anxiety Scale; SCS-R, Self-Consciousness Scale Revised; SPS, Social Phobia Scale; STAXI, Stait-Trait Anger Expression Inventory;

3.3 Quality assessment

All selected studies were assessed using an adapted section of the Critical Appraisal Skills Programme, Case Control Study Checklist (CASP, 2017). Section A of the checklist assesses the validity of the studies by asking the following questions:

1) Did the study address a clearly focused issue?

2) Did the authors use an appropriate method to answer their question?

3) Were the cases recruited in an acceptable way?

4) Were the controls selected in an acceptable way?

5) Was the exposure accurately measured to minimise bias?

6) Have the authors taken account of the potential confounding factors in the design and/or in their analysis

Each question can be rated 'yes', 'no', or 'can't tell'.

The CASP Case Control Study Checklist was adapted for use in the six single population studies by combining questions three and four. The selected studies generally met a good standard in the validity of their results (Table 3.), although some factors limit the extent to which firm conclusions can be drawn. All studies met criteria 1 (showed a clear focus) and 2 (used an appropriate method to answer the question), and all studies used acceptable methods for recruiting their participants and controls (criteria 3 and 4). However, convenience and student sampling limit the generalisability of the data. Most studies used valid and reliable measures, with the exception of Study 12, which used an unvalidated 'What If' delusional scenario derived from clinician experience to measure behavioural response. Most studies did not meet criteria 6 ('Have the authors taken into account confounding factors?'), as only three studies (studies 5, 10 and 11) explicitly addressed confounding factors. These included accounting for confounding effects

of social anxiety in interpersonal distances and considering effects of individual or collectivist cultures on help-seeking. Six studies did not recruit control populations, and of those that did, five studies did not recruit clinical controls. Most of the included studies are also cross-sectional and correlational in design. These factors limit the ability to draw firm overall conclusions and the existing understanding of the specific relationship between paranoia, coping and safety-seeking behaviours needs to be interpreted with caution.

In general, the literature on behavioural responses to paranoia appeared to be of good quality, using valid measures. However, 13 different measures of response styles (coping and safety-seeking behaviours) were used across the 14 studies. Some measures broadly categorise behaviours (e.g. the Maladaptive and Adaptive Coping Style Questionnaire, MAX), whilst others break down behaviours into more specific categories (e.g. COPE Inventory). Three studies took measures of interpersonal distance. The wide range of measures makes it difficult to draw comparisons between the studies. It appears that whilst the quality of individual studies is relatively high, overall conclusions can only be tentatively made in the absence of consistent results.

Table 3.

Quality assessment of validity of studies

Study	1. Clear focus	2. Appropriate method	3. Acceptable recruitment of cases	4. Acceptable recruitment of controls	5. Accurate measurement	6. Accounted for confounders
Case-control studies						
1. Lincoln et al. 2014	√	√	√	√	√	-
2. Melo & Bentall, 2013	√	√	√	√	√	-
3. Moritz, Ludtke et al. 2016	√	√	√	√	√	-
4. Ponizovsky et al. 2013	√	√	√	√	√	-
5. Schoretsanitis et al. 2016	√	√	√	√	√	√
6. Taylor et al. 2013	√	√	√	√	√	-
7. Veling et al. 2014	√	√	√	√	√	-
8. Wusten et al. 2015	√	√	√	√	√	-
Clinical samples only						
9. Freeman et al. 2001	√	√	√	N/A	√	-
10. Freeman et al. 2007	√	√	√	N/A	√	√
Non-clinical samples only						
11. Melo & Bentall 2010	√	√	N/A	√	√	√
12. Moritz & Van Quaquebeke, 2014	√	√	N/A	√	N	-
13. Moritz et al. 2016	√	√	N/A	√	√	-
14. Simpson et al. 2012	√	√	N/A	√	√	-

Ratings: -: Can't tell; N: No; √ : Yes; N/A: Not applicable

3.4 Synthesis of results

A summary of the selected papers can be found in Table 2. The main research questions were reviewed below.

3.4.1 What behavioural strategies do people use to manage the experience of paranoia?

All studies included in this review found that individuals with experiences along the paranoia spectrum engaged in behavioural responses to cope. Five studies investigated safety-seeking behaviours (SSBs) specifically (Freeman, Garety, & Kuipers, 2001; Freeman et al., 2007; Simpson, MacGregor, Cavanagh, & Dudley, 2012; Taylor & Stopa, 2012; Veling, Brinkman, Dorrestijn, & van der Gaag, 2014), whilst nine studies examined coping behaviours (Lincoln, Möbius, Huber, Nagel, & Moritz, 2014; Melo & Bentall, 2010, 2013; Moritz, Jahns, et al., 2016; Moritz, Lüdtke, et al., 2016; Moritz & Van Quaquebeke, 2014; Ponizovsky et al., 2013; Schoretsanitis, Kutynia, Stegmayer, Strik, & Walther, 2016; Wüsten & Lincoln, 2015).

3.4.1.1 Safety-seeking behaviours

All five studies found that participants used SSBs to cope with paranoid experiences, with reported levels of 96% (Freeman et al. 2007) and 100% (Freeman, Garety, & Kuipers, 2001) in clinical participants. These behaviours were assessed with a range of measures, including the Social Behaviour Scale (SBS), Paranoid Safety Behaviours Questionnaire (PSBQ), Safety Behaviours Questionnaire (SBQ), Davos Assessment of Cognitive Biases Scale (DACOBS), and a measure of interpersonal distance.

Two studies reported the undifferentiated use of SSBs (Taylor & Stopa, 2012; Veling et al., 2014). Two studies (Freeman, Garety, & Kuipers, 2001;

Freeman et al., 2007) used the SBQ, a semi-structured interview where behaviours are identified and then rated for frequency of use. Both studies found avoidance to be the most frequently used SSB in samples of individuals experiencing persecutory delusions, reported by 92% and 78% of participants respectively. This is followed by 'in-situation' behaviours (92% and 63%), 'escape' (36% and 35%), 'compliance' (24% and 25%), help-seeking (36% and 31%), aggressive (20% and 24%) and delusional behaviours (8% and 6%). Simpson and colleagues (2012) used the PSBQ, adapted from the SBQ, and found 'in-situation' behaviours to be the most commonly used in a non-clinical sample, followed by avoidance and help-seeking, with aggressive behaviours being the least frequently endorsed.

3.4.1.2 Coping behaviours

Of the nine studies investigating coping behaviours, two used the Maladaptive and Adaptive Coping Style Questionnaire (MAX), which categorised behaviours broadly into 'adaptive', 'maladaptive' and 'avoidance' categories (Moritz, Jahns, et al., 2016; Moritz, Lüdtke, et al., 2016). Two studies (Lincoln et al., 2014; Wunsten & Lincoln, 2015) used the Response to Paranoid Thoughts Scale (RePT) in both clinical and non-clinical samples. Both studies found that all populations engaged in a range of coping behaviours, with positive distraction as the most commonly used strategy. This was followed by normalising, concealing, depressed, rational, believing, composed, physical, communicative and devaluating.

Similarly, Melo and Bentall (2010) used the COPE Inventory (Carver et al. 1989) and found non-clinical participants to engage in a wide range of behaviours. However, they did not report frequency of use. These behaviours were grouped as: active coping, planning, suppression of competing activities, restraint, seeking social support for emotional reasons, seeking social support for instrumental reasons, positive interpretation and growth, acceptance, turning to religion, focus on venting of emotions/emotional coping, denial, behavioural disengagement, mental

disengagement, joking, and alcohol and drug use. Moritz and Van Quaquebeke (2014) used a 'What if' scenario paradigm to assess how non-clinical participants would respond if pursued by a secret service. Factor analysis showed behavioural responses in five domains: 'delete traces' (i.e. efforts to remain inconspicuous), 'drastic security' (i.e. engaging in elaborate security measures), 'simple security' (i.e. simple measures such as changing locks), 'emotional response', and 'violent measures'. They found that men scored higher than women on all scales apart from emotional response, and that participants with university degrees scored lower than those without on simple, drastic and violent responses. In an analysis between high and low paranoia groups, the study found that participants in the high paranoia group engaged in more coping behaviours, with the number of behaviours increasing across both groups with increasing levels of conviction in the paranoid belief. Finally, three studies found that clinical participants adjusted interpersonal distance as a way of coping with paranoia (Ponizovsky et al., 2013; Schoretsanitis et al., 2016; Veling et al., 2014). For example, they found significant relationships between the experience of threat and persecution, and minimum comfortable interpersonal distance.

Studies included in the review indicated that individuals in clinical and non-clinical samples engaged in a wide range of behavioural strategies to manage their experience of paranoia. Measures of behaviours are varied, and reporting of frequency and proportion of use is inconsistent; there does not appear to be a consensus on which behavioural strategies are most commonly used across the studies.

3.4.2 Is there evidence for associations between coping and safety-seeking behaviours and changes in a. paranoid experiences, b. distress, and c. other factors that influence wellbeing?

3.4.2.1 Associations with paranoid experiences

Three studies found significant relationships between the use of coping behaviours and SSBs and the level of paranoia in both psychosis and non-clinical populations. Broadly speaking, maladaptive and safety-seeking behaviours were positively associated with paranoia, whilst adaptive behaviours showed a negative association (Moritz, Jahns, et al., 2016; Moritz, Lüdtke, et al., 2016; Simpson, MacGregor, Cavanagh, & Dudley, 2012). There was evidence to show that the positive relationship between maladaptive behaviours and paranoia was stronger than the negative relationship between adaptive behaviours and paranoia. Further analysis by Moritz, Jahns and colleagues (2016) suggested psychopathology increased with the number of coping behaviours used, regardless of whether they were adaptive or maladaptive, and the use of coping behaviours in a non-clinical student population was a significant predictor of the level of persecution experienced (Melo & Bentall, 2010).

There was an association between avoidance and paranoia; Simpson and colleagues (2013) found avoidance behaviours to be significant predictors for non-clinical paranoia, and this association remained significant when controlling for depression (Moritz, Ludtke et al., 2016). Perhaps linked with avoidance behaviours, Melo and Bentall (2010) found higher persecution scores in their student sample to be associated with less use of social support. Other coping behaviours that predicted higher persecution scores were engaging in dangerous activities, using substances, venting of emotions, and denial (Melo & Bentall, 2010). Schoretsanitis and colleagues (2016) also found that larger interpersonal distances were positively associated with higher levels of clinical paranoia.

There is evidence to suggest that the association between paranoia and behavioural responses are mediated by other factors (e.g. depression); the magnitude of the relationship is reduced when these factors are accounted for

(Moritz, Ludtke et al., 2016). This finding is important to consider when drawing conclusions from the data, as several of the studies (Melo & Bentall, 2010; Moritz, Jahns et al., 2016; Simpson et al., 2013) did not recruit control populations to account for this.

3.4.2.2 Associations with distress and mental health

Four studies investigated the association between coping and safety-seeking behaviours, emotional distress and other mental health difficulties. There was a positive association between the number and frequency of SSBs and the experience of anxiety, depression and emotional distress in clinical and non-clinical samples (Freeman, Garety, & Kuipers, 2001; Freeman et al., 2007; Simpson et al. 2013). Specifically, the use of avoidance behaviours was associated with higher levels of anxiety and emotional distress, whilst 'positive' SSBs (i.e. active, rather than passive), were associated with increased intensity of emotional distress. Freeman and colleagues (2001) also found a trend toward a positive association between aggressive SSBs and anger. They also suggested that there might be a link between the use of SSBs and the development of negative symptoms of psychosis. In contrast, a follow up study (Freeman et al., 2007) found the opposite effect; SSBs were associated with less alogia, whilst levels of depression in their participants with persecutory delusions were associated with negative symptoms. Lincoln and colleagues (2014) found significant positive associations between depressed and devaluating responses, and depression, with the relationship partially mediated by depression, social integration and externality. Again, it is important to consider the small number of studies providing these results, and the limitations in study design (i.e. lack of prospective studies and manipulation of variables) means it is not possible to draw conclusions regarding the specificity and directionality of these associations.

3.4.2.3 Associations with other factors that influence wellbeing

Three studies reported on the association between coping and safety-seeking behaviours and other factors that may impact upon wellbeing and quality of life. Freeman and colleagues (2001) found compliance SSBs to be associated with lower levels of self-esteem in participants with persecutory delusions. Similarly, Melo & Bentall (2013) found a trend toward distraction coping methods being associated with poor self-esteem in participants with persecutory delusions, whilst those who used social emotional support were more likely to have higher self-esteem.

Lincoln and colleagues (2014) found significant positive associations between depressed responses and less social integration in their clinical sample. In contrast, normalising coping behaviours were positively associated with emotional support, social integration and self-efficacy, with this relationship fully mediated by participants' perceived levels of social integration.

The results of the review show that there are associations between behavioural strategies, paranoia, levels of distress and other mental health difficulties. There are also significant associations with other factors that can impact upon a person's wellbeing. This suggests that the using behavioural strategies to manage the experience of paranoia can have positive and negative effects in both the clinical and non-clinical populations. Using behavioural strategies may relate to attempts to control the paranoid experience; evidence suggests that attempts at cognitive control in clinical and non-clinical populations are positively associated with distress relating to psychotic-like experiences (Brett, Heriot-Maitland, McGuire, & Peters, 2014).

3.4.3 Are there differences in coping and safety-seeking behaviours between the clinical and non-clinical populations?

Six studies reported on differences between clinical and non-clinical populations. Of these, three reported on SSBs specifically. Using a virtual reality paradigm, Veling and colleagues (2014) found that clinical participants used significantly more SSBs than non-clinical participants, whilst non-clinical participants kept more distance from VR avatars compared to the first episode psychosis (FEP) participants. The results showed an interaction with ethnicity and population density, where participants kept longer interpersonal distances when the environment contained avatars of other ethnic groups, in low population density. In contrast, Schoretsanitis and colleagues (2016) found that clinical participants with paranoid threat kept significantly larger interpersonal distances compared to non-clinical participants. In a fixed-distance paradigm, clinical participants also showed significantly less comfort with closer distances, and more comfort with longer distances compared to non-clinical controls.

One study (Taylor & Stopa, 2013) did not find any significant differences in SSBs in social situations between the clinical paranoia group, and the clinical and non-clinical control groups (social phobia). Melo and Bentall (2013) found a trend for clinical participants using distraction coping behaviours more than non-clinical participants.

Two studies using the RePT found that clinical participants were significantly more likely to engage in depressive, concealing and physical coping behaviours, and significantly less likely to engage in more helpful behaviours, such as normalising and positive distracting (Wusten & Lincoln, 2015). In fact, differences in normalising and depressed coping behaviours could significantly differentiate between the groups of participants (Lincoln et al. 2014).

Research in this area is currently limited, and the varying focus of each study makes it difficult to summarise existing findings. The results indicate that there

are some differences in behavioural strategies used to manage paranoid experiences between the clinical and non-clinical populations. Currently, it is not known whether there is a linear progression of paranoia from the non-clinical population to a clinical 'need for care' population. There might be qualitative differences between the populations in frequency and quality of experiences, which will need to be explored in future research. Perhaps unexpectedly, FEP participants were found to keep shorter distances from VR avatars compared to non-clinical controls (Veling et al., 2014). The FEP individuals also employed more SSBs. It is possible that the use of SSBs enabled people to approach the feared situation during this scenario. Researchers in the field of anxiety disorders argue that whilst SSBs can maintain anxiety in the long term, they might not be ultimately detrimental in treatment, suggesting that there might be a reasonable use for SSBs in certain situations, e.g. to increase a person's perception of control over threat (Hofmann & Hay, 2018; Milosevic & Radomsky, 2008; Sy, Dixon, Lickel, Nelson, & Deacon, 2011). Studies have also argued that SSBs are difficult to differentiate from adaptive coping behaviours, as they can often appear similar, however they are employed with different intentions (Thwaites & Freeston, 2005).

Discussion

4.1 Review of research questions

The aim of this review was to systematically examine the existing literature on behavioural responses to paranoia and see whether there are associations between the use of coping and safety-seeking behaviours and paranoid experiences, distress, general mental health and factors that affect wellbeing (e.g. self-esteem). The review also aimed to find out whether there are differences between clinical and non-clinical populations in terms of how they respond to experiences along the paranoia spectrum, with the purpose of examining whether there are different ways of coping that can help people to keep well. The search

yielded 14 studies in total. Whilst the findings generally align, the scope of the included studies is broad, and with many studies investigating slightly different areas. Consequently, there is very limited research in each area, particularly in studies focusing specifically on SSBs, and those investigating the impact of behavioural responses on distress, mental health difficulties and other factors that are associated with quality of life in people experiencing paranoia.

The review found that, in general, individuals experiencing paranoia adopt a wide range of behaviours to help them cope, reduce threat, or manage distress. There does not appear to be a clear consensus in the literature on what these behaviours are or how they are used in this population, due to the number of different measures used in research. There are some contrasting results, for example, whilst two studies have found that people manipulate interpersonal distance in attempts to reduce threat and feel safe, whether they increase or reduce distance remains unclear. The results of these studies suggest that the way individuals cope in these interpersonal situations can be influenced by characteristics of the other person and of the environment, for example, ethnicity and population density (Schoretsanitis et al., 2016; Veling et al., 2014). This may have implications for research and clinical practice. For example, it suggests the need to understand clearly specified context and function of behaviours, which will be explored in more detail later in the discussion. Whilst adaptive coping methods are associated with lower levels of paranoia, there is limited evidence to suggest that the use of safety and maladaptive coping behaviours are associated with higher levels of paranoia. One hypothesis may be that the association is positive in some studies, whilst being negative in others, due to changing contexts and functions of behaviours as they are studied. Further research will need to be conducted. Given that none of the studies were longitudinal in design, and the presence and absence of safety and coping behaviours were not manipulated, it is not possible to draw

conclusions on the causality within these relationships. There is some evidence to suggest specificity of the relationship between avoidance and paranoia, as the relationship remains significant when accounting for lack of activity associated with depression (Moritz, Ludtke et al., 2016). The cognitive model of persecutory delusions would suggest that these behaviours initially arise as an attempt to manage threat and distress and go on to maintain paranoia over time, however further research would need to be conducted to clarify this.

There is some limited evidence from the review to suggest that emotional distress, anxiety and depression are associated with the use of safety and maladaptive coping strategies. There appears to also be a relationship between the use of coping and safety-seeking behaviours and self-esteem, self-efficacy and social integration. The number of studies investigating these areas is very limited, and it is not possible to draw firm conclusions from the cross-sectional data. Melo and Bentall (2013) suggested that it is important to take into consideration self-esteem in developing an understanding of a person's paranoid experiences and links this with negative beliefs about the self and negative self-evaluations. Other studies have suggested that there are conceptual conflicts in the understanding of self-esteem and self-evaluative beliefs and have found that whilst self-esteem remains relatively stable in paranoia, negative self-evaluations and beliefs are significantly more present in people with paranoia when compared to a non-clinical control group (Valiente, Cantero, Sánchez, Provencio, & Wickham, 2014). This relationship is likely to extend beyond paranoia to other mental health difficulties, i.e. in depression, where negative self-evaluations are a core component (Beck, 2002). Further research could clarify the specific role of negative self-evaluations in paranoia.

The above findings are consistent with the current literature on cognitive models of persecutory delusions and positive symptoms of psychosis, as well as the

literature on SSBs and anxiety disorders. Research suggests that there is an important influence of behaviours that reduces the person's ability to develop functional coping strategies and prevents reality testing (Piccirillo, Dryman, & Heimberg, 2016). Engaging in these behaviours and resisting exposure to perceived threat or a fear stimulus maintain negative threat appraisals, and prevents people from gaining disconfirmatory information, accessing external support, and from habituating to anxiety or other distressing emotions. Studies in the general psychosis literature indicates that many of these methods of coping (e.g. substance and alcohol use, social withdrawal) and associated factors (e.g. lower self-evaluations and beliefs, social isolation) are risk factors for the development and persistence of psychotic experiences and higher levels of distress (Singh, Sharan, & Kulhara, 2003). They may also prevent or make it more difficult for a person to engage in positive activity that can help maintain wellbeing, leading to longer periods of disability and distress. It would follow that the presence of these factors, in the context of anomalous experiences, would result in a feedback loop of unhelpful behaviour and emotion distress, thus maintaining paranoia over time and negatively impact the person's quality of life overall.

Six studies investigated differences between clinical and non-clinical populations in safety and coping behaviours and found varying results. In general, it appears that most studies found differences between the two populations, whilst one did not (Taylor & Stopa, 2013). Taylor and Stopa reported that the measures used in their study did not reliably differentiate between the paranoia and social phobia populations. This suggests that possible overlap between the measures of paranoia and social phobia may have confounded any differences between clinical and non-clinical paranoia populations. Whilst there is support in the literature to show overlaps in paranoia and social threat (Freeman, Gittins, et al., 2008), this calls into question the reliability of the use of these particular measures in this area

of research. The aim of investigating these populations was to establish how individuals experiencing paranoia in the general population progress into a 'need for care' stage, with significant levels of distress and impairment. Understanding which safety and coping behaviours are positively or negatively associated with progression can help treatment planning, managing and decreasing paranoid experiences and increasing wellbeing and psychological resilience. There is some evidence in the existing literature of naturalistic change in levels of paranoia over time in a non-clinical population (Allen-Crooks & Ellett, 2014). In their longitudinal study, Allen-Crooks and Ellett found that paranoia and associated distress decreased over time in their participants. Several factors contributed to this change, including accessing social support. This allowed people to consider alternative explanations for their experiences and develop better ways of coping with perceived threat. The cross-sectional and observational nature of most studies included in this review limits the ability to determine change over time. Some studies have found that seeking social support and social integration are associated with positive factors for wellbeing, whilst the opposite is associated with higher levels of persecution. This suggests that working with social isolation and helping people to access social support can be an important area to address in clinical interventions. However, this has limited significance as cross-sectional observations do not necessarily suggest a progressive relationship over time, and further research is required in this area.

The current evidence in the paranoia literature is limited. However, research from the general psychosis literature may help to form some hypotheses for future research. Studies have found that whilst clinical (individuals with a 'need for care') and non-clinical (psychotic experiences but no 'need for care') participants experienced comparable levels of psychotic experiences, the non-clinical group engaged in fewer SSBs and experienced significantly lower levels of distress,

depression and anxiety (Boumans, Baart, Widdershoven, & Kroon, 2017; Gaynor, Ward, Garety, & Peters, 2013). The relationship between SSBs and emotional distress was mediated by threat appraisals. This suggests an important role of SSBs in coping with the perception of threat and in driving symptom persistence and distress. We would expect to see a similar relationship between SSBs and paranoia specifically within the cognitive behavioural model of persecutory delusions.

4.2 Confounding variables

It is likely that the results of the included studies have been affected by confounding factors. Six out of 14 studies did not recruit control populations. Of the eight studies that did, only three recruited clinical control populations. Studies have found mediating effects of depression, and have noted conceptual overlaps with social anxiety, suggesting that these factors would be important to consider in identifying relationships specific to paranoia. Research have found high levels of comorbidity with depression, anxiety and other disorders in psychosis (Wigman et al., 2012), schizophrenia (Buckley, Miller, Lehrer, & Castle, 2009) and at risk populations (Fusar-Poli, Nelson, Valmaggia, Yung, & McGuire, 2014). It is possible that the safety and coping behaviours identified in studies are employed by the person in part to manage symptoms of other mental health conditions, or are symptoms of other comorbid experiences.

4.3 Limitations

One of the main limitations of the review is the small number of studies in the literature. These studies employ a wide range of measures to investigate a range of areas, giving limited evidence for each area. The studies are also mainly correlational and cross-sectional in design. Some studies are also exploratory in nature and thus the sample sizes recruited were small, with no reports of power

analyses. It is not possible to make comparisons and extrapolate firm conclusions from the existing evidence.

It is also important to consider the conceptual overlap highlighted in the studies, for example, between safety and coping behaviours (expanded upon in the next section), or paranoia and symptomatology of other psychological conditions. This limits the specificity of the results to paranoia and leaves the results open to the effects of confounding factors.

Most studies included in the review either did not recruit control populations or did not recruit clinical controls. Those that recruited non-clinical controls generally used convenient or student sampling, which limits the generalisability of the data across the general non-clinical population. However, some studies did attempt to recruit control participants from the local community, which would arguably be more representative. Clinical samples were generally recruited through psychiatric clinics and clinicians. It is possible that those individuals experiencing the highest levels of persecutory delusions would not choose to participate in research, which would limit the extent to which the clinical sample can represent the overall target population. We may expect to see stronger associations with behavioural responses in higher levels of paranoia.

4.4 Safety-seeking behaviours or coping behaviours?

Both 'coping' and 'safety-seeking' behaviours were included as search terms in this review. In bringing together the data, it is apparent that the two areas and the measures used to investigate them have considerable conceptual overlap in the literature. Coping has been defined as 'conscious volitional efforts to regulate emotion, cognition, behaviour, physiology, and the environment in response to stressful events or circumstances' (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). In contrast, SSBs are behaviours specifically employed by a

person to reduce harm and protect from perceived threat (Salkovskis, 1991). Both SSBs and maladaptive coping behaviours are also defined by their long-term consequences (i.e. of maintaining or exacerbating difficult or stressful situations in the long term), whilst adaptive behaviours may be defined by their impact on reducing distress or difficulties. Measures developed to assess these two types of behaviours contain overlapping items, for example, the presence of avoidance behaviours on measures of safety-seeking and coping, and measurement of 'help-seeking behaviours' (COPE Inventory) and 'seek social support for emotional/instrumental reasons' (SBQ). It could be argued that SSBs are a more clearly defined subset of coping behaviours, where the goal is to specifically manage distress associated with perceived threat, for example, anxiety and paranoia, whilst coping behaviours incorporate a broader effort to manage emotion and stress. In this case, the differentiating factors would be 1) the contexts within which the behaviours are employed, 2) their intended function and 3) the consequences of engaging in the behaviours, which are not assessed by current measures of coping. This has important implications in clinical work with people engaging in a range of coping and safety-seeking behaviours, where distinctions between the groups may be unclear. It would be essential to take an individual approach to behavioural responses and assess these three factors, rather than taking a rigid and manualised approach to reducing or promoting behaviours.

4.5 Implications for future research

This review highlights several areas for future research. Firstly, the review identified a wide range of measures used for exploring coping and safety-seeking behaviours. It would be helpful to develop a measure specifically for use in investigating SSBs, i.e. behaviours intended to reduce harm as a result of perceived threat. This would aid in more comparable data and avoid overlap with distinct but conceptually similar areas such as general coping behaviours. Alternatively, studies

investigating paranoia and SSBs could utilise the Safety Behaviours Questionnaires (SBQ) more consistently to allow for comparable data.

Secondly, it has not been possible to draw conclusions of causality or direction of influence from the current literature due to the limited number and the cross-sectional nature of many of the studies. Longitudinal and experimental designs investigating the relationship between paranoia and SSBs over time, whilst manipulating the presence and absence of the behaviours would allow for more valid and reliable conclusions.

Thirdly, it would be useful for studies to consistently include measures of distress, anxiety, depression and factors that influence wellbeing. This would allow for a better understanding of the impact of SSBs in paranoia on different areas of a person's life. Consistent measurements and designs would allow for comparison between clinical, non-clinical and high/low paranoia populations and help increase understanding on symptom progression and factors that maintain psychological wellbeing.

Lastly, one study included in the review sought to account for sociocultural factors that may influence how people behave in response to perceived threat (Melo & Bentall, 2010). They proposed that cultural differences, such as religiosity and whether a culture is more collectivist or individualist, can impact the way that people view and interpret the world. These differences may also influence the way that people respond to paranoid experiences, for example, in help-seeking behaviour and seeking social support. Morrison (2001) noted the role of cultural acceptability in determining a psychotic experience, i.e. misinterpretations of experiences are deemed psychotic if they are considered cultural unacceptable. He concluded that the cultural unacceptable nature of these misinterpretations leads to additional distress. There is evidence of cultural differences in coping between individuals

experiencing auditory hallucinations in the UK and in Saudi Arabia (Wahass & Kent, 1997). This would suggest a role of culture in determining levels of impairment and distress, as well as progression of initial anomalous experiences into distressing persecutory delusions. Future research could inform the development of culturally sensitive clinical interventions.

4.6 Implications for clinical practice

The review highlights several areas of clinical relevance. Overall, it appears that supporting service users to reduce SSBs would be helpful in reducing symptoms and distress. However, it would be important to conduct a comprehensive assessment and formulation of the contextual factors, functions of behaviours and intent of the user when considering behavioural responses to paranoia. Results of the review would suggest that some behaviours are helpful and can maintain wellbeing as well as reduce distress. Individualised assessment will help the clinician and service user in differentiating between SSBs, maladaptive coping and adaptive coping behaviours. This would allow for further treatment planning. There is some evidence to suggest that it is not the lack of adaptive coping strategies that lead to distress and persistence of symptoms, as clinical participants already engage in a range of adaptive coping strategies. Rather, the presence and possible overuse of maladaptive coping strategies is key. This would suggest that maladaptive coping needs to be addressed as a priority and is essential in working with people with persecutory delusions.

Avoidance, social isolation and accessing social support have been identified as common and essential factors that influences a person's experience of paranoia. This highlights the importance of addressing this within clinical interventions. This may be in the form of working to reduce avoidance and to increase tolerance of perceived threatening situations or helping service users to develop and access sources of personal, community and peer support.

Lastly, with more research and firmer understanding of the relationship between behavioural responses, paranoia, distress and wellbeing, behavioural work can be developed for use in early intervention and with at-risk populations. For example, in identifying and working with the service user to reduce behaviours that can increase their risk of progression into a 'need for care' stage, and in supporting people to develop helpful behaviours that can maintain and improve their psychological wellbeing.

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Part 2: Empirical Paper

A Game Theory Perspective on Social Cognitions in Non-Clinical Paranoia

Abstract

Aims: Current paradigms to investigate social cognitive processes in paranoia and how these determine behaviour are limited. A recent study proposed that competition during a Prisoner's Dilemma Game (PDG) was a behavioural marker for paranoia (Ellett et al., 2013). This study aims to clarify the role of paranoid cognition during a live social interaction as presented within a Prisoner's Dilemma Game (PDG).

Method: Two-hundred and three participants (147 female, 56 male) were recruited from the general population to take part in an online PDG task. They played three rounds of the PDG; during each round, participants also indicated their expectations of the other player's choices and their interpretations of the other players' intentions. Participants also completed self-report measures of trait and state paranoia, core beliefs and their perceptions of their game partners.

Results: Analyses showed that expectation of the other player's choice predicted participants' behaviour. There was no effect of trait or state paranoia on participants' expectations and behaviours during the PDG. Paranoia was associated with perceptions of hostile intent, whilst positive beliefs about others predicted cooperation.

Conclusions: The PDG was an effective tool in exploring social cognitive processes underlying live interactions within an ambiguous social scenario. Overall levels of paranoia and negative beliefs were low in the study sample, and it was not possible to detect specific effects of these factors. Further study is required to ensure sufficient levels of paranoia.

Introduction

Research in psychosis and persecutory delusions (PDs) suggests that social cognitive processes underlying paranoid thinking are essential in a person's perception of others and their behaviours during a social interaction (Buck, Healey, Gagen, Roberts, & Penn, 2016; Combs, Finn, Wohlfahrt, Penn, & Basso, 2013; Combs, Penn, Wicher, & Waldheter, 2007; Klein, Kelsven, & Pinkham, 2018; Pinkham, Harvey, & Penn, 2016). People who experience paranoia show biases that impact upon the accuracy of their interpretations of cues in their environment (Freeman, Evans, Černis, Lister, & Dunn, 2015). Knowing how these processes relate to the development and maintenance of paranoia can provide valuable information on how people who experience paranoia perceive and navigate social situations and inform clinical interventions. Recent research has used game theory and socioeconomic games to present participants with ambiguous social tasks in order to investigate paranoia under controlled conditions (Ellett, Allen-Crooks, Stevens, Wildschut, & Chadwick, 2013; Raihani & Bell, 2017, 2018). This paper will briefly present current understandings and methods of researching paranoia and describe an investigation of paranoid cognition using a Prisoner's Dilemma Game paradigm.

1.1 Paranoia

Persecutory delusions (PDs) are core components of many psychotic disorders, including schizophrenia, schizo-affective disorder and delusional disorder. Increasingly, researchers have taken a single symptom approach to investigating these disorders (Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017; Garety & Freeman, 2013; Owen et al., 2011). Specific research in the area requires clear and well-defined classification of these individual symptoms. In the cases of PDs, this has been complicated by individual differences in presentation in the main dimensions of delusions as they are currently understood, and lack of

clarity and differentiation between the different categories of delusions (Freeman, 2007; Freeman & Garety, 2000). Freeman and Garety (2000) highlighted the factor that differentiates persecutory delusions from other delusions, i.e. the element of harm, and proposed a more specific definition. Table 1 shows the criteria and conditions. In summary, to classify an experience as a persecutory delusion, two essential criteria must be met: a) the person must believe that they will be harmed, and b) a persecutor will have the intention to cause harm to them.

Table 1.
Criteria for a delusion to be classified as persecutory (from Freeman & Garety, 2000)

Criteria A and B must be met:
A. The individual believes that harm is occurring, or is going to occur, to him or her
B. The individual believes that the persecutor has the intention to cause harm
There are a number of points of clarification:
Harm concerns any action that leads to the individual experiencing distress
Harm only to friends or relatives does not count as a persecutory belief, unless the persecutor also intends to have a negative effect upon the individual
The individual must believe that the persecutor at present or in the future will attempt to harm him or her
Delusions of reference do not count within the category of persecutory beliefs

1.1.1 Current understanding of paranoia

Cognitive models of psychosis and PDs highlight the essential aspects of maladaptive appraisals and reasoning, negative beliefs, affective processes, and negative interpretations in the formation and maintenance of symptoms (Freeman, 2016; Garety et al., 2001; Morrison, 2001). For example, an internal sensation or thought comes into awareness and is misinterpreted as occurring externally. Factors such as past traumatic experiences, life stressors, interpersonal sensitivity, negative schemas and social cognitive biases may increase the likelihood that these experiences are perceived as threatening. Freeman's (2016) six-factor model proposes that once a threat belief is formed, 1) worry processes maintain the

paranoid thoughts in awareness and generate negative emotions, whilst 2) negative

self-beliefs maintain the feeling of being vulnerable to threat. 3) Further anomalous

experiences and 4) sleep difficulties drive continued misinterpretations, negative

affect and deplete the person's ability to cope. 5) Reasoning biases and 6) safety

behaviours prevent the person from developing alternative explanations for their

misinterpretations. Research has sought to understand in more detail the roles of

these maintenance and vulnerability factors in paranoia to develop effective

cognitive behavioural interventions.

1.1.2 The continuum approach

Past research has generally looked to clinical populations to understand

PDs, as clinical presentations have traditionally been viewed as distinct from

'normal' experience in the general population. However, research shows that

delusional beliefs exist in the general population in the absence of psychotic

disorders and their prevalence rates exceed those of psychotic disorders (Freeman,

2006). These experiences are not categorically different to clinical presentations

(Elahi et al., 2017; Johns et al., 2004; Johns & van Os, 2001; van Os et al., 2009).

Bebbington and colleagues (2013) found that persecutory delusions build on and

present a more severe form of what is experienced in the general population, i.e.

mistrust, ideas of reference, ideas of persecution and interpersonal sensitivity.

Within this understanding, many people experience everyday social concerns, and

few experience true PDs, creating a hierarchy of paranoid experiences (Figure 1.;

Freeman et al., 2005). Whilst milder symptoms do not persist over time for most

people, or persist at a sub-clinical level (Hanssen et al., 2005), evidence shows that

a small number of individuals progress along the paranoia continuum. The presence

of non-clinical experiences have been found to predict future clinical symptoms

(Poulton et al., 2000). This predictive relationship highlights the importance of

exploring and understanding paranoid experiences in the general population as it

may provide valuable information on symptom progression. Furthermore evidence suggests that individuals with persistent subclinical paranoia also experience a variety of factors that have detrimental effects on their lives, such as increased stress, impaired social functioning and a range of mental health symptoms (Freeman et al., 2011). Understanding the role of non-clinical paranoia in wellbeing can aid effective treatment outside of psychosis services. In order to effectively and accurately investigate paranoia, we must consider the validity and reliability of measurement tools in this area.

Given the range of presentations along the paranoia spectrum, this study will use the term 'paranoia' to refer to the whole continuum of experiences, 'persecutory delusions (PDs)' to refer to the clinical symptoms requiring 'need for care' and will specify non-clinical paranoia where needed.

Figure 1. The paranoia hierarchy. (from Freeman et al., 2005)

1.2 Current research paradigms

1.2.1 Self-report measures

Traditionally, self-report measures have been the main method of investigating paranoia in the non-clinical population; for example, the Paranoia Scale (PS, Fenigstein & Vanable, 1992). Self-report measures have the advantage of being cost-effective and relatively simple to administer, particularly in studies recruiting large sample sizes. However, current self-report measures do not assess whether the person's threat beliefs are unfounded or based in reality, i.e. as logical consequences of life experiences and personal context (Mosley et al., 2017). They also require the person to think and reflect on their past experiences, or imagine a hypothetical scenario, and relate them back to the questions in a meaningful way. This does not assess 'real time' judgements and reactions and instead the process is dependent upon factors such as memory retrieval, insight, and the person's willingness and ability to relay information clearly and accurately; results obtained may be influenced by subjective interpretation, memory and response bias (Brewin, Andrews, & Gotlib, 1993; Offer, Kaiz, Howard, & Bennett, 2000; van de Mortel, 2008).

1.2.2 Virtual reality

Virtual reality paradigms arguably provide a measure of paranoia that can be constructed to be neutral, and not provide specific threat cues. Interpretation of these ambiguous scenarios then depend upon individual differences and social cognitive biases essential in paranoia, such as the hostility bias (Combs et al., 2009, 2013, 2007).

Freeman and colleagues conducted a series of virtual reality studies to show that paranoia can be triggered in social situations involving virtual reality characters (Freeman, Pugh, et al., 2008). Participants attributed mental states and intentions to

these characters in similar ways as they do in real life situations, and experience interpersonal sensitivity and negative affect (Freeman et al., 2003). Virtual reality paradigms can also differentiate between low paranoia, high non-clinical paranoia and persecutory delusions populations (Freeman et al., 2010). However, these studies have been mainly observational and have not yet allowed for studying paranoia within a live interaction with others, e.g. engaging in shared activity.

1.2.3 Game theory paradigms

Researchers have also explored using game theory and socioeconomic games to investigate non-clinical paranoia (Ellett et al., 2013; Raihani & Bell, 2017, 2018). A recent review (Bell, Mills, Modinos, & Wilkinson, 2017) proposed that psychosis involves a breakdown in the systems of social agent representation. This social cognitive process is used to help a person make sense of their social environment, attribute mental states to others, and make decisions in a social interaction. Changes in the usual function of this system means that a person with paranoia may hold distorted mental representations of social others, i.e. that they intend harm. The review highlights the difference between 'offline' and 'live' representations (Schilbach, 2014), where the former refers to perceptions of imaginary or hypothetical interaction (i.e. representations explored within self-report or virtual reality experiments) and the latter are employed in 'real' interactions. Here, a person may be required to hold the representation over the duration of the interaction and update it as new information is provided by the other social agents. Strategic game paradigms tap into this 'live' process by introducing a shared social task that model a real world interaction and examining the social cognitive processes that are employed.

These games often involve players making decisions to cooperate with each other or act in their self-interest for rewards, with the largest rewards usually resulting from self-interest decisions or 'defection'. This presents a social dilemma

and conflict of interest, i.e. making a choice between acting with benevolence and acting in self-interest, often at the expense of the other player(s). In many situations involving an option to defect, e.g. in the Prisoner's Dilemma Game, logic would state that the best strategy for earning the most would be to always defect, yet many people do not. Research has sought to understand why people choose to cooperate and has found the importance of trust and expectations of the other player (i.e. perceived intentions) in determining a person's behaviour (Balliet & Van Lange, 2013). Trust involves 'expectations of benign behaviour from someone in a socially uncertain situation due to the beliefs about the person's dispositions (including his feelings towards you)' (Yamagishi, 2011, p.27). In a social dilemma, a person is more likely to choose to cooperate with the other player if they expect the other person will also have benevolent motives and act in the collective interest (Engel & Zhurakhovska, 2016). It reasonably follows that a person would be less likely to cooperate and more likely to defect if the agents within their social representations are hostile, and the person experiences distrust.

Ellett and colleagues (2013) investigated paranoia in the non-clinical population using the Prisoner's Dilemma Game (PDG). The PDG is a dyadic game where participants can choose to cooperate or compete (defect). Earnings are highest for the competitor when the other player cooperates, and lowest for the co-operator when the other competes. The study found that approximately a third (35%) of their sample chose to compete (defect), and this choice was associated with higher levels of state paranoia. The study also investigated participants' reasons for competing, i.e. due to distrust, or simply due to wanting to earn more (greed-based). Results showed that paranoia was associated only with distrust-based competition, and the authors concluded that competition in the PDG is a behavioural marker for paranoia. Raihani and Bell (2017, 2018) used game theory to extend understanding of social cognitive processes during a game interaction.

Paranoia was associated with perceived harmful intentions from the other player both when the participants engaged in a shared game task, and when they observed a social interaction between others, suggesting an underlying negative bias in social representations of others. Perhaps in relation to this, research shows that paranoid individuals show greater anticipation of threat and overestimate the likelihood of future threat through biases in heuristic reasoning, i.e. the use of the availability heuristic (Bentall et al., 2009; Corcoran et al., 2006). This would increase a person's expectations of harmful intentions during a shared game task and increase the likelihood of distrust-based competition.

In these studies, the socioeconomic games allowed for the study of individual differences in paranoia, as well as the role of participants' negative expectations of others in the context of paranoia. They have the benefit of presenting a controlled interpersonal interaction in a relatively inexpensive form and as the above studies have shown, these games can be conducted over the internet, allowing for more ease of recruitment.

1.3 The current study

1.3.1 Study aims and hypotheses

The current study aims to extend upon the work by Ellett and colleagues (2013) using the Prisoner's Dilemma Game. Though there was a positive relationship between competition and distrust, the role of paranoid thinking and social cognitive processes (i.e. negative beliefs, and expectation of harmful intent from others) remains unclear. The main aim of this study is to clarify the effect of each of these factors on behavioural choice in the Prisoner's Dilemma Game in a non-clinical population.

1.3.1.1 Hypothesis 1: Paranoia, expectations, and choices in the PDG

Expectations of the other player will predict behavioural choice in the PDG. State and trait paranoia will be associated with behavioural choice in the PDG, in line with Ellett and colleagues' (2013) findings. State and trait paranoia will predict high levels of expected competition from the other player.

1.3.1.2 Hypothesis 2: Paranoia and intentions

Paranoia will be associated with interpretations of hostility-based competition, and not with earnings-based competition.

1.3.1.3 Hypothesis 3: Paranoia, beliefs about others, and the PDG

Beliefs about others will predict expectations of the other player: negative beliefs will predict expected competition, whilst positive beliefs will predict expectations of cooperation. Beliefs about others will also predict participants' choices in the PDG: negative beliefs will predict more competition, whilst positive beliefs will predict cooperative responses.

1.3.1.4 Hypothesis: Distress

Participants' ratings of distress (how much they are bothered by the other player's choices) will be associated with higher levels of expected competition, more competitive responses, hostility-based interpretations, and paranoia.

Methods

2.1 Participants

Prior to the main study, 43 participants were recruited in a separate study and provided pilot data to assess the feasibility of conducting the PDG through a computer task, using the PDG to elicit expectations and intentions, and the clarity of the instructions. These participants were recruited through the UCL Psychology Subject Pool (67% female). The mean age of participants was 20 years (range = 19-22; standard deviation, SD = .997).

Participants were recruited to the main phase of the study from the general population through word-of-mouth, social media advertising and the UCL Psychology Subject Pool. This mixed sampling method was used to broaden the scope of recruitment and to ensure that participants were not only from a student population. All participants were required to meet the following inclusion criteria:

1. Over 18 years of age
2. Not currently seeking, or have not sought in the past, professional help for a mental health difficulty.

Three hundred and four (304) participants were recruited to take part. The completion rate for the study was 69%, with 210 out of 304 participants completing all relevant tasks.

2.2 Statistical power analysis

A power analysis was conducted prior to commencing the study to estimate the minimum sample size. This was informed by previous studies using a Prisoner's Dilemma Game paradigm to explore paranoia in a non-clinical population (Ellett et al., 2013). The power calculation was conducted using G power 3 (Faul, Erdfelder, Lang, & Buchner, 2007), with desired power at 80% and an alpha level of 5%. The analysis estimated a minimum sample of 191 participants in order to detect a small to medium effect.

2.3 Design

This study employed a cross-sectional, between-subjects quantitative design to investigate the hypotheses. Paranoia, beliefs about others were continuous independent variables, whilst expectation of others' choices was the categorical (dichotomous) independent variable. Categorical (dichotomous) dependent variables were expectations of others' choices, and the participants' choices in the

PDG, whilst distress and ratings of perceived intentions were continuous dependent variables.

The feasibility of using the PDG computer task to address the study hypotheses was assessed in the pilot stage through collecting qualitative data on participants' understanding of the task (see Pilot Testing section below).

2.4 Measures

2.4.1 Demographics

Demographic information was collected at the start of the study. This included: age, gender (female, male, rather not say, other – please specify), country of residence, ethnicity, and occupation status (student, employed, unemployed, other – please specify).

2.4.2 Affect

The Depression, Anxiety and Stress Scale – 21 Items (DASS-21, Henry & Crawford, 2005) was used to measure state affect and stress. This is a self-report measure comprised of three scales and gives scores of current depression (e.g. 'I felt that I had nothing to look forward to', anxiety (e.g. 'I was aware of dryness of my mouth') and stress (e.g. 'I found it hard to wind down'). Each scale contains seven items. Participants are asked to read each item and give a rating that best applies to their experience over the past week. All items are rated on a four-point Likert scale ranging from '0' (did not apply to me at all) to '3' (applied to me very much or most of the time). Overall scale scores are obtained by multiplying each scale total by two and range from 0 to 42. The DASS-21 categorises scores into 'normal', 'mild', 'moderate', 'severe' and 'extremely severe'. The measure shows good internal consistency (Cronbach's α) in the original non-clinical sample for depression (α = .88), anxiety (α = .92), stress (α = .90), and for the total (α = .93).

2.4.3 Self and other evaluations

Beliefs and evaluations were measured by the Brief Core Schema Scales (BCSS, Fowler et al., 2006). The BCSS is a 24-item self-report measure developed for use in the clinical and non-clinical paranoia populations. It assesses beliefs that people hold about themselves and about other people. The scale provides scores on four dimensions of evaluation: negative self (e.g. I am unloved), positive self (e.g. I am respected), negative other (e.g. other people are hostile) and positive other (e.g. other people are fair). Participants are asked to make judgements on how they feel generally; they indicate whether they hold each belief, and if they do, rate on a four-point Likert scale ranging from '1' (believe it slightly) to '4' (believe it totally). Possible scores in each subscale range from 0 to 24. The measure shows good internal consistency and test-retest reliability in non-clinical samples (Fowler et al., 2006) for positive self ($\alpha = 0.78$; $r = .82$, $p < .001$), negative self ($\alpha = .86$; $r = .84$, $p < .001$), positive other ($\alpha = .88$; $r = .72$, $p < .001$) and negative other ($\alpha = .88$; $r = .7$, $p < .001$).

2.4.4 Paranoia

Trait paranoia was assessed using the Green et al. Paranoid Thought Scales (GPTS, Green et al., 2008). The GPTS is a 32-item self-report measure of paranoia and gives scores on two dimensions: persecution (e.g. certain individuals have had it in for me) and ideas of social reference (e.g. I spent time thinking about friends gossiping about me). Each item gives a statement of a paranoid thought and is rated on a five-point Likert scale ranging from '1' (Not at all) to '5' (Totally). The two dimensions of 16 items can be administered separately or can be combined to give a total score; possible scores on each dimension range from 16 to 80. The measure shows good internal consistency in the original non-clinical samples (Green et al., 2008) for social reference ($\alpha = .90$), persecution ($\alpha = .92$) and total scores ($\alpha = .95$). It also reports good test-retest reliability, giving significant intra-class correlation coefficients for social reference (.88), persecution (.81) and total
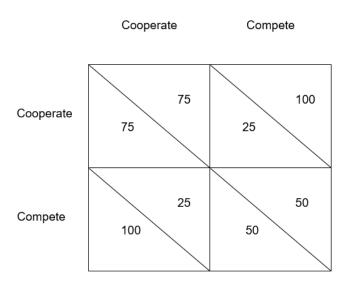
scores (.87). The scale shows good convergent validity and correlates highly with the Paranoia Scale (PS; Fenigstein & Vanable, 1992).

State paranoia was assessed using the State Social Paranoia Scale (SSPS, Freeman, Pugh, et al., 2007). The SSPS is a 20-item self-report measure. Five items in the scale are related to neutral views of others (e.g. I wasn't really noticed by anybody), whilst five items related to positive views (e.g. someone was friendly towards me). Ten items measuring paranoia provides the overall score (e.g. someone had bad intentions toward me); possible overall scores range from 10 to 50. Participants are presented with statements and are asked to rate their agreement on a five-point Likert scale ranging from 1 (do not agree) to 5 (totally agree). The measure shows good internal consistency in the original sample (Freeman, Pugh, et al., 2007; α = .91), with acceptable test-retest reliability ($r = .78$, $p < .001$), and convergent validity with the GPTS total score ($r = .41$, $p < .001$). It also report divergent validity with the positive ($r = -0.27$, $p < .001$) and neutral ($r = .-0.44$, $p < .001$) items included in the scale.

2.4.5 Prisoner's Dilemma Game (PDG)

The design of the PDG used in this study was modelled on the design used by Ellett and colleagues (2013). The game is played by two players who are required to either compete or cooperate with each other. The best strategy in the game is to compete, as it yields the best outcome if the other player cooperates, however if both players compete, payoff for both players is less. Figure 2. shows the possible outcomes of choice combinations. If one player competes whilst the other cooperates, the competitor is awarded 100 points, whilst the other player receives 25. If both players compete, they both receive 50 points, and if both cooperate, they both receive 75 points. In this design of the PDG, the other player, or the pre-determined computer responses, will always be set to compete. It is more likely for competitive behaviour from the other player to provide an ambiguous interpersonal

situation that allows divergent interpretations of the other player's strategy and motivations, as well as allow divergent behavioural responses in the participants. It is also more likely that a competitive response from the other plater will result in higher levels of state paranoia.

	Cooperate	Compete
Cooperate	75 / 75	100 / 25
Compete	25 / 100	50 / 50

Figure 2. Point outcomes for all possible choice combinations in the PDG.

2.4.6 Interpretations and distress

Participants' interpretations of the other player's intentions were rated using two visual analogue slider scales ranging from 0 (not at all) to 100 (completely). They were asked to rate their responses exploring earnings-based competition ('Please rate on the scale below how much you think the other player wanted to earn more for themselves') and hostility-based competition ('Please rate how much you think the other player wanted to reduce your earnings').

Participants were also asked to rate 'How much are you bothered by the other players' choices?' on a visual analogue slider scale ranging from 0 (not at all) to 100 (extremely).

2.5 Pilot testing

The PDG was piloted for use in a student population. Forty-three participants were recruited to take part in a pilot project to trial the computerised version of the

PDG and the instructions. The computer task was created and hosted using PsychoPy (Peirce, 2008). Pilot participants played two trials of the PDG and initial analyses showed that the computerised PDG task allowed detection of significant relationships between expectation of others and the participants' own behavioural choices on both trials: $X^2(1) = 22.252$, $p < .001$; $X^2(1) = 12.444$, $p < .001$. A logistic regression was carried out to determine the effects of state paranoia on behavioural choice; the model was found to be significant on the second trial, $X^2(1) = 8.676$, $p = .01$. The model explained 24% of the variance in behavioural choice (Nagelkerke R^2) and correctly classified 62.8% of cases. Verbal feedback from the participants indicated there were no detrimental effects from the element of deception, and all participants understood the PDG instructions.

The final version of the PDG as presented on Gorilla.sc (www.gorilla.sc/about) was also trialled on four participants and feedback was sought regarding the user experience of the programme, clarity of the instructions and the acceptability of the overall task. Following this, one minor amendment was made to the amount of time participants spent waiting for the other player to respond. Pilot participants felt the initial 30 second wait was too long; this was reduced to 18 seconds. Screenshots of the PDG task can be found in Appendix D.

2.6 Procedure

Participants completed the study on their personal devices with access to the internet. All information, questionnaires and game tasks were hosted by Gorilla.sc (www.gorilla.sc/about). Gorilla.sc is an online platform that can be used to create and host behavioural experiments and can be distributed to participants through a shared experiment link. All participants who agreed to take part took part in all aspects of the study. Once participants accessed the link, they were shown the information sheet (Appendix B), and were able to give consent via a click-through checkbox (Appendix D). If they did not consent, they were unable to proceed with

the rest of the study. Participants were told that they were taking part in a study investigating how beliefs and expectations of other people can impact on people's behaviour in ambiguous social situations, and that the study would involve completing some questionnaires and then playing a game with another participant.

Once consent was given, participants were taken to pages where they could enter demographic information (Appendix C) and complete a series of self-report questionnaires (DASS-21, BCSS, GPTS). Participants were the presented with instructions on the game and were informed of their options in the game (to cooperate, or to compete), and potential choice combinations including minimum and maximum earnings. Participants were not told that they would be playing a version of the PDG, nor were they given instructions on play strategy, i.e. whether they should compete or cooperate with the other player. Following the instructions, participants were shown the choice matrix (Figure 2.) and were presented with two scenarios to ensure comprehension of the instructions (e.g. if you and the other player both choose to cooperate how many points will you each earn?). They were given immediate onscreen feedback on these trials (e.g. green tick or red cross). Following the practice trials, participants were informed that they would be connected to another player online whilst they answered some initial questions (rating expectations and giving their own responses). In reality, they were playing against pre-determined responses of the programme. Participants played three rounds of the game; the choice matrix was presented at all times during choice-making. Each round consisted of the following:

1. Rating their expectations of the other player's choice
2. Making their own choices
3. Being informed of the other player's choice (always 'Compete')
4. Rating on a scale (0 to 100) how much they thought the other person was playing to maximise their own earnings

5. Rating on a scale (0 to 100) how much they thought the other person was playing to reduce the participant's earnings

In between steps 2 and 3, participants were shown a screen with the instructions to 'Please wait whilst the other player responds'. This lasted for 18 seconds, with a countdown clock indicating the final 10 seconds. This was included to increase the believability of participants playing the game with another person. Previous studies have found that the association between paranoia and behavioural choice is only present when participants believe that they are playing against another person, rather than the computer (Ellett et al., 2013).

At the end of three trials, participants were shown a feedback screen summarising their and the other player's choice. They were then asked to rate on a scale (0 to 100) how much they were bothered by the other player's choices (referred to in the analysis as 'distress' ratings). Participants then completed the final measure (SSPS) before being taken to the debrief screen, where they were informed of the deception, and were provided with contact details for further information and support. Finally, participants were asked to email the researcher to enter the prize draw for Amazon.co.uk e-gift cards.

2.7 Ethical considerations

The study received ethical approval through the University College London Research Ethics Committee (CEHP/2014/519; Appendix E). Prior to taking part, all participants were informed about the study procedure and their rights to participate and withdraw from participation. Participants were required to give explicit consent through ticking a box on their computer screen before they could begin the tasks. Participants who did not complete all aspects of the study (n = 94) were assumed to have withdrawn their participation in line with the BPS Ethics Guidelines for Internet-

Mediated Research (2017); they were excluded from the analysis and their data deleted.

Consideration was given to the potentially distressing nature of the questionnaire measures used in the study; some measures ask participants about their experiences of paranoia and negative beliefs about themselves and others. The risks were relatively low, as these measures were developed for use in the non-clinical population and have been used successfully in previous studies. The element of deception was also considered. During the computer task, participants were informed that they were playing a live game with another participant over the internet, when they were responding the pre-determined computer answers. This was trialled in the pilot phase of the study and participants did not report any distress due to this aspect. All participants were fully debriefed at the end of the study and were given contact information to the researchers, for access to further information, opportunities to debrief, or if they experienced any adverse effects from the study. The full debrief inform is included in Appendix F.

2.8 Data analysis

Data were analysed using the Statistical Package for Social Sciences, version 24.0 (SPSS, version 24.0, IBM). Exact values are given for relevant statistics and p-values, whilst percentages are summarised to one decimal point.

For all analyses involving the categorical dichotomous variables of expectations of others and behavioural responses, 'Compete' was coded as '1', and 'Cooperate' was coded as '0' in SPSS. Due to the dichotomous dependent variables, binary logistic regressions were run to examine the effect of paranoia and participants' beliefs on their expectations of the other player and on their behavioural responses. To determine the association between participants' expectations of others and their behavioural choices in the PDG, Pearson's Chi-

square analysis was conducted for each trial of the game (three in total), as both variables were categorical and dichotomous.

To examine Hypothesis 2, non-parametric correlations (Spearman's rank-order correlations) were run, given the non-normally distributed data, to determine the relationship between paranoia and participants' interpretation ratings. For hypothesis 4, Spearman's rank-order correlations were conducted to examine the relationship between participants' ratings of distress and their expectations of the other player and their behavioural choices. Spearman's rank-order correlations were also conducted between ratings of distress and interpretations of the other player's intentions, as well as between distress and paranoia.

2.9 Data screening

The completion rate for the study was 69%, with 210 out of 304 participants completing all relevant tasks. Checkpoints included in the study indicated that 94 participants did not complete the study after giving consent; of these, 45 (15%) participants did not reach the first checkpoint after the initial questionnaires, 18 (6%) participants did not complete the game task and 31 (10%) participants did not complete the final questionnaire. Other studies have found immediate dropout rates (i.e. before first checkpoint) in online psychological research of 10% (Hoerger, 2010), and non-completion rates of 74.4% (Crawford, Couper, & Lamias, 2001), depending on length of tasks.

Incomplete data were excluded from the analyses. Participants were also excluded from the analyses if they gave incorrect answers to both practice trials (n = 5). This was to ensure that only participants who had correctly understood the instructions were included in the analysis. Participants were also excluded from the analysis if they gave '0' ratings to all items on a questionnaire (n = 2). It is unlikely

on the included questionnaires to score 0 overall, so this step was taken to avoid the effects of insufficient effort or falsified data in responses.

2.10 Tests of normality

All data were screened for normality and skew. Kolmogorov-Smirnov tests of normality were found to be significant for most measures, indicating that the data were not normally distributed. The Kolmogorov-Smirnov test of normality was not significant for the BCSS subscale of positive beliefs about the self (p = .07). Examination of stem-and-leaf plots indicated positive skews to most of the data, with the exception of ratings for the intention of the other player to increase earnings, which showed a negative skew.

Results

3.1 Participant demographics

The final sample consisted of 203 participants and was predominantly female (72.4%), and white (49.3%), with a mean age of 29 years (range = 18-74, SD = 11.02). Participants were mainly from the UK (72.4%), followed by North America (11.8%), other European countries (5.4%), Southeast Asia (5.4%), East Asia (3%), South Asia (1.5%), South America (0.5%) and East Africa (0.5%). Occupation information was missing for one participant. Most of the participants were students (53.2%), followed by employed (40.9%), unemployed (2.5%), self-employed (1.5%) and retired (1.5%). All participant demographic information is summarised in Table 2.

Table 2.

Summary of participant demographics

Demographic	Value
N	203
Mean age in years, *(SD)*	29 (*11.02*)
Gender, female (%)	147 (72.4)
Country of residence, N (%)	*203 (100)*
UK	146 (71.9)
Europe – Other	11 (5.4)
North America	24 (11.8)
South America	1 (.5)
Asia – East	6 (3.0)
Asia – South	3 (1.5)
Asia – Southeast	11 (5.4)
Australia	1 (.5)
Ethnicity, N (%)	*202 (99.5)*
White	100 (49.3)
Asian – East	44 (21.7)
Asian – South	13 (6.4)
Asian – Southeast	1 (.5)
Asian – Other	13 (6.4)
Black – African	3 (1.5)
Black – Caribbean	1 (.5)
Black – Other	2 (1.0)
Mixed/multiple ethnic groups	8 (3.9)
Other	17 (8.4)
Occupation, N (%)	*202 (99.5)*
Student	108 (53.2)
Employed	83 (40.9)
Unemployed	5 (2.5)
Other – Self-employed	3 (1.5)
Other – retired	3 (1.5)

3.2 Outcome measures

3.2.1 Affect

The study sample had a median depression score as measured by the DASS-21 of 8.00 (range: 0-38), median anxiety score of 6.00 (range: 0-36) and median stress score of 12.00 (range: 0-36). These scores place the majority of the sample in the 'normal' category for depression, anxiety and stress, comparable to scores in the general population, however the range shows that some participants scored in the mild to very severe categories. This suggests that though participants in the study sample have not sought professional help for any distress they experience, the extent of their depression, anxiety and stress may overlap with what is seen in clinical samples.

3.2.2. Self and other evaluations

Overall, participants mainly scored in the low range in negative beliefs about the self (mdn = 2.00; range: 0-23) and others (mdn = 2.00; range: 0-24). The median score for participants' positive beliefs about themselves was 12 (range: 0-24), and the median score for positive beliefs about others was 10.5 (range: 0-20). These scores are similar to previous scores obtained in non-clinical samples (Fowler et al., 2006).

3.2.3. Paranoia

Overall, participants scored in the low range on the GPTS, a measure of trait paranoia. The median score was 25 (range: 16-74) on the GPTS ideas of social reference subscale, 17 (range: 16-67) on the social persecution subscale and was 43 (range: 32-141) overall (Table 3.). These scores are comparable to the mean scores in non-clinical samples found in previous studies (Green et al., 2008; GPTS social reference $M = 26.8$, persecution $M = 22.1$, total $M = 48.8$), suggesting that the study sample was populated by individuals in the non-clinical paranoia population.

The large range in scores suggests that some individuals experienced paranoia that overlaps with individuals in a clinical sample. A Spearman's rank-order correlation was conducted to determine the relationship between trait and state paranoia in the study sample. Significant positive correlations were found between state paranoia as measured by SSPS and GPTS social reference (r_s(201) = .504, p <.001), GPTS persecution (r_s(201) = .469, p <.001), and GPTS total (r_s(201) = .526, p <.001); participants' experience of state paranoia during the PDG increased with their levels of trait paranoia.

SSPS scores showed that the modal group consisting of 30.5% of participants (n = 62) scored the lowest possible score of 10, with 75% (n = 154) of participants scoring below 20, out of a possible 50. Data for the GPTS shows a similar pattern. The modal groups for the ideas of social reference and persecution subscales were at the lowest possible score of 16, consisting of 6.9% (n = 14) and 37.9% (n = 77) of participants respectively. Most of the participants (75%, n = 153) scored below 33 out of a possible score of 80 on the GPTS ideas of social reference subscale, and most (75%, n = 153) scored below 23 out of a possible score of 80 on the GPTS persecution subscale.

Table 3.

Descriptive information for measures of paranoia

	Descriptives	
	Mdn	*Range*
SSPS	14	10-46
GPTS soc. ref.	25	16-74
GPTS pers.	17	16-67
GPTS total	43	32-141

3.2.4. Prisoner's Dilemma Game

Behavioural responses (Responses) and participants' expectation of the other player (Expectations) on the three trials (T1, T2 and T3) were considered separately. There was an increase of expectations and responses of competition as the trials progressed. At T1, 63 participants (31%) expected the other player to compete, whilst 59 participants (29.1%) competed overall. At T2, 115 participants (56.7%) expected the other player to compete, and 96 participants (47.3%) chose to compete. At T3, 151 participants (74.4%) expected the other player to compete, whilst 127 participants (62.6%) chose to compete.

3.2.5. Intentions and distress ratings

Participants rated on a scale of 0-100 how much they thought the other player competed due to wanting to maximise their earnings (earnings-based competition), and how much they thought the other player competed to reduce the participant's earnings (hostility-based competition). Descriptive information can be found in Table 7. Friedman's ANOVAs showed that, at all three time points, participants gave higher ratings of earnings-based competition compared to hostility-based competition: T1, ($X^2(1)= 123.626, p < .000$), T2, ($X^2(1)= 112.389, p < .000$) and T3, ($X^2(1)= 88.316, p < .000$). Friedman's ANOVAs were conducted on participants' ratings of intentions. There was an overall significant increase in participants' ratings of earnings-based competition across the three trials ($X^2(2) = 9.733, p = .008$). Pairwise comparisons with adjusted p-values did not find significant differences between T1 and T2 ($p = .858$), T1 and T3 ($p = .055$), or T2 and T3 ($p = .591$) for ratings of earnings-based competition. There was also an overall significant increase in participants' ratings of hostility-based competition from the other player across the three trials ($X^2(2) = 12.927, p = .00$). Pairwise comparisons with adjusted p-values showed a significant increase between T1 and

T3 in particular (p = .011). The increase from T1 to T2 (p = .111) and T2 to T3 (p= 1.00) were not significant.

3.3 Hypothesis testing

3.3.1 Hypothesis 1: Paranoia, expectations and choices in the PDG

This study hypothesised that participants would be more likely to compete if they expected the other player to compete. Each trial of the game was considered separately (T1, T2, T3). Peason's Chi-Square analyses were run between Expectations and Responses. At T1, there was a significant relationship between expectation of the other player and the participant's response in the PDG (X^2 (1) = 47.787, p < .001). Based on the odds ratio, the odds of participants competing was 9.731 times higher if they expected the other player to also compete. The relationship remained significant at T2, where 47.3% of participants chose to compete (X^2 (1) = 27.888, p < .001). Based on the odds ratio, the odds of participants competing was 4.910 times higher if they expected the other player to compete. The relationship also remained significant at T3, where 62.6% of overall participants chose to compete (X^2 (1) = 30.168, p <.001). The odds of participants competing was 6.25 times higher if they also expected the other player to compete. These results supported the hypotheses that behavioural choice in the PDG is associated with expectations of the other player.

The study also hypothesised that both state and trait paranoia will be associated with behavioural choice in the PDG, as seen in Ellett and colleagues' (2013) findings. Each trial of the game was considered separately (T1, T2, T3); binary logistic regressions were run between the dichotomous variable of behavioural response and trait paranoia. At T1, there was no significant effect of trait paranoia on behavioural choice (X^2 (1) = 0.556, p = .757). There was also no significant effect of state paranoia on behavioural choice (X^2 (2) = 0.041, p = .839).

These relationships remain insignificant at T2 (trait, $X^2(2) = 0.833$, $p = .659$; state: $X^2(1) = 0.005$, $p = .943$) and T3 (trait, $X^2(2) = 0.833$, $p = .659$; state, $X^2(1) = 0.469$, $p = .493$). These results indicate that the hypothesis is not supported by the findings in this study.

Binary logistic regressions were run to examine the relationship between paranoia and participants' expectations of the other player. At T1, there was no effect of paranoia on whether participants expected the other player to cooperate or compete (trait, $X^2(2) = 1.985$, $p = .371$; state, $X^2(1) = 0.359$, $p = .549$). There was also no significant effect of paranoia on expectation at T2 (trait, $X^2(2) = 0.110$, $p = .947$; state, $X^2(1) = 1.319$, $p = .549$) and T3 (trait, $X^2(2) = 2.087$, $p = .352$; state, $X^2(1) = 0.222$, $p = .637$). These results do not support the hypothesis. Table 4 summarises descriptive information for state and trait paranoia scores by expectation category in all three trials.

Table 4. Descriptive information for trait and state paranoia by expectation category.

	T1		*T2*		*T3*	
	$E_{compete}$	$E_{cooperate}$	$E_{compete}$	$E_{cooperate}$	$E_{compete}$	$E_{cooperate}$
SSPS						
Median	14	14.5	16	12	15	13
Range	10-46	10-42	10-46	10-38	10-46	10-42
GPTS social ref.						
Median	27	23	25	24.5	23	27
Range	16-65	16-74	16-56	16-74	16-74	16-54
GPTS persecution						
Median	18	17	17	17	17	19.5
Range	16-57	16-67	16-57	16-67	16-67	16-53
GPTS total						
Median	46	41	44	42.50	42	47.50
Range	32-111	32-141	10-16	32-141	32-141	32-107

Note. $E_{cooperate}$: Expectations of cooperation from other player; $E_{compete}$: Expectation of competition from other player

3.3.2 Hypothesis 2: Paranoia and intentions

Hypothesis 2 proposed that paranoia would be associated with interpretations of hostility-based competition, and not with earnings-based competition. Non-parametric Spearman's rank-order correlations were run between trait and state paranoia, and participants' interpretation ratings; the three trials were analysed separately. The results supported the hypothesis. There were significant relationships between participants' interpretations of hostility-based competition, and trait and state paranoia, i.e. as trait and state paranoia increased, so did participants' interpretations that the other player was aiming to reduce the participants' points. There were no significant relationships found between paranoia and earnings-based competition, i.e. the other player simply wanted to increase their own points. Table 5 summarises the relevant statistics.

Table 5.

Correlations between participant interpretations, and state and trait paranoia.

		T1				T2				T3			
		Earnings-based		Hostility-based		Earnings-based		Hostility-based		Earnings-based		Hostility-based	
	N	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p
SSPS	203	.058	.414	**.396**	**.000**	-.007	.925	**.393**	**.000**	.072	.308	**.355**	**.000**
GPTS soc. ref.	203	-.058	.408	**.214**	**.002**	-.058	.408	**.212**	**.002**	-.001	.989	**.224**	**.001**
GPTS pers.	203	.008	.908	**.209**	**.003**	.008	.908	**.148**	**.035**	.036	.608	**.217**	**.002**
GPTS total	203	-.031	.664	**.230**	**.001**	-.031	.664	**.205**	**.003**	.026	.718	**.236**	**.001**

Note: significant results are shown in bold

3.3.3 Hypothesis 3: Paranoia, beliefs about others, and the PDG

Binary logistic regressions were run to test the hypothesis that participants' beliefs about other people would predict their expectations of the other player. Descriptive information is shown in Table 6. At T1, the logistic regression model containing negative and positive beliefs about others was significant (X^2(2) = 6.571, p = .037). The model explained 4.5% (Nagelkerke R^2) of the overall variance in expectations and correctly classified 69.5% of cases. The results show that though negative beliefs about others contributed to the model, positive beliefs about others had a significant effect and were associated with the participants being less likely to expect competition from the other player (X^2(1) = 5.284, p = .022, odds ratio = .929, 95% CI: .872-.989).

At T2, a similar pattern was seen: the overall logistic regression model was approaching significance (X^2(2) = 5.378, p = .068), and found a significance contribution of positive beliefs about others to the model (X^2(1) = 4.204, p = .040, odds ratio = .941, 95% CI: .887-.997), suggesting that positive beliefs about others decrease the likelihood of participants expecting competition in the other player. At T3, there were no significant differences between positive beliefs (U = 4116.5, p = .601) or negative beliefs (U = 3433, p = .167) *in* the two categories. The results show partial support for the hypothesis.

The study also hypothesised that beliefs about others would predict behavioural responses in the PDG. Binary logistic regressions were run; descriptive information is shown in Table 6. At T1, the overall logistic regression model for both negative and positive beliefs was significant (X^2(2) = 12.472, p = .002). The model explained 8.5% (Nagelkerke R^2) of the variance and correctly classified 70.9% of cases. The results indicated that only positive beliefs about others significantly

decreased the likelihood of the participant competing in the PDG (odds ratio = .890, 95% CI: .833-.952).

Table 6.

Descriptive information by expectation category for participants' beliefs about others

	T1		*T2*		*T3*	
	$E_{compete}$	$E_{cooperate}$	$E_{compete}$	$E_{cooperate}$	$E_{compete}$	$E_{cooperate}$
Negative beliefs						
Median	3	2	3	2	2	4
Range	0-24	0-18	0-24	0-18	0-24	0-18
Positive beliefs						
Median	9	11	9	12	11	10
Range	0-18s	0-20	0-19	0-12	0-20	2-19
	$R_{compete}$	$R_{cooperate}$	$R_{compete}$	$R_{cooperate}$	$R_{compete}$	$R_{cooperate}$
Negative beliefs						
Median	2	2	3	2	2	3
Range	0-14	0-24	0-18	0-24	0-24	0-18
Positive beliefs						
Median	9	11	9.5	12	10	11
Range	0-18	0-20	0-19	0-20	0-20	0-19

Note. $E_{cooperate}$: Expectations of cooperation from other player; $E_{compete}$: Expectation of competition from other player; $R_{compete}$: competitive responses, $R_{cooperate}$: cooperative responses

At T2, the logistic regression model for both variables was approaching significance ($X^2(2) = 5.795$, $p = .055$). Within this, positive beliefs about others significantly decreased the likelihood of participants choosing to compete ($X^2(1) = 5.596$, $p = .018$, odds ratio = .932, 95% CI: .879-.988).

At T3, there were no significant differences in positive ($U = 4806$, $p = .961$) and negative ($U = 4175.5$, $p = .100$) beliefs about others between participants who

chose to compete and those who chose to cooperate in the PDG. The results show

partial support for the hypothesis.

3.3.4 Hypothesis 4: Distress

Hypothesis 4 proposed that participants' ratings of distress would be

associated with negative expectations of others, competitive responses, more

hostility-based interpretations, and higher levels of paranoia. Descriptive

information for distress and interpretations of intentions are shown in Table 7 below.

Table 7.

Descriptive information for participants' distress ratings and interpretations of other
players' intentions

	T1		T2		T3	
	Mdn	Range	Mdn	Range	Mdn	Range
Interpretations						
Earnings-based	87	25-100	92	25-100	98	0-100
Hostility-based	40	0-100	50	0-100	50	0-100
Distress	50	100				

At T1, there was a significant difference in distress scores between

participants who expected the other player to compete, and those who expected the

other player to cooperate, $U = 3484.5$, $p = .016$. The results indicate that

participants who expected the other player to cooperate experienced more distress.

This relationship was not significant as T2 ($U = 498$, $p = .846$), and T3 ($U = 3713$, $p

= .558$). A similar pattern was seen in participants' response in the PDG. At T1,

there was a significant difference in distress between participants who competed

and those who cooperated ($U = 3154.5$, $p = .004$), and at T2 ($U = 4743$, $p = .345$)

and T3 ($U = 4855$, $p = .943$) these relationships are not significant.

Spearman's rank-order correlations were conducted between ratings of distress and participants' interpretations of the other players' intentions on the three trials. The results are summarised in Table 8 below.

Table 8.

Correlations between distress ratings, interpretations of player intentions and state paranoia.

	T1		T2		T3	
	Earnings-based	Hostility-based	Earnings-based	Hostility-based	Earnings-based	Hostility-based
Distress						
r_s	**.177**	.083	**.156**	**.163**	.128	.122
p	**.012**	.238	**.026**	**.020**	.068	.083

Note: significant results are shown in bold

The results did not fully support hypothesis 4. There were significant associations between distress and interpretations of hostility-based competition at T2 only (r_s (201) = .163, p = .020), indicating that on the second trial, participants' ratings of distress increased with their interpretations of hostility-based competition. Distress was also significantly associated with earnings-based competition at T1 (r_s (201) = .177, p = .012) and T2 (r_s (201) = .156, p = .026), indicating that on these two trials, distress increased with interpretations of earnings-based competition.

There was also a significant relationship between participants' ratings of distress and state paranoia (r_s (201) = .407, p = .001), indicating that state paranoia was associated with distress during the PDG.

Discussion

4.1 Summary of findings

The current literature on the use of socioeconomic games in the study of paranoia is limited. Ellett and colleagues (2013) found a significant relationship between paranoia and behaviour in the Prisoner's Dilemma Game (PDG), whilst

Raihani and Bell (2017, 2018) found evidence to suggest the additional influence of other factors on behaviour in the Ultimatum and Dictator Games, such as self-interest and negative beliefs about others. The current study aimed to clarify the role of paranoid thinking and participants' beliefs of others in the PDG.

4.1.1 Hypothesis 1: Paranoia, expectations, and the PDG

The study hypothesised that participants' expectations of the other player would determine how they responded in the PDG; this was supported by the data. Participants were much more likely to compete when they expected competition. This would suggest that participants made predictions of the other player's behaviours and responded accordingly. This was consistent across all three trials of the game and is in line with the current literature on behavioural choice in socioeconomic games (Ng & Au, 2016; Zettler, Hilbig, & Heydasch, 2013). The study did not find evidence to support the hypothesis that paranoia informed participants' expectations of the other player. Similar to Ellett and colleagues' (2013) findings, approximately a third of participants chose to compete in the first trial of the PDG, however the relationship between trait and state paranoia and behavioural choice in the PDG was not significant. This suggests that the relationship between expectation of the other player and participants' choices were driven by factors other than non-clinical paranoia in this study.

The a priori power analysis conducted prior to recruitment suggests that the study sample had enough power to detect an effect. One possible explanation for the lack of relationship between state paranoia and the PDG might be that the dynamic nature of state paranoia. Evidence in the literature suggests that paranoia changes over time due to factors such as fluctuating self-esteem (Melo, Corcoran, Shryane, & Bentall, 2009; Thewissen et al., 2007; Thewissen, Bentall, Lecomte, van Os, & Myin-Germeys, 2008). As state paranoia was only measured once at the end

of the study, it is not clear whether these fluctuations occurred during the PDG. It is possible that more distinct relationship could be detected if state paranoia was measured at the end of each trial.

A second explanation might be the overall distribution of paranoia scores in the study sample. Data on both trait and state paranoia scales were positively skewed to the low end of the distribution and showed a floor effect. This suggests that paranoia in the study sample was low in general, which would limit the possibility of detecting an effect of paranoia. Several measures were taken in the design of the study in an attempt to increase the likelihood of state paranoia during the study, such as using the terms 'cooperation' and 'competition' during the game with the participants. The 'other player' was also set to consistently compete. It was expected that competition from the other player would be more likely to present an ambiguous situation and elicit paranoia. It may be helpful in future research to induce state paranoia whilst participants played the PDG, to ensure sufficient levels, for example, by introducing increased self-awareness as a way to induce paranoia (Ellett & Chadwick, 2007; Fenigstein, 1984; Fenigstein & Vanable, 1992; Kingston & Ellett, 2014).

4.1.2 Hypothesis 2: Paranoia and intentions

The study hypothesised that paranoia would be associated with interpretations of hostility-based competition, and not with earnings-based competition. This was supported by the data. Though paranoia was low in general, those who experienced higher levels of both trait and state paranoia perceived the other player as more hostile and made more hostility-based interpretations. This replicated Ellett and colleagues' (2013) findings and supported the concept that people who experience paranoia have hostile social cognitive biases and attribute harmful intentions and threat in ambiguous social situations (Combs et al., 2009,

2013, 2007; Huddy, Brown, Boyd, Wykes, 2014; Pinkham, Brensinger, Kohler, Gur, & Gur, 2011; Pinkham, Harvey, & Penn, 2016). This has implications for individuals navigating their social environment, as the hostility bias is associated with difficulties in relationships and social functioning (Combs et al., 2013).

4.1.3 Hypothesis 3: Paranoia, beliefs about others, and the PDG

The results of the study partially supported the hypotheses. Contrary to expectation, there were no associations between participants' negative beliefs about others and their expectations of competition from the other player, nor their own choices to compete in the PDG. Only positive beliefs were associated with the expectations of cooperation from the other player and participants' choice to cooperate. Raihani and Bell's (2018) finding that negative beliefs about others influence socially punitive behaviours, and it follows that positive beliefs would encourage more cooperative, or socially affiliative behaviours. This relationship would need to be examined in more detail in further research.

Given previous findings on the role of trust in the PDG (Balliet & Van Lange, 2013), it might be expected that trust mediates the relationship between beliefs and behaviour. A possible explanation for the lack of the expected relationship between negative beliefs about others and competition is the floor effect seen in the scores for negative beliefs. This, combined with the low paranoia scores in the sample, would make it difficult to detect an effect of negative beliefs about others. In a sample consisting of higher levels of paranoia and negative beliefs, we would expect this relationship to be more present.

Raihani and Bell also identified the motivations of the participant as a factor to consider. So far, this study has considered the participants' choices as consequences of paranoia and their perceptions of the other player, however Raihani and Bell (2018) found that participants' own self-interest and aims to

maximise their earnings may also drive behavioural choices. Similarly, other studies have found that individuals characteristics such as social value orientation (Bogaert, Boone, & Declerck, 2008; Mischkowski & Glöckner, 2016; Pletzer et al., 2018), risk aversion (Glöckner & Hilbig, 2012; Sabater-Grande & Georgantzis, 2002), and personality traits (Boone, De Brabander, & van Witteloostuijn, 1999; Zettler et al., 2013) all influence decision making in social dilemmas. Additional factors such as game riskiness, fairness, payoff and whether the game consists of one or multiple iterations of the game (Bland et al., 2017; Embrey, Fréchette, & Yuksel, 2018; Engel & Zhurakhovska, 2016; Glöckner & Hilbig, 2012) are also taken into account. This suggests that participants consider game characteristics as well as their perception of the other player. Research has also found that people experiencing paranoia can moderate their behaviour as impression management in a social interaction (Pinkham, Hopfinger, & Penn, 2012), which may account for some of the discrepancy between participants' negative expectations and beliefs on their behaviour during the PDG. This has interesting implications for research into paranoid cognition in social interactions, as it may be expected that paranoia would interact with individual and situational factors. In conclusion, there is some evidence from the current study to suggest a relationship between perception of others and one's choices, though the study hypotheses were not all supported. Participants may be engaging in a complex process of decision making involving consideration of multiple factors, including social cognitive biases in paranoia, beliefs, their own motivations, and perceived characteristics of the game itself. This would be important to explore with further research.

4.1.4 Hypothesis 4: Distress

The study hypothesised that participants' ratings of distress would be positively associated with paranoia, hostile intentions, expected and response competition. The aim of assessing distress was to examine the role of negative

affect associated with paranoia, as it has an important role in the maintenance of paranoid experiences. The results showed that participants who experienced more state paranoia also experience more distress. Participants who expected competition and those who competed at T1 experienced more distress, however this effect disappeared at T2 and T3. The results partially supported the hypothesis of a positive relationship between distress and interpretations of hostility-based competition; participants were more bothered by the other player's choice when they thought it was due to hostile intentions. This association was only present at T2. Unexpectedly, there were significant associations between distress and interpretations of earnings-based competition at T1 and T2. Participants were bothered by the interpretation that the other player was competing to maximise their own winnings. It is possible that the inconsistent results are due to the change of the distress relationship over time and multiple iterations of the PDG. As distress was only measured once at the end of the study, it is not possible to determine changes in distress ratings over the three trials.

Another explanation for the results is that the question asked ('how much are you bothered by the other player's choices?') did not specifically address distress. We intended to explore participants' negative emotions directly related to state paranoia, however the wording used may have been interpreted differently by participants. For example, it is possible that the question touched upon broader emotions of anger or annoyance as the result of facing challenge from the other player. This would mean that though distress associated significantly with paranoia and interpretations of hostility-based competition, it was also related to other factors during the PDG.

4.2 Limitations

It is important to consider the results of the study within the context of its limitations. Though the study was able to recruit a sample size recommended by the

priori power calculation, the sampling methods (convenience and snowball) used did not appear to have recruited sufficient diversity in levels of paranoia experienced by the participants. Participants were required to self-select for the study; it is possible that individuals who experience higher levels of paranoia were less likely to self-select for participation. The sample was predominantly White British, female, and below 30 years of age, which clearly limits the generalisability of the results.

There is evidence to show that online studies yield results comparable to those conducted offline (De Beuckelaer & Lievens, 2009; Weigold, Weigold, & Russell, 2013) and conducting the current study online allowed for increased diversity in the sample. However, it was necessary to include an element of deception due to previous findings regarding the necessity of the 'other player' (Ellett et al., 2013); the effectiveness of this manipulation was difficult to ascertain and could have affected the reliability of the data. In future internet-mediated studies, it would be useful be include a free-text field at the end of the study to gather participant feedback on whether they sensed the game responses were pre-determined. The 'other player' during the PDG task was also set to consistently compete. This was included to increase the ambiguity of the scenario and thus the likelihood that paranoid interpretations could be made. However, this limits the conclusions that can be drawn from the data and future studies could vary the game responses to determine their effect on participants' perceptions. We would expect that there would be increased cooperation, as ambiguity of the other players' motivations decrease.

An additional limitation due to conducting the study online is the high level of dropout and non-completion: 31% of participants who gave consent did not complete the study. Current research states that dropout rates increase with the length and demand of study tasks (Crawford et al., 2001). It is possible that some participants did not find the tasks in the study acceptable and thus withdrew. It is also possible that the running of the tasks was impacted by the participants'

environmental demands, internet access and other factors that cannot be controlled in an online study. During the current study, it was not possible for participants to re-enter an incomplete task at a later time, which would inflate the dropout rates. Providing a 'leave study' link in future studies could help determine which proportion of non-completers were due to dropout, and which were due to other factors.

4.3 Research and clinical implications

The current study raises some further questions to be explored. To clarify the role of paranoia and paranoid cognitions during decision-making in the PDG, it will be necessary to recruit participants both at the low and high ends of the non-clinical paranoia distribution. This may be done in two ways: 1) pre-screening all participants on a measure of paranoia and selecting the highest and lowest scoring individuals, or 2) manipulate state paranoia within the experimental design. Studies have manipulated levels of self-focused attention and self-awareness to increase participants' perceptions of vulnerability and induce paranoia during ambiguous scenarios (Ellett & Chadwick, 2007; Kingston & Ellett, 2014).

Previous findings in the literature suggest other factors influence participants' choices in the PDG other than paranoia, such as personal motivations (i.e. self-interest) and game characteristics (i.e. riskiness and payoff). This would be important to explore, particularly to clarify how these other factors interact with paranoia within the PDG. This would help to develop understanding of how people who experience paranoia make decisions and interact with others during a social exchange and inform psychological intervention, such as working within a Cognitive Behaviour Therapy model to challenge negative beliefs and common social cognitive biases in paranoia. It would also help highlight deficits in a person's social functioning (i.e. impairments in social reasoning) and identify treatment targets, for example, within Social cognition and interaction training (SCIT, Roberts & Penn, 2009; Roberts et al., 2014) to improve social functioning for people diagnosed with

psychotic disorders. Real-life interactions are likely to provide a variety of factors and cues that would inform decision making and the types of behaviour a person can engage in. It would be helpful for future studies to employ a mixed-methods design to qualitatively investigate participants' goals and interpretations, as this may allow more detailed exploration of what may be a complex decision-making process.

4.4 Summary

In summary, there is evidence from the current study to suggest that a person's beliefs about others influence their expectations and behaviours within an ambiguous social exchange. Whilst the study did not find an effect of paranoia upon expectations and behaviour, paranoia was found to be associated with hostile attributions. Further research will need to be conducted to clarify this. However, the study suggests that the Prisoner's Dilemma Game is a viable paradigm for investigating the role of social cognitive processes as it allows for the study of individual differences in how people perceive, interpret and making decisions within a 'live' social interaction. It presents a social dilemma that reflects an everyday situation where a person may need to make decisions on whether to engage in cooperative, or prosocial behaviour within a social exchange.

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Part 3: Critical Appraisal

This critical appraisal will outline my personal reflections and learning on developing and conducting a piece of doctoral research, and the challenges encountered. It will mainly focus on the empirical study and will consider the methodological strengths and limitations of online recruitment and research.

Developing Research

My interest in this project stemmed from my previous experience of conducting Master's level research into non-clinical paranoid cognition. This was the first time that I have been involved with developing a study from the start and following the project through to completion. I was excited to be researching a fairly new area of study (using game theory to investigate paranoia) however this also proved challenging at times. As I began to read into the area, it became apparent that though there was well-established literature on social dilemmas and strategic games, its relation to paranoia was very limited; with only one study having explored the relationship at the time (Ellett, Allen-Crooks, Stevens, Wildschut & Chadwick, 2013). With a lack of existing literature to help develop my understanding, I initially found it difficult to form my thoughts on the topic, particularly as I knew very little about game theory at the time.

As the study developed, it was necessary to consider balancing the initial aims with feasibility and the practicalities of conducting research using existing software and within a set timeframe. With the support of my supervisor, I drew from Ellett and colleagues' (2013) design of a Prisoner's Dilemma Game (PDG), literature of social cognitions in paranoia and the literature of strategic games and initially designed a mixed methods study to take place in person. Participants would be recruited in pairs to play the game against each other, and they would be interviewed regarding their thinking during the study. The traditional face-to-face recruitment and research methods would have allowed for a mixed methods design

more easily, however, initial power analyses indicated that I would need to recruit over 190 participants to detect an effect. This would have been difficult to achieve without utilising internet-mediated methods. I decided to recruit and host the study online, as it would likely increase the reach of the study and allow me to recruit larger samples (Khatri et al., 2015). This concerned me, as it would involve using software that I was unfamiliar with to build the task (Gorilla.sc; www.gorilla.sc/about), and I was unsure of whether the manipulation (participants playing against another player) would be effective online. As a result, I spent a great deal of time developing and testing different versions of the PDG task and researching ways of increasing the believability of the manipulation, e.g. including waiting screens. I was aware of the need to keep the design as simple and the tasks as short as possible to reduce participant dropout (Hoerger, 2010). I decided with my supervisor that a pilot study could test out the procedures and ease the concerns. I found that the design of the tasks was limited by my knowledge of programming and task development using Psychopy (Peirce, 2008) and Gorilla, however I was able to build tasks that collected the required information. Ultimately, I enjoyed the challenge of learning new software and creating the PDG tasks. I found that conducting research on a doctorate level allowed a lot of autonomy and independent thinking in decision making, whilst being supported by my supervisor. I found this essential in developing my confidence and research skills, and in solidifying my interest in carrying out clinically-relevant research.

Internet-Mediated Research (IMR)

I was pleasantly surprised by the number of people who were willing to take part in online research for little, or no, compensation for their time. I initially considered using the UCL Psychology subject pool, where UCL students can gain credits from taking part in research. However, I was aware that psychological research often over-uses the university student population, which provides biased

samples that often differ from a non-student population (Peterson, 2001). This would limit the extent to which broader conclusions could be drawn.

Dedicated social media accounts (Twitter, Facebook, Tumblr and Reddit) were created for the recruitment period. Regular posts on each of the accounts were made containing briefly stated information and a link to the study as well as the Facebook page. I asked people to help forward these posts on to their own social media accounts in the hopes of reaching a larger network. I found that this method of advertising was successful in helping me to reach a larger number of participants than would have been possible otherwise, however it still depended on people I know and people known to them. Given that I had a very small social media presence and network, I feel this had limited reach.

I found that recruitment through social media advertising began to slow down after the first two weeks once potential participants had been reached already; I had recruited only 120 people and there were very few new sign ups despite continued social media posts. I was quite anxious and concerned by this, as I only had a limited time to continue recruiting. As a result, I utilised UCL Communications and the UCL Psychology subject pool to meet my recruitment target. Despite my efforts to reach a more diverse population, most participants were White British, female and relatively young, though I was able to recruit international participants (29.1%), and those who were employed (40.9%). Though the snowball recruitment method allowed for the recruitment of larger samples, it increases the risk of a bias toward recruiting like-minded individuals, as most of the people in my network are professionals or people in academic institutions.

Having had an active role of decision-making and control over all aspects of the study, I found that online recruitment was an anxiety-provoking process. This was particularly exacerbated by the fact that I had little control over the process

once the study recruitment link had gone live, aside from reposting on social media. It was not possible to get an impression of how participants found the study or to assess whether there were any problems. Participants were able to email me or reach out through social media to ask clarifying questions and raise concerns, however I was worried that this extra step would prevent people from seeking further information and that they would simply not take part.

The data collection system allowed for checkpoints to track participant progress through the tasks. During recruitment, I was able to see that a proportion of participants exited the experiment following the PDG task. This was surprising, as they had already completed the majority of the tasks and knew that there was only one more questionnaire to follow. It was possible that a group of these participants did not find the PDG task to be acceptable and thus withdrew from the study. I entered the study link to see if there were issues with the running of the programme and found that the loading time of the final questionnaire was very slow. This might have led participants to assume that the webpage had stopped loading, and thus disengaged from the study. Furthermore, whilst IMR allowed me to present all participants with the same experimental tasks and manipulations, it was not possible to control for factors in the participants' environment, such as distractions or being called away. This would have inflated dropout and incompletion rates. I found this frustrating, as there was little I could do to reduce this. During the design of the study, I had attempted to reduce the rate of missing data; participants were not able to progress to the next page if they had missing items. This was effective as there was very little missing data collected. However, it is important to consider the ethics of this; participants were not able to choose not to disclose on individual items (BPS, 2017). It is possible that this increased dropout rates, as participants could choose not to continue if they did not wish to complete an item. In addition to this, I found the IMR guidelines published by the British Psychological Society

(2017) to be helpful in developing the study and managing collected data. In developing the information sheet, I needed to provide enough information for participants to give informed consent however I was aware that if the information was too dense and required too much time to read, many potential participants would simply leave the page. There was no way of assessing whether participants had fully understood the study to give informed consent. The guidelines suggest an addition of a check-box at the end of the study to confirm consent. This would be useful to incorporate in future research.

There are clear benefits of using IMR. Though it took some time to learn the software and to develop the tasks, once this was finalised the online recruitment process allowed me to progress with other aspects of research and use my time more efficiently. The software organised the data into individual files for each questionnaire and the PDG task; collating the raw data into a combined database and calculating scale scores was a lengthy process. However, traditional methods would have required me to create a database and enter participants' scores individually by hand and would have increased the risk of human error. Recruiting and conducting research online is also more cost-effective compared to traditional methods, particularly when contacting a large number of people. Overall, I found that IMR required fewer resources and created a more efficient data collection process.

In addition to ease of recruiting larger, more diverse samples, IMR removes the element of power imbalance and bias from characteristics of the researcher in face-to-face research. It can also break down barriers and open up the world of research to individuals who may not normally take part in face-to-face studies, such as participants who experience high social anxiety, those with physical disabilities, people who work hours that would prevent them from attending research appointments, or previously hard-to-reach populations who take part due to

increased anonymity in IMR (Illingworth, 2001; Naglieri et al., 2004; Obst & Stafurik, 2010; Temple & Brown, 2012). This will generate more diversity in viewpoints, and allow for previously infrequently heard voices to contribute.

Data quality in IMR

Despite the benefits explored above, there are clear weaknesses introduced by conducting research online that affect the quality and reliability of data. An important limitation in online recruitment is the potential of bias in the study sample. Online studies are more likely to recruit younger participants compared to traditional methods (Frandsen, Walters & Ferguson, 2013; Ramo, Hall & Prochaska, 2010). There is evidence to suggest that frequent users of social media differ in personality traits to people do not use, or only use social media infrequently. For example, social media use is associated with extroversion, openness to experiences, and men with more emotional instability (Correa, Hinsey & De Zuniga, 2010). Other studies have found differences in race, gender, parental education attainment (Hargittai, 2007). Crowdsourcing platforms such as Amazon Mechanical Turk (MTurk; https://www.mturk.com/) and Prolific (https://prolific.ac/) are becoming increasingly popular in psychological research. These platforms create databases of participants and studies and facilitate the matching of the two. A recent study found that over half of MTurk users are female and from the United States, with a mean age of 31 years, and with a large proportion of higher education attainment (Ross, Zaldivar, Irani & Tomlinson, 2009). Other characteristics that appear unique to MTurk users compared to community and student samples are: paying less attention to experimental materials, seeking answers on the internet and personality characteristics such as lower self-esteem (Goodman, Cryder & Cheema, 2013). These individuals cannot be viewed as being representative of the general population as a whole, and can only be said to represent an 'internet-using', or crowdsourcing population. This suggests that research using online recruitment may

need to be interpreted with caution and may not generalise to the general population.

Research has compared online and 'offline' (i.e. pen-and-paper) self-report data and found inconsistent results. Whitehead (2011) found comparable results for the Hospital Anxiety and Depression Scale (HADS) in the two conditions, whilst others have found inflated HADS online scores (McCue, Buchanan & Martin, 2006). In a study of 16 measures, there were no differences between online and paper responses (Ritter, Lorig, Laurent & Matthews, 2004). In the context of paranoia, studies have found differences in reports of psychotic symptoms between online and offline ratings, however it appears that online self-assessments of psychotic symptoms also provide an important source of information (Moritz, Van Quaquebeke, Lincoln, Kother & Andreou, 2013). It is difficult to control for false reporting in IMR and I had to trust in the authenticity of participant responses. As recommended by Moritz and colleagues, I excluded participants who entered the same value for all items on a scale. In future studies, more formal checks of plausibility and lie scales could be incorporated. IMR, as with all self-report measures, cannot control for accurate reporting by the participant. In cases where the accuracy of certain factors are essential to the research questions, it may be important to balance the benefits of IMR against the possibility of compromised data.

It is interesting to view the quality of IMR data in the current climate of the 'replication crisis' in psychological research. This refers to the frequent failure to replicate past studies, often with the replication study failing to find the same significant effects as previous research (Open Science Collaboration, 2015). Some have argued that this questions the validity of past research and have suggested biases and underpowered designs as potential causes (Ioannidis, 2005). Others have argued that whilst methodological problems are likely, the probabilistic nature

of psychological research and often practical adaptations of replication study methodologies will naturally lead to failures to replicate exactly (Rodgers & Shrout, 2017). This is relevant to IMR in the discussion of the quality and validity of data; bias in sampling may mean that future replication attempts are likely to access slightly different populations, reducing the replicability of results. As discussed above, researcher control is limited in IMR, allowing for potentially confounding effects that may not be replicable.

I considered this in the context of the current empirical study failing to find significant effects of paranoia on participants' expectations and behaviours whilst playing a Prisoner's Dilemma Game. Of course, there were differences in methodology between my PDG task and the one used by Ellett and colleagues' (2013) research. It was also apparent that though I had sufficient power to detect an effect, participant characteristics (i.e. scores on paranoia measures) may have differed to those in Ellett and colleagues' study. This may reflect the factors discussed above, such as biases in sampling, and practical design changes. The ability to replicate may depend on a range of conditions that need to be met (Stroebe & Strack, 2014), and may be difficult in IMR. This may be addressed through repeated replications to assess patterns, rather than exact findings (Maxwell, Lau, & Howard, 2015).

Summary

I see that there is great value in using IMR, particularly within time, cost and resource constraints, and in exploratory research seeking large and relatively more diverse samples. For a doctoral research project, I found that it vastly reduced the amount of time I spent in recruitment and data organisation compared to traditional methods of face-to-face recruitment and experimentation. However, it is also clear that the limitations within IMR need to be considered in the design of a study,

particularly if accuracy in measurement and researcher control are essential.

Results from an IMR study should be interpreted within the context of its potential biases. With the increasing use of IMR and crowdsourcing platforms, further research will need to take place to develop effective adaptations to reduce bias. Overall, I enjoyed the opportunity to develop new skills in an area of growing method of research. IMR may be a useful addition to traditional methods that can capitalise on increasing numbers of people who are online and are accessing smart-technology.

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Appendices

Appendix A. Critical Appraisal Skills Programme, Case Control Study Checklist,

Part A

(A) Are the results of the study valid?
Screening Questions

1. Did the study address a clearly focused issue?
☐ **Yes** ☐ **Can't tell** ☐ **No**
HINT: A question can be focused in terms of
☐ The population studied
☐ The risk factors studied
☐ Whether the study tried to detect a beneficial or harmful effect?

2. Did the authors use an appropriate method to answer their question?
☐ **Yes** ☐ **Can't tell** ☐ **No**
HINT: Consider
☐ Is a case control study an appropriate way of answering the question under the circumstances? (Is the outcome rare or harmful)
☐ Did it address the study question?

Is it worth continuing?

Detailed questions

3. Were the cases recruited in an acceptable way?
☐ **Yes** ☐ **Can't tell** ☐ **No**
HINT: We are looking for selection bias which might compromise validity of the findings
☐ Are the cases defined precisely?
☐ Were the cases representative of a defined population? (geographically and/or temporally?)
☐ Was there an established reliable system for selecting all the cases
☐ Are they incident or prevalent?
☐ Is there something special about the cases?
☐ Is the time frame of the study relevant to disease/exposure?
☐ Was there a sufficient number of cases selected?
☐ Was there a power calculation?

4. Were the controls selected in an acceptable way?
☐ **Yes** ☐ **Can't tell** ☐ **No**
HINT: We are looking for selection bias which might compromise the generalisability of the findings
☐ Were the controls representative of defined population (geographically and/or temporally)
☐ Was there something special about the controls?
☐ Was the non-response high? Could non-respondents be different in any way?
☐ Are they matched, population based or randomly selected?
☐ Was there a sufficient number of controls selected?

5. Was the exposure accurately measured to minimise bias?
☐ **Yes** ☐ **Can't tell** ☐ **No**

HINT: We are looking for measurement, recall or classification bias

☐ Was the exposure clearly defined and accurately measured?

☐ Did the authors use subjective or objective measurements?

☐ Do the measures truly reflect what they are supposed to measure? (Have they been validated?)

☐ Were the measurement methods similar in the cases and controls?

☐ Did the study incorporate blinding where feasible?

☐ Is the temporal relation correct? (Does the exposure of interest precede the outcome?)

6. (a) What confounding factors have the authors accounted for?
HINT: List the ones you think might be important, that the author missed.

☐ Genetic

☐ Environmental

☐ Socio-economic

(b) Have the authors taken account of the potential confounding factors in the design and/or in their analysis?

☐**Yes** ☐**Can't tell** ☐**No**

HINT: Look for

☐ Restriction in design, and techniques e.g. modelling stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factor

Appendix B. Participant Information Sheet

Please save or print this information sheet if you would like to keep a copy. Alternatively, you could contact the research team to request a copy.

Title **Everyday paranoia and making social choices**

This study has been approved by the Research Department of Clinical, Educational and

Psychology Ethics Chair

Project ID Number: CEHP/2014/519

We would like to invite you to participate in this research project. You should only participate if you want to and choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear, or you would like more information.

What is this research about? The purpose of this research is to investigate how an individual's beliefs and expectations of other people can influence their feelings and behaviours when in ambiguous social situations.

What will I have to do? If you agree to take part, you will be asked to complete several online questionnaires assessing your mood, how you view others, and certain beliefs you hold about yourself and others. You will also be asked to take part in playing an online game with another player. This will involve making choices to earn points and making inferences of the other player's strategy.

Who must we exclude? We must ask you *not* to participate if you have sought or are seeking professional help for a mental health difficulty. Our study aims to understand experiences of people who have not yet sought help for any distress they might be experiencing. We also ask you *not* to participate if you are aged below 18.

Are there any risks or possibility of discomfort? The risks involved in participating are minimal. If there are questions that you find distressing or intrusive, you are free to not answer those questions or to withdraw from participating. If you find yourself becoming distressed during the study, you can choose to stop at any time. If you feel upset or distressed as a result of participation, please contact the research principal investigator VH, a qualified clinical psychologist, who will be able to provide information for accessing resources or services which you may find helpful.

How will we maintain your privacy and confidentiality? You will be asked to give some demographic information, such as your age, gender, and ethnicity. All information will be stored confidentially and only the researchers involved in the study will have access or process the data. Participation cannot take place without your agreement. All data will be collected and stored in accordance with the Data Protection Act 1998. If you choose to withdraw from the study, you have the option of also requesting that all data be deleted.

When and where will the study take place? The study will take place at a time convenient to you. The questionnaires and game task should each take less than 10 minutes.

Will I be compensated for my participation? Unfortunately, limited resources mean the research team cannot compensate everyone for participation. However, there will be a draw at the end of the study to randomly select lucky participants who will receive Amazon vouchers, with three prizes of £50 each, and five prizes of £20 each.

What I have questions about the project? If you have any questions or require more information about this study, please contact the researcher using the contact details below:

Researcher: Jenn Qian Zhang

    Email:

Principal Investigator: Dr Vyv Huddy

    Tel:, Email:

If you feel you require any additional support or participation has harmed you in any way, you can contact the principal investigator using the details above for further advice and information.

Appendix C: Demographic screen

Please enter your demographic information below

Please select your sex:

○ Female
○ Male
○ Rather not say
○ Other (please specify)

How old are you?

[   ]

Where is your country of residence?

[   ]

What is your ethnicity?

[   ]

What is your occupation status?

[Please Select...   ▾]

Please continue to the next page to begin the questionnaires.
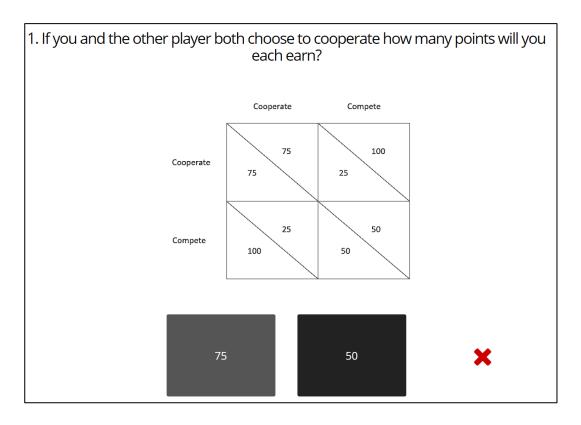
Next

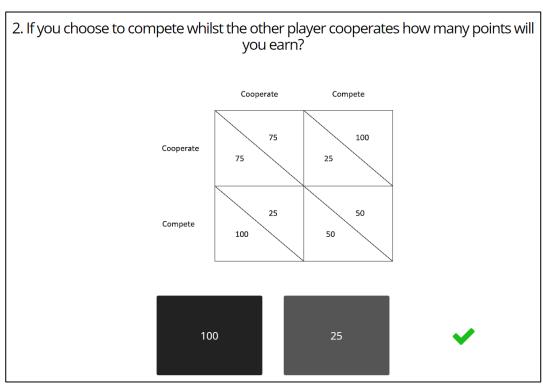**Appendix D.** Screenshots of the PDG task

Participants consent checkbox

Participant Consent Form

This study is conducted by the Department of Clinical, Educational and Health Psychology, University College London. It has been approved by the UCL Research Department of Clinical, Educational and Health Psychology Ethics Chair.

Your participation is anonymous and voluntary, and you may discontinue participation at any time. All data will be collected and stored in accordance to the Data Protection Act 1998.

If you have any questions regarding this study or for further information, please contact: Jenn Qian Zhang Email: qian.zhang.15@ucl.ac.uk

If you are happy to take part, please give your consent by ticking the box below.

☐ I have read the information sheets and consent to taking part in this study.

[Next]
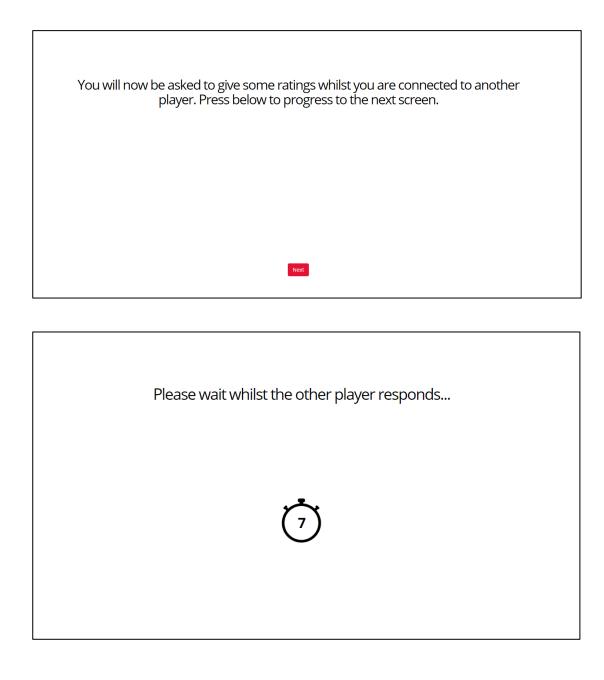
Instructions for the Prisoner's Dilemma Game

Instructions

You will be playing a game with another player over the computer. There will be three rounds of the game. You will be able to make two choices:

1. To cooperate with the other player, or
2. To compete against the other player.

The number of points you earn will depend on the combination of your choices. In each trial of the game, the maximum number of points you can earn is 100, and the minimum is 25.

Below are possible choice combinations and their points:

1. If both players decide to cooperate, you will each earn **75** points
2. If one person competes and the other cooperates, the competitor will earn **100** points. The co-operator will earn **25** points
3. If both players choose to compete, you will each earn **50** points

Click below to proceed to practice rounds

[Continue]

1. If you and the other player both choose to cooperate how many points will you each earn?

2. If you choose to compete whilst the other player cooperates how many points will you earn?

Elements included to increase believability of 'other player' deception

You will now be asked to give some ratings whilst you are connected to another player. Press below to progress to the next screen.

Next

Please wait whilst the other player responds...

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What do you think the other player will choose to do?

	Cooperate	Compete
Cooperate	75 / 75	100 / 25
Compete	25 / 100	50 / 50

[Cooperate] [Compete]

Would you like to Cooperate or Compete with the other player?

	Cooperate	Compete
Cooperate	75 / 75	100 / 25
Compete	25 / 100	50 / 50

[Cooperate] [Compete]

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Appendix E. Ethical approval and amendment approval emails

From: ███████ <████████████████>
Sent: 09 May 2014 17:11
To: █████████ <████████████████>; AcadServ.Ethics <████████████████>
Subject: Ethics Approval CEHP2014_519

Dear ███,

I am writing to let you know that we have approved your recent ethics application, "Looking into the Future: A Resource for Wellbeing?"

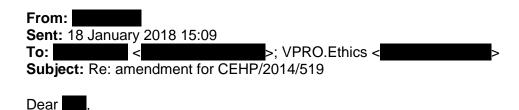The approval reference number is CEHP/2014/519. I have attached a signed copy of your application form.

I will keep the approved forms on file, and a copy will be lodged with the Graduate School Ethics Committee. Please notify us of any amendments, in line with guidance at https://www.ucl.ac.uk/psychlangsci/intranet/staff-docs/geninfo/forms/ethics.

Best Wishes,

████████

Chair of Ethics, CEHP

From: ████████████
Sent: 18 January 2018 15:09
To: █████████ <████████████████>; VPRO.Ethics <████████████████>
Subject: Re: amendment for CEHP/2014/519

Dear ███,

I'm happy to approve this. Your wording regarding psychiatric history is appropriate, and to be clear I would not discourage researchers from excluding participants on this grounds across the board - it's a contextual decision.

Please keep this email as a record of the approval.

████

Appendix F. Participant debrief information

Participant Debrief Sheet

Please save or print this information sheet if you would like to keep a copy. Alternatively, you could contact the research team to request a copy.

Thank you for your participation in our study, which involved completing our online questionnaires and taking part in the online game.

This study aims to investigate how people's expectations of others influence their decision making and behaviour in ambiguous social interactions. Specifically, we sought to find out whether people who experienced more negative expectations of other people's intentions (i.e. that others will aim to reduce your points earned) competed more in the game compared to those who experience more neutral, or more positive expectations (i.e. that other players will aim to maximise all points earned). In ambiguous situations where we don't have information about the other person, our expectations of their intentions may arise from pre-existing beliefs that we hold (e.g that other people are cooperative or hostile).

During the online game phase of the study, you were told that you were playing against another participant. In reality, you were responding to pre-set computer choices. Past studies have shown that the effect on behavioural choices is only seen when a 'real' social interaction is simulated, as opposed to simply playing the game with a computer.

Everyone who took part can be included in the prize draw at the end of the study. They will be in the form of Amazon vouchers: three £50 each, five £20 each. If you would like to be included in the prize draw, please email the researchers on the address below:

███████████████████████

If you have any further questions, or you feel you've been adversely affected by taking part in the study, please feel free to contact the research team using the contact information below:

Principal investigator: ████████████████████████████████

Researcher: ███████████████████████████

Thank you again for your participation. You can now close the window.

Next