UNIVERSITY OF HULL | DEPARTMENT OF PSYCHOLOGY

Attentional Bias in Itch & Psoriasis

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

in

Psychology

at the

University of Hull

Submitted by

Sarah Elizabeth Etty

BSc (Sheffield Hallam University)

MSc (University of Hull)

April 2022

Contents

Acknowledgements

This research project has been a privilege to be involved in, particularly as obtaining a PhD is something I never *really* thought I would actually be able to do. I have many people to thank for their help and support, without whom this project would not have been possible:

I would first like to extend my utmost gratitude for the guidance and support of my two supervisors, Henning and David, whose vast knowledge and intelligence still astonishes me. An extra special mention must go to Henning's unwavering serenity in the face of my numerous statistics-related meltdowns. I am extremely lucky to have been supported by two such kind and inspiring researchers, thank you.

I would also like to thank the Psoriasis Association for not only the funding for this project, without which I would have been unable to complete a PhD, but also for their assistance and encouragement in getting the word out about this important work.

My fellow PhD students have been unswervingly reliable in their willingness to offer advice, engage in a good old fashioned rant about SPSS, and show their belief in me when I was lacking in my own. I thank you all.

I would also like to thank all the strong women in my life that I have had the honour to see thrive and gain inspiration from. They helped me to believe that I, too, can achieve as they have.

Above all, I would like to offer my deepest gratitude to my husband and best friend, Che. You have been my own personal comedian during life's most challenging times, of which this PhD ranks highly. Thanks mate.

Attentional Bias in Itch and Psoriasis

Sarah Etty

Abstract

Attentional bias to threat is known to be altered in people with anxiety, however this phenomenon in people experiencing acute itch and people with psoriasis has not been well investigated. Attention is known to modulate itch intensity, however, the degree to which acute itch affects attention is not currently well understood. Two studies, using either itch-related words (Exp. 1) or itch-related images (Exp. 2) were therefore conducted to investigate whether acute itch induces an attentional bias towards or away from visual itch-related stimuli, and if so, whether it occurs in the early or later stages of processing. Healthy individuals were subjected to a skin prick (either histamine or placebo) followed by completion of a spatial cueing paradigm. Results suggest that experience of acute itch induces attentional avoidance of visual itch threat words, which occurs at a later processing stage in the form of facilitated disengagement of attention from itch and/or delayed disengagement from neutral information. No pattern of attentional bias for itch-related images was found. The results of Experiment 1 suggest that experiencing acute itch changes attentional processing of lexical information, by inducing attentional avoidance of visual itch threat words.

Having validated the research paradigm, the second part of the PhD investigated the role of attention in people with psoriasis; a chronic skin disease that causes itchy and often painful lesions. The social impact of psoriasis and its association with anxiety has been well documented, however, the role of attention in psoriasis is not widely known, and existing research presents divergent conclusions. Volunteer samples of 100 participants with psoriasis and 100 matched controls completed 6 versions of an

emotional spatial cueing task and a single emotional Stroop task; each version of the spatial cueing task differed by SOA, type of cue (words vs images), and valence of control words (negative vs positive). Results showed that no attentional bias was detected using the emotional spatial cueing task, but that disease-specific words induced longer reaction times than neutral words in psoriasis participants when using the emotional Stroop task. This suggests that people with psoriasis do not display attentional bias for disease-specific information, but that the presence of this information produces an overall attentional disruption in this population.

Introduction

Psoriasis

Psoriasis is a chronic inflammatory skin condition which is commonly reported to affect 2% of the world's population (Christophers, 2001). However, prevalence rates appear to vary greatly by country, with prevalence rates of 1.3% reported in the UK compared with rates of 8.5% in Norway, which has been argued could be due to geographical location with respect to proximity to the equator (Parisi et al., 2013). The most common form of psoriasis is psoriasis vulgaris, also referred to as plaque-type psoriasis, which accounts for approximately 80% of cases (Mounsey & Kulakov, 2018).

Psoriasis is characterised by patches of flaking red skin covered with distinctive silver-coloured scales which cause high levels of itch. These lesions are caused by uncontrolled production of keratinocytes (cells in the outermost layer of the skin), as a result of persistent inflammation (Rendon & Schäkel, 2019). This is due to T cells (a type of white blood cell) used by the immune system attacking healthy skin cells, causing the skin to produce more cells more quickly, which then prompts the immune system to produce further T cells (NHS, 2018).

Treatment

Psoriasis can be treated in different ways depending on the severity of the condition. Topical medications are recommended as first line treatments in the UK (NICE, 2012a). One of the oldest topical treatments for psoriasis is coal tar, which is applied to the skin. This treatment is still offered to patients today; however, it has a strong odour and can cause staining on bedding and clothing, which may make it an unattractive option to patients who may already be experiencing difficulties with self-consciousness. Other topical treatments currently offered for the treatment of psoriasis include corticosteroids, vitamin D_3, and a combination of both (Mounsey & Kulakov, 2018).

Topical corticosteroid side effects can include thinning of the skin, telangiectasia (spider veins), and striae (stretch marks), and sudden cessation of this treatment can lead to rebound flares of psoriasis. Side effects of topical vitamin D_3 are milder, and can include hypercalcaemia (high levels of calcium in the blood) and mild irritation (Mounsey & Kulakov, 2018). Phototherapy (the exposure of ultraviolet light to skin) is recommended as second-line treatment for psoriasis (NICE, 2012b), but despite being an effective treatment, can cause cataracts, skin burning, and increased risk of skin cancers (Menter & Griffiths, 2007). Systemic therapy (intravenous or oral medication) is recommended as the third-line treatment for psoriasis (NICE, 2012b), and only when other treatments have been ineffective, psoriasis is severe or extensive, or quality of life is significantly impacted (NICE, 2012b). Systemic therapy can be divided into two categories: non-biological and biological. Non-biological therapies are also referred to as small-molecule therapies, and target psoriasis by inhibiting the cellular processes that occur within the disease (Rendon & Schäkel, 2019). There are a range of options for non-biological therapies, all of which can be taken orally, with methotrexate, acitretin, and ciclosporin being the most common (Menter & Griffiths, 2007). Side effects of these drugs can be extensive and include, but are not limited to, headache; nausea; vomiting; diarrhoea; dry mouth; abdominal pain, joint stiffness; haemorrhage; anaemia, drowsiness; chest pain; blurred vision; fever; eye inflammation; hypertension. Biological therapies, also referred to as biologics, are engineered molecules that target specific inflammatory pathways, and are administered either subcutaneously or intravenously (Rendon & Schäkel, 2019). Side effects are, for most biological therapies, milder and less varied than non-biological therapies, however these drugs must be administered by a health professional on differing weekly schedules (Rendon & Schäkel, 2019). Research has shown that one of the biggest obstacles to effective management of psoriasis is adherence to treatment (Brown et al., 2006).

Comorbidities

Psoriasis has been shown to be associated with a number of diseases. One study showed that the lifespan for people with severe psoriasis is around 6 years shorter than the lifespan of healthy individuals. It was also found that people with severe psoriasis were at increased risk of death from cardiovascular disease, malignancy, chronic lower respiratory disease, diabetes, dementia, infection, and kidney disease (Abuabara et al., 2010). Psoriasis has also been linked to psoriatic arthritis, with one study showing 8.6% of psoriasis participants also suffered with the condition (Ogdie et al., 2013). In addition to physical health comorbidities, psoriasis has been associated with heightened levels of anxiety, self-consciousness and social isolation, and patient descriptions of their appearance indicated disgust, and avoidance of exposing their lesions to others or even themselves (Narayanan et al., 2014). Psoriasis, unsurprisingly has been shown to significantly impact upon quality of life (Wahl et al., 2000), to the same level, if not more so, than having other health issues such as cancer, hypertension, heart disease, depression, or diabetes (Rapp et al., 1999).

Cognitive Approach to Psoriasis

As previously mentioned, psoriasis is a chronic condition, which means that its symptoms can only be managed rather than cured, and treatment can often be associated with difficult and unpleasant side effects. Attentional processes have been found to differ in those with chronic conditions. For example, those with chronic pain conditions including fibromyalgia and chronic migraines have been found to differ from healthy control participants in their attentional processing of pain-related stimuli (P. Broadbent et al., 2021; Schoth et al., 2012). Attentional processing of threat-related stimuli has also been found to differ in those with heightened anxiety when compared with healthy control participants (Bar-Haim et al., 2007). It has also been shown to differ in those having experiencing acute itch (van Laarhoven et al., 2018). As psoriasis is a chronic

condition associated with persistent itch, and heightened levels of anxiety (Narayanan et al., 2014), it would be logical to question whether attentional processing of disease-related stimuli also differs within this population, and furthermore, whether this contributes to the maintenance and severity of the disease. This thesis will focus on attentional bias in people with psoriasis and also healthy participants experiencing acute itch, and will therefore review the existing literature within these areas. However, in order to outline this literature, first the core models of attention must be explained before moving on to attentional bias, the models of attentional bias for threat, and how attentional bias is measured.

Attention

William James (1890, p. 404.) defined attention as "the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others". Attention is essential as it enables learning by allowing distractions to be ignored while focusing on the source of information, and also facilitates survival in that immediate threats can be attended to and physically avoided. As only so much information can be processed at one time, attention acts as a type of filter and controls what information is prioritised.

Attention can be divided into two categories: divided or selective. Divided attention refers to the process that occurs when two or more stimuli or activities are attended to at once (also referred to as multitasking). This thesis is primarily concerned with selective (or focussed) attention, which is the ability to focus attention on an external stimulus (i.e., an object, location, or message), or internal stimuli such as thoughts or memories. As external information is better able to be measured, research

and theories focus mostly on attention with regards to external information. One of the earliest models of selective attention is the Filter theory of attention, put forward by Broadbent (1958). The Filter theory of attention is the idea that all auditory information enters a sensory register and is then quickly passed on to a selective filter. This selective filter then determines which stimulus is attended based on physical characteristics of the input, e.g., tone and pitch of an auditory stimulus. Broadbent's (1958) theory is able to account for the Cocktail Party Effect (Cherry, 1953), a phenomenon that occurs when lots of auditory information is competing for attention (such as at a cocktail party) but attention is able to be focused upon one particular stimulus (such as a conversation with a fellow party-goer). However, Broadbent's (1958) theory does not explain the phenomenon of being able to detect one's own name being spoken aloud in a noisy environment when an alternative auditory stimulus is already being attended (such as that party-goer). Two further theories of attention are able to account for this phenomenon; Treisman's (1964) Attenuation Model of Attention, and Deutsch & Deutsch's (1963) Late Selection Model of Attention. Treisman's (1964) Attenuation Model posits that information is filtered in the early stages of processing, similarly to Broadbent's (1958) model, however it argues that information is *attenuated*, or weakened, rather than completely filtered out. Deutsch & Deutsch's (1963) model differs in that it argues that all information is processed to the same degree until they reach a late selection filter that occurs immediately prior to working memory, and information is filtered based on the semantic characteristics of the stimuli. These three models of attention are largely concerned with auditory attention; however, this thesis will focus more on selective *visual* attention.

Treisman & Gelade (1980) proposed a theory of selective visual attention referred to as Feature Integration Theory. This theory suggests that the features that make up objects are detected early, automatically, and in parallel across a visual field

during a “pre-attentive stage”. These features include characteristics such as colour, orientation, brightness, spatial frequency, and direction of movement. It claims that stimulus or object locations are then later processed consecutively with focal attention, in order to recombine these separate features into objects. An alternative view is that, according to Posner (1980), visual attention can be thought of as a spotlight, in that attention focuses on one particular field at once, and that spotlight can shift to different locations without any physical eye movement. Control of the attentional spotlight is assumed to consist of three separate elements; initial orienting of attention, engagement with a stimulus, and subsequent disengagement from a stimulus (Posner & Petersen, 1990). A theory that combines elements from both Feature Integration Theory and Spotlight Theory of Attention, was proposed by Eriksen & Yeh (1985). Their Zoom Lens Theory of Attention posits that attentional capacity can modify from an equal distribution across a total visual field, to an extremely focussed area. The smaller the area of focus, the more detail and information can be processed and attended to, whereas detail must be sacrificed when the area of focus is larger.

Two major attentional systems have been identified with regards to visual attention: One is described as goal-driven, endogenous, and more voluntary, whereas the other is defined as stimulus-driven, exogenous, and involuntary (Corbetta & Shulman, 2002; Posner, 1980; Posner & Petersen, 1990). The top down, goal-directed system is mediated by current goals, knowledge, and expectations, whereas the bottom-up, stimulus driven system is mediated solely by the stimulus itself. According to James (1890), bottom up processing is activated when the stimulus is either sudden, distinctive, voluminous, or intense. Many theorists have argued that the two systems interact with each other, and Corbetta & Shulman (2002) have speculated that top down attention is interrupted by bottom up attentional processing of newly detected, unattended stimuli.

What is Attentional Bias?

Attentional bias (AB) is the concept that the attentional spotlight is more likely to be drawn towards certain information more than others. AB for threatening information has been found to be present among anxious individuals (Bar-Haim et al., 2007), and at both the automatic and strategic stages of processing (McNally, 1995).

AB within anxious populations has been described in the literature (Aue & Okon-Singer, 2015; Cisler & Koster, 2010) as having three different types; enhanced attentional capture, difficulty to disengage, and avoidance: The first, enhanced attentional capture, is an automatic and involuntary bias towards threatening stimuli in the very early, unconscious stages of processing (Mogg & Bradley, 1998; Williams et al., 1988). This type of AB is concordant with features of the fight or flight response, in that when a threat is perceived certain physiological reactions are activated in order to enable the individual to survive the threat. These reactions include pupil dilation (mydriasis) which is said to help the person identify further threats, or opportunities for escape or "flight". Additionally, extra oxygen is delivered to the brain to increase the individual's alertness. This enhanced ability to identify potential threats and heightened alertness to their surroundings is arguably similar to this particular type of AB. It follows, therefore, that anxious individuals experiencing symptoms of the fight or flight response would display AB towards information that signifies a threat. Rued et al. (2019) found that when inducing stress in undergraduate students, those experiencing high levels of stress were faster to react to the presence of threatening stimuli in a visual search task. Research by Koster et al. (2006) showed that participants with high levels of trait anxiety displayed enhanced attentional capture towards highly threatening stimuli.

The second type of AB is referred to as difficulty to disengage, as this feature describes the difficulty experienced in shifting attention away from threat (Cisler &

Koster, 2010) and occurs in the later, more strategic stages of processing. A difficulty to disengage from threat has been identified in those with heightened anxiety (Fox et al., 2001), and those with social anxiety (McGlade et al., 2020), with participants demonstrating slower responses for trials requiring attention to disengage from threat stimuli than non-threatening stimuli. Fox et al. (2001) noted that the difficulty to disengage from threat may be a maintaining factor in anxiety disorders, as prolonged attention on threatening information may increase anxiety levels.

Avoidance of threatening information is proposed in the literature to be the third type of AB, that also occurs in the later, more conscious, or strategic stages of processing. Some of the literature does suggest that avoidance can occur in the early stages of processing also (Koster et al., 2006), and that this takes the form of slower attentional capture with threat, which could be interpreted as a reluctance to engage with the threat. Whereas avoidance in the later, strategic stages of processing presents as faster attending away from the threat. This suggests that there are two ways in which attentional bias can differ: direction (hypervigilance or attentional bias *towards* threat, and avoidance or attentional bias *away* from threat), and phase of processing (engagement versus disengagement).

Theories of Attentional Bias in Anxiety

There are a number of different theories of AB that will be discussed here. Theories of AB can be divided into two categories: those that subscribe to the top-down perspective of processing i.e., the view that existing knowledge determines how information is processed, whereas others prefer the bottom-up approach of processing which states that the stimulus itself determines how it is processed.

One of the earliest theories of AB in anxiety was put forward by Williams et al., (1988). This model proposes that AB processes occur at a very early, preconscious level, and that an Affective Decision Mechanism assesses the threat value of incoming stimuli. If a stimulus is deemed to be highly threatening a further system referred to as the Resource Allocation Mechanism is activated and allocates attentional resources to the threatening stimulus. If the Affective Decision Mechanism deems a stimulus to be of a low threat level, the Resource Allocation Mechanism remains inactive and therefore attention is not disturbed from the previous task. If the Affective Decision Mechanism judges a stimulus to be of a high threat level, this prompts the Resource Allocation Mechanism to allocate attentional resources appropriately based on the individual's trait anxiety level. In high trait anxiety individuals, attention will be allocated towards the stimulus in the form of hypervigilance, whereas in low trait anxiety individuals, attention will be directed away from the stimulus in the form of avoidance. This model uses bottom-up processing to explain AB, in that it claims that the threat level of incoming stimuli affects attentional processing of information. However, the model also uses elements of top-down processing to explain direction of AB, in that an individual's anxiety level, and any associated expectations or goals, inform whether AB will be in the form of hypervigilance or avoidance. Cisler & Koster (2010) made an astute observation in that this model of AB effectively implies that the ADM of those with low state anxiety would be unlikely to consider highly threatening stimuli as such, and therefore the RAM would not allocate attentional resources to it. This is a valid criticism as if this were the case those with low state anxiety would not attend to highly threatening information, which is extremely unlikely. However, research has shown mixed results regarding low anxious individuals and AB to threat: Mogg et al. (2000) showed that low trait anxious participants showed a higher level of AB toward highly threatening information than mildly threatening information. This finding was echoed in research conducted by Wilson

& MacLeod (2003), whereas Yiend & Mathews (2001) found that low anxious participants displayed an avoidance of all threatening information regardless of stimulus threat level.

Wells & Matthews (1994) proposed a theory of AB that subscribes to top-down processing, in that it states that variables such as self-knowledge, personal goals, and individual beliefs contribute to AB for threat. Their theory states that heightened anxiety is associated with an ongoing perceived threat to the individual's self-perseverance, and this results in the constant monitoring of the environment for potential threat, resulting in an AB towards threatening information. This theory shares the notion with the model proposed by Williams et al. (1988) that high anxiety levels induce hypervigilance for threat, but differs in that it makes no mention of avoidance. Wells & Matthews (1994) also argued that AB could only occur in the later, more conscious stages of processing, and that any early AB detected is the result of pure chance or accident.

Beck & Clark (1997) put forward the cognitive model of AB. This theory claims that anxiety causes AB at three stages of processing: initial registration of a threatening stimulus, the consequent activation of a primal response that is innate and designed to enable survival and caused by the recognition of negative, personally relevant information, and the third of slower elaboration and processing of the threat that is driven by existing schema. This theory acknowledges a timeline of processing involved in attention to threat, which allows for the consideration of the types of AB that differ in their direction of bias and stage of processing.

Mogg & Bradley (1998) proposed a cognitive-motivational model, also referred to as the vigilance-avoidance hypothesis, that suggests the presence of an overly sensitive valence evaluation system in anxious individuals, which provides an output of perceived threat level. This output informs the activity of a goal-engagement system, which governs

the allocation of attention, resulting in AB towards all stimuli that could signify a threat, no matter how mild. This model implies that AB to threat occurs in both the early and late stages of attention, as attention is necessary in the early stages for the valence evaluation system to produce an output. This output decides on the later stage allocation of attention, which for anxious individuals is expected to be biased *away* from the threatening stimuli in the form of avoidance.

Eysenck et al. (2007) offered the attentional control theory as an explanation for AB in anxious populations. Attentional control theory suggests that anxiety disturbs two functions associated with attentional control: inhibition and shifting. Inhibition in this context refers to an individual's ability to inhibit automatic responses (e.g., maintaining attention on the current task), and attentional control theory states that anxiety reduces control over top-down regulatory processes. This indicates that it contributes towards a difficulty to disengage attention from distracting threat-related stimuli. Shifting, on the other hand, refers to the ability to shift attention between tasks. Shifting is said to be enhanced by higher levels of anxiety, in that shifting attention towards threatening stimuli is enhanced (enhanced attentional capture), and therefore shows increased levels of bottom-up processing in anxious populations. This theory includes the concept of early and late processing in AB but does not consider the concept of avoidance.

Measuring Attentional Bias

There are three paradigms that are most commonly used as methods of measuring AB in the literature; the dot-probe, the emotional Stroop and the emotional spatial cueing task (Bar-Haim et al., 2007). All three are tasks that present stimuli to participants and collect responses in the form of reaction times.

The emotional Stroop task (Williams et al, 1996) is a modification of the original stroop task (Stroop, 1935), which consisted of having the names of colours appear in a different colour ink to the word, thereby presenting two features within the same object (colour and word). Participants are asked to state the colour the word is written in. The Stroop effect refers to the difference in reaction times for colour congruent trials (word appears in the colour that matches the word) and colour incongruent trials (word appears in a colour that does *not* match the word), with longer reaction times for colour incongruent trials. The cause of the Stroop effect is commonly said to be the automaticity of word reading causing interference in the less frequently used process of colour naming. The original Stroop task has since been adapted to create the emotional Stroop task by the inclusion of negative emotion words or threat words instead of the names of colours, in order to measure whether this type of emotive stimuli has a more pronounced effect on participants' processing time than neutral stimuli. The emotional Stroop task can use words or images as stimuli, or both at the same time. For example, Agustí et al. (2017) investigated the effects of age on attentional processing using an emotional Stroop that presented images of faces depicting expressions of happiness or sadness, with a word superimposed across the face that was either congruent or incongruent with the expression (e.g., sad, happy). The emotional Stroop test was found by Evans et al. (2018) to demonstrate acceptable internal consistency, and a good level of test-retest reliability. Bar-Haim et al. (2007) identified a difficulty with this paradigm in that longer reaction times for threat stimuli may not be the result of attentional processes, but rather a result of the negative emotional state of participants that the presentation of threat stimuli induces. The Stroop is unable to distinguish between these two possibilities because both would result in longer reaction times. This paradigm is also unable to explore the type of AB that the reaction times may indicate, i.e., hypervigilance or avoidance, as again, both would result in longer reaction times.

The dot-probe task (MacLeod et al., 1986) is a computer-based task that also evaluates attentional processes by measuring reaction times. The participant is shown two stimuli (either images or words), one emotionally threatening and one neutral, side by side on a screen followed by a "probe", often in the form of a dot or circle. The participant is asked to indicate as quickly and accurately as possible the side of the screen the probe is shown by pressing a button. If participants' reaction times are quicker when the probe appears in the same location as the threatening stimuli (congruent trials), this indicates hypervigilance for threat. If reaction times are quicker when the probe appears in the same location as the neutral stimuli (incongruent trials), this indicates avoidance of threatening information. The dot-probe offers some advantages over the emotional Stroop task, in that it can identify the direction of AB and offers the opportunity to present an alternative type of stimuli to words without having to superimpose a colour filter over the top. The chronology for AB can also be explored using the dot-probe task by manipulating the length of time that stimuli are presented which is referred to as the stimulus onset asynchrony (SOA). Additionally, it can also differentiate between hypervigilance and avoidance. The capability to explore both direction and time course of AB is something the emotional Stroop is unfortunately unable to offer. The dot-probe task has been very frequently used in AB research (Bar-Haim et al., 2007) despite a number of studies citing its lack of reliability and consistency (Evans et al., 2018).

The spatial cueing task (Posner, 1980) was adapted by Stormark et al. (1995) to use emotionally valenced stimuli in the form of words or images, which was later employed by Fox et al. (2001) in order to measure AB to threat in anxious participants, using neutral, positive and threat related stimuli. The emotional spatial cueing task begins with a fixation cross in the centre of the screen that remains on screen throughout, followed by a cue (in the form of a neutral, positive, or threat-related stimulus) appearing on either the left or the right side of the screen. The neutral target (often a dot or circle)

is then shown immediately after on either the same side of the screen as the stimulus (valid trial) or on the opposite side of the screen (invalid trial). The objective for participants is to indicate as quickly and accurately as they can, with a keyboard button press, which side of the screen the target appears. Reaction times for each trial are then collected, with each trial differing by validity (valid or invalid) and cue type (threat, neutral or positive). Posner (1980) used a ratio of 20% invalid trials and 80% valid trials in the original spatial cueing task, in order to prime the participant to expect the target to appear on the same side as the cue in all trials. This provides a reasonable level of certainty that participants are going to move their attention to the cue when it is presented, as they expect the target to appear in the same location shortly after. As participants are primed to expect the target to appear on the same side as the cue, it is expected that reaction times for valid trials will be smaller than for invalid trials, indicating faster responses to the cued target. This concept is referred to as the validity effect. The increase in reaction times for invalid trials is referred to in the literature as reorientation costs, as the larger reaction time represents the time cost of the participant having to reorient their attention to the new un-cued location. Reaction times are also expected to differ depending on the type of cue presented. If validity effects are larger for threat trials than neutral trials, this is interpreted as a pattern of hypervigilance as the reorientation costs are more pronounced when the cue is threat-related. Conversely, when validity effects are *smaller* for threat trials than neutral trials, avoidance is indicated. This is due to participants not having to make as much effort to reallocate attention to the target when the cue is threat related, as represented by the reduced reorientation costs for threat trials.

The emotional spatial cueing task, like the dot-probe, offers the opportunity to explore both direction and time course of AB, as the task can differentiate between hypervigilance and avoidance, and allows manipulation of the SOA. However, the emotional spatial cueing task offers a further avenue of investigation into the component

of AB activated for threat stimuli. Examination of differences between cue type for each type of validity allows the identification of whether AB occurs in the engagement phase of attention, or the disengagement phase. If differences between cue types are significant for valid trials it suggests that AB has occurred in the engagement phase of attention, whereas if differences between cue types are significant for invalid trials this suggests that AB has occurred during the disengagement phase of attention (Bar-Haim et al., 2007). If hypervigilance is present, reaction times are expected to be either quicker for valid trials in which a threatening stimulus is presented, due to early attentional capture, or slower for invalid trials due to difficulty to disengage (or a combination of both). Whereas if an avoidance pattern is present, the opposite for both valid and invalid trials is to be expected, demonstrating slower attentional capture with the threat stimulus, and facilitated disengagement from the threat stimulus respectively.

There has been very little investigation into the quality of the emotional spatial cueing task as a measure of AB. However, studies by Enock et al. (2014) and Waechter & Stolz (2015) found low reliability for this measure. Due to the limited amount of research into the psychometric properties of the emotional spatial cueing task, however, it would be inadvisable to discount this measure as a tool to assess AB. This paradigm is a valuable addition to AB research as it produces a wealth of information which allows investigation into the direction, time course and component of AB.

The AB paradigms discussed here have been used extensively to measure AB in the context of anxiety (Bar-Haim et al., 2007) and pain (Crombez et al., 2013), however the physical experience of itch, as well as health conditions associated with high levels of itch remain largely unexplored in conjunction with AB.

Attentional Bias and Itch

Itch is an unpleasant somatosensory symptom associated with a number of skin conditions such as eczema and psoriasis, and closely related to stress. As previously discussed, those experiencing anxiety have been shown to also display an AB for threatening information. Van Laarhoven et al. (2018) examined itch and attentional processes in a study in which 41 healthy participants completed 3 separate tasks; it began with a somatosensory attention task during which electrically induced itch was administered to the wrist areas of participants. This task was then followed by an emotional Stroop task and a dot-probe task, the order of which was randomised. The somatosensory attention task required participants to respond via a button press, using either the left or right index finger, which red target bulb lights up (left or right) after a centrally positioned green fixation light is lit. In half of the blocks, an electrical itch-inducing stimulation was applied to one forearm. The results showed a response-slowing for the arm affected by acute itch (itch-congruent trials), which was interpreted by the authors as participants disengaging attention away from the itch location. However, the effect was only statistically significant in the second half of the blocks, and the finding was not replicated in a later study (van Laarhoven et al., 2017). Additionally, due to the nature of their design, the results do not allow conclusions about whether acute itch induces a specific attentional avoidance of visual itch threats, or whether it leads to generalised attentional avoidance. Furthermore, it could be argued that the delayed response for the itch-congruent trials was not necessarily caused by attentional processing of the itch stimulus. An alternative explanation could be that participants encountered a reluctance to move the arm that was experiencing the itch sensation.

For the modified Stroop, participants were asked to state aloud the colour that 8 itch-related words and 8 neutral words were printed in. Each word was repeated 5 times

in different colours, making a total of 80 trials. The results from the emotional Stroop task showed that participants had significantly longer reaction times for itch-related words than for neutral words, which suggests that the presence of itch-related words had an effect on attentional processing. However, due to the nature of the emotional Stroop task, this effect cannot be attributed to AB for itch-related words with complete certainty. As previously mentioned, MacLeod et al. (1986) argued that any response latency may be the result of a negative emotional state triggered by the presence of threat related words. As the emotional Stroop is also unable to explore the direction of any AB, the general AB identified in this study by the emotional Stroop cannot be categorised as either hypervigilance or avoidance.

For the dot-probe task, 10 itch-related pictures and 10 neutral pictures were used with a 500ms SOA. Results from the dot-probe task showed significantly longer reaction times for incongruent trials (when the dot appears on opposite side to itch picture), indicating hypervigilance for itch stimuli. The capacity for identifying the direction of AB is an advantage, especially as the emotional Stroop cannot provide that information for the word stimuli, but further exploration into time course of this AB would have added further strength to this study which could have been achieved by manipulating the SOA.

This study by van Laarhoven et al. (2018) is, as far as can be seen, the first of its kind to examine attentional processing of those experiencing acute itch. It examined attention to both lexical and pictorial formats of itch related stimuli, and for the images used a task that can allow for the direction of AB to be observed. Overall, this research by van Laarhoven et al. (2018) demonstrates an AB towards visual itch-related stimuli among healthy participants, and attentional avoidance of the location of a physical itch stimulus. However, the lack of a control group leaves it unclear as to whether healthy participants demonstrated a pre-existing AB towards itch-related information, or whether

participants were primed by the preceding somatosensory attention task during which a physical itch stimulus was administered. It is likely that in their study, the itch sensation that was induced during the somatosensory attention task had already fully subsided by the time the dot-probe and emotional Stroop tasks were completed, however the lasting psychological effects of having recently experienced physical itch are likely to have affected the outcomes of these tasks. The inclusion of a control group, specifically for the modified Stroop and dot-probe tasks, would have allowed the presence of acute itch to be better isolated as the cause of AB.

To summarise, there is a distinct lack of research examining the effect of acute itch on AB, with the only known study being unable to demonstrate that the cause of AB identified was acute itch, due to the lack of a control group and the likelihood of itch experience having subsided before AB was measured.

Attentional Bias and Psoriasis

As stated, anxiety has been found to be prevalent among individuals with psoriasis. For example, Lakshmy et al. (2015) found that 76.7% of their sample of psoriasis patients were experiencing some form of anxiety disorder. As anxious individuals have been shown to display an AB for threat related stimuli, it should follow that those with psoriasis with comorbid anxiety would also demonstrate AB towards threat information. A study by Fortune et al. (2003) examined AB for disease-specific and psychosocial threat in patients with psoriasis. This study recruited 60 participants with psoriasis and 60 age-matched healthy controls to complete an emotional Stroop task, in which negative words associated with perceptions of the self (e.g., stupid, ridiculous) and perceptions of others (e.g., stare, disgust), words associated with psoriasis (e.g., itchy, messy) and neutral words were presented (e.g., table, field). The results showed that psoriasis patients displayed longer response times than control participants when exposed

to words relating to their disease or psychosocial threat. This may indicate an AB towards disease-related or psychosocial threat stimuli, although the Stroop task cannot give any indication to the type of AB. As previously indicated, longer reaction times in the Stroop task may not indicate AB, but rather an intensified negative affective state triggered by exposing the participant to the threatening stimuli used in the experiment, which may then affect reaction times. Interestingly, this study also found that levels of depression, anxiety (measured using Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983)) and worry (measured using Penn State Worry Questionnaire (Meyer et al., 1990)) were not significantly correlated with response latency, indicating that patient status is the only indicator of AB. However, disease severity (as measured by Psoriasis Area and Severity Index) and duration of disease were also not significantly correlated with the response latency. This raises the question of whether psoriasis was the contributing factor of AB found in this particular sample.

The study by Fortune et al. (2003) administered psychometric assessment questionnaires which included the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) and the Penn State Worry Questionnaire (Meyer et al., 1990) after the Stroop task had been completed by participants in order to avoid the effect of questionnaire priming on response times. This effect has been found to be present when using the emotional Stroop task (Lundh & Czyzykow-Czarnocka, 2001), and an important detail to consider when using AB measures. A useful amendment to this study could have been the inclusion of a social anxiety specific questionnaire, as the negative emotional words presented to participants in the study were associated with participants' negative perceptions of themselves and of what others see in them, which is a typical symptom of social anxiety (NHS, 2020).

A more recent study by van Beugen et al. (2016) examined AB for disease and stigmatisation-related threat in people with psoriasis and their significant others. They recruited 50 participants with psoriasis, 50 significant others of those in the psoriasis group, and 50 healthy control participants and administered an emotional Stroop task to each group. The words used as stimuli were either related to social threat (e.g., "bullying", "shame"), disease-related threat ("scaling", "flaking"), general negative threat ("bombs", "murder"), were neutral (e.g., "light bulb", "kitchen") or positive (e.g., "friendly", "nice"). People with psoriasis were found to respond significantly faster for general negative threat words than for neutral words compared with their significant others and control participants. No differences were found between groups regarding responses to disease-related words, however all 3 groups showed slightly slower response times for disease-related words, but this did not reach full significance. The difference in findings between these two studies (Fortune et al., 2003; van Beugen et al., 2016) could be explained by the disease severity of each of the samples. Disease severity was higher in psoriasis participants in the study by Fortune et al. (2003) that identified AB, than in the more recent study by van Beugen et al. (2016) that did not. Another factor could be the words used for the Stroop task. The disease-related words selected by Fortune et al. (2003) were chosen from previous research with patients and from symptoms reported by patients to a consultant dermatologist, and the socially-related words were taken from focus group interview data and from a clinical psychologist with experience treating patients with psoriasis. The words used in the study by van Beugen et al. (2016) were validated in a pilot study with people with skin conditions, healthy individuals, and medical psychology professionals. This resulted in words that are more related to other types of skin conditions being included in the disease-related stimulus set, such as "eczema", "rash", and "blisters" which are arguably unrelated to psoriasis. The relevance

of the stimuli presented to psoriasis participants may also have contributed to the lack of AB detected in this research.

These contrasting findings leave the question of whether those with psoriasis display AB for disease-related threatening information largely unanswered. An effective way to address this question may be to continue to measure AB to threat among those with psoriasis, but to use a paradigm that allows evaluations to be made around the direction of AB (i.e., avoidance or hypervigilance) and the stages of processing that this bias occurs in (whether an AB occurs in early or later stages of processing). The emotional spatial cueing task is equipped to explore both of these areas. Further exploration in this field is an important pursuit due to the chronic nature of psoriasis, and that the condition is often worsened by stress and anxiety, both of which have been shown to be associated with AB to threat.

Attentional Bias Modification Training

Attentional bias modification training (ABMT) is a relatively new intervention that aims to alter any existing AB to threat. The most commonly used method of delivering this intervention is with a modified version of the dot-probe task, however the emotional spatial cueing task has also been used. This intervention using the dot-probe aims to alter the AB of the intended individual by having the target appear on the same side as the threatening stimuli when aiming to reduce avoidance, and the opposite side when aiming to reduce hypervigilance. This trains the individual to respond differently to threat by allocating their attention to the previously unattended location. A similar pattern is used for when the task is the emotional spatial cueing task: to reduce hypervigilance all threat trials are invalid, and to reduce avoidance all threat trials are valid. Neutral trials retain the original 75%/25% ratio for valid and invalid trials.

Previous research has shown the presence of AB to threat among those with anxiety and not in non-anxious healthy individuals, which suggests an association between the two variables. It could follow, then, that reducing AB may be likely to reduce the anxiety levels also. However, research has provided a complex array of results when examining the correlation between AB and anxiety. A review by Van Bockstaele et al. (2014) showed that while some studies found a positive correlation between AB and anxiety, others found a negative correlation, or no correlation at all. A number of factors may contribute to such varied findings such as AB paradigm used, type of anxiety measured (state vs. trait) and stimuli used when measuring AB. Despite this complexity in the relationship between AB and anxiety, a meta-analysis by MacLeod & Clarke (2015), which reviewed studies that administered ABMT to those with high levels of anxiety, showed that when ABMT was successful in reducing AB to threat it also lead to reduced anxiety levels.

ABMT was delivered using the emotional spatial cueing task by Bar-Haim et al. (2011) to train anxious children to disengage attention from threat. This study allocated 34 highly anxious children to either a treatment group or a control group. Delivery of the ABMT using the spatial cueing task was successful in altering AB to threat, and it was found that those in the treatment group reported less state anxiety compared to those in the control group. If the present research shows that those with psoriasis demonstrate a clear AB for threat, and the AB detected is found to be predictive of disease severity and/or disease-related quality of life, future research could employ ABMT to investigate whether altering AB in someone with psoriasis also improves their quality of life and disease severity. This is a hugely valuable avenue of investigation, as current treatments for psoriasis can be costly, are associated with difficult side effects, and the application of some can often be unpleasant for patients. AMBT could offer a cheaper, simpler, less invasive method of treatment for a chronic and emotionally impactful disease.

Aims of the Present Thesis

Existing literature investigating whether healthy people experiencing acute itch demonstrate AB for itch related stimuli is extremely limited. This is also the case for research investigating AB in psoriasis populations, with the added difficulty that existing literature provides mixed results. Differences in attentional processing may be an important factor in the severity and maintenance of psoriasis, and the exploration into this field may provide an opportunity for an alternative treatment to be developed in the form of Attentional Bias Modification Training. This could present a low cost, easily implemented intervention with no known side effects, which would be a welcome avenue of treatment given the difficulties associated with current methods of treatment for this disease. It is expected that AB will differ in all experimental groups (those experiencing experimentally induced itch, and those with psoriasis), however, the direction of any AB and the component of attention it affects are more difficult to predict, due to the limitations of previous research (i.e. paradigm used). Therefore, the present thesis aims to investigate the following research questions:

1. Do healthy participants experiencing experimentally induced itch demonstrate AB for itch-related stimuli?
    1.1. If AB is present, does this take the form of hypervigilance or avoidance, and during which component of attention does this occur in (engagement or disengagement)?
2. Do people with psoriasis demonstrate AB for disease-specific stimuli?
    2.2 If AB is present, does this take the form of hypervigilance or avoidance, and during which component of attention does this occur in (engagement of disengagement)?
    2.3 If AB is present, is it associated with disease severity?

Experiment 1: Does acute itch induce an attentional bias towards itch-related words[i]?

Introduction

Experiment 1 aimed to investigate the effects of acute itch on AB to threat in the form of itch-related words. Previous research (van Laarhoven et al., 2018) has demonstrated AB for itch-related words using a modified Stroop task, and hypervigilance for itch related images using a dot-probe task, in healthy participants. However, due to the nature of their design, the results do not allow conclusions to be made about whether acute itch induces AB for itch-related threat, or whether this bias already exists without the experience of acute itch. Acute itch was administered via an electrical stimulation during a task examining AB for physical itch location that was completed prior to the reaction time tasks measuring AB for itch-related threat. As the itch stimulation was not applied during the AB reaction time tasks and there was not a control group employed for comparison, the attentional biases detected cannot be attributed to the experience of acute itch with any certainty. The tasks used to measure attentional biases are also unable to provide information regarding the stages of processing involved in AB, and the Stroop is also unable to identify direction of AB. The measurement of AB using the Stroop task has also been questioned as to whether longer reaction times for emotional words actually represent AB, or rather negative emotional disruption caused by the presence of threat words that delays responses. Experiment 1 aimed to identify whether the experience of acute itch produces an AB for threat-related words using a histamine prick test, which has been shown to induce acute itch lasting on average 13.5 minutes (Hawro et al., 2019), and isolate the cause of any AB by including a control group for comparison. It also aimed to further explore the

direction and chronology of AB for itch-related words by using a paradigm that allows for this to be investigated. It was predicted that those experiencing experimentally induced itch would demonstrate AB for itch-related threat words, and that control participants would not. It was therefore predicted that validity effects would significantly differ between experimental and control groups. As previous research investigating AB and itch has not used a paradigm that allows for direction of AB to be explored when using words as stimuli, the direction of AB cannot be predicted.

Method

Participants

Experiment 1 obtained ethical approval from the University of Hull Psychology Department Ethics Committee in order to collect data from its student population. Students at the university were recruited via Sona, the university's online research participation system, and data were collected using the computer software Presentation. Exclusion criteria was defined within the study information on Sona prior to participants signing up for participation. Exclusion criteria was; hypersensitivity to any of the ingredients of the histamine solution, which are (apart from water and salt) histamine, phenol, glycerol, and sodium hydroxide; currently suffering from acute allergic symptoms; currently have a skin infection on the inner wrist area; suffer acute/chronic eczema; have a severe hearing or sight impairment; suffer from a serious general disorder; currently have a fever; receive treatment with β-Blockers; suffer from any disease of the heart or blood vessels (cardiovascular disease); have a history of low blood pressure; have a history of fainting during medical procedures (e.g., during a flu shot, or immunization shot); suffer from asthma; be pregnant or breastfeeding; have taken antihistamines in the last 48 hours; or suffer from a condition called histamine intolerance.

A total of 60 undergraduate students from the University of Hull made up the sample of participants, 55 of whom were female, and six of whom were male (90.2% / 9.8%). This sample size was chosen because it is sufficient to detect a large effect (Cohen's d ≥ 0.8) in a between-group design with a probability of 80% (2-tailed test, α=0.05), as indicated by a priori power analysis (Cohen, 1992). The age range of participants was 18 to 37 years (M = 20.35, SD = 3.64). All participants provided their written informed consent to participate in the study.

Materials

Experiment 1 relied on an experimental induction of acute itch using the histamine prick techniques. Two groups of participants underwent a prick test, using either histamine or an aqueous solution as a control. Following the prick test, participants provided itch ratings for 10 minutes via a computerised electronic rating scale (General Labelled Magnitude Scale; Jones et al., 2017). The results of these ratings are part of a separate publication and therefore not reported further here. Following the rating phase, each participant completed an emotional spatial cueing task (Fox et al., 2001). Both tasks were produced using the experiment software Presentation®. A second prick test was administered, and further itch ratings collected but the results of this are also not reported here due to being part of a separate publication.

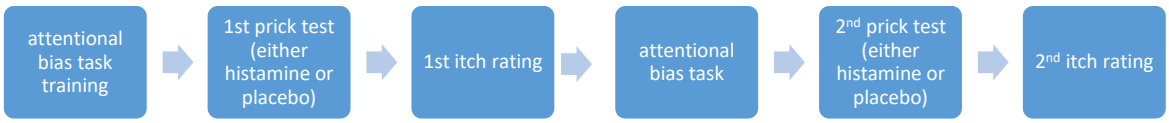


Figure 1 Experiment Procedure

Experimental Design

AB was measured with the emotional spatial cueing task, which is an adaptation of the Posner (1980) spatial cueing task. This task was modified by Stormark et al. (1995) to use emotionally threatening stimuli, and first used by Fox et al. (2001) in order to measure AB to threatening information among anxious individuals. This computer-based task involved participants being briefly shown a cue on either the left- or right-hand side of a fixation cross, followed by a target, which may appear in the same location as the stimulus, or the opposite side of the screen (the un-cued location). The participant's task was to indicate via a keyboard button press which side of the screen the target appeared (F for left side, J for right side), and their reaction times were recorded. When the target appears in the same location as the stimulus, it is referred to as a valid trial (Figure 2). When the target appears in the opposite location to the stimulus (i.e., the other side of the screen) is it referred to as an invalid trial (Figure 3).

A trial of the spatial cueing task began with a fixation cross in the centre of the screen with two rectangles on either side (height=86mm, width=58mm, distance between rectangles: 58mm). After 1000ms, the cue was then presented on either the left or the right side of the screen for 200ms. The cue then disappeared, and after 50ms the circular target (visual angle 0.92º) was then presented. The stimulus onset asynchrony (SOA) between cue word onset and target was therefore 250ms. There were 32 trials in each block, and the study used 3 blocks of the task, resulting in 96 recorded reaction times. Each trial differed by validity, cue, cue type and the side of the screen the cue is presented.

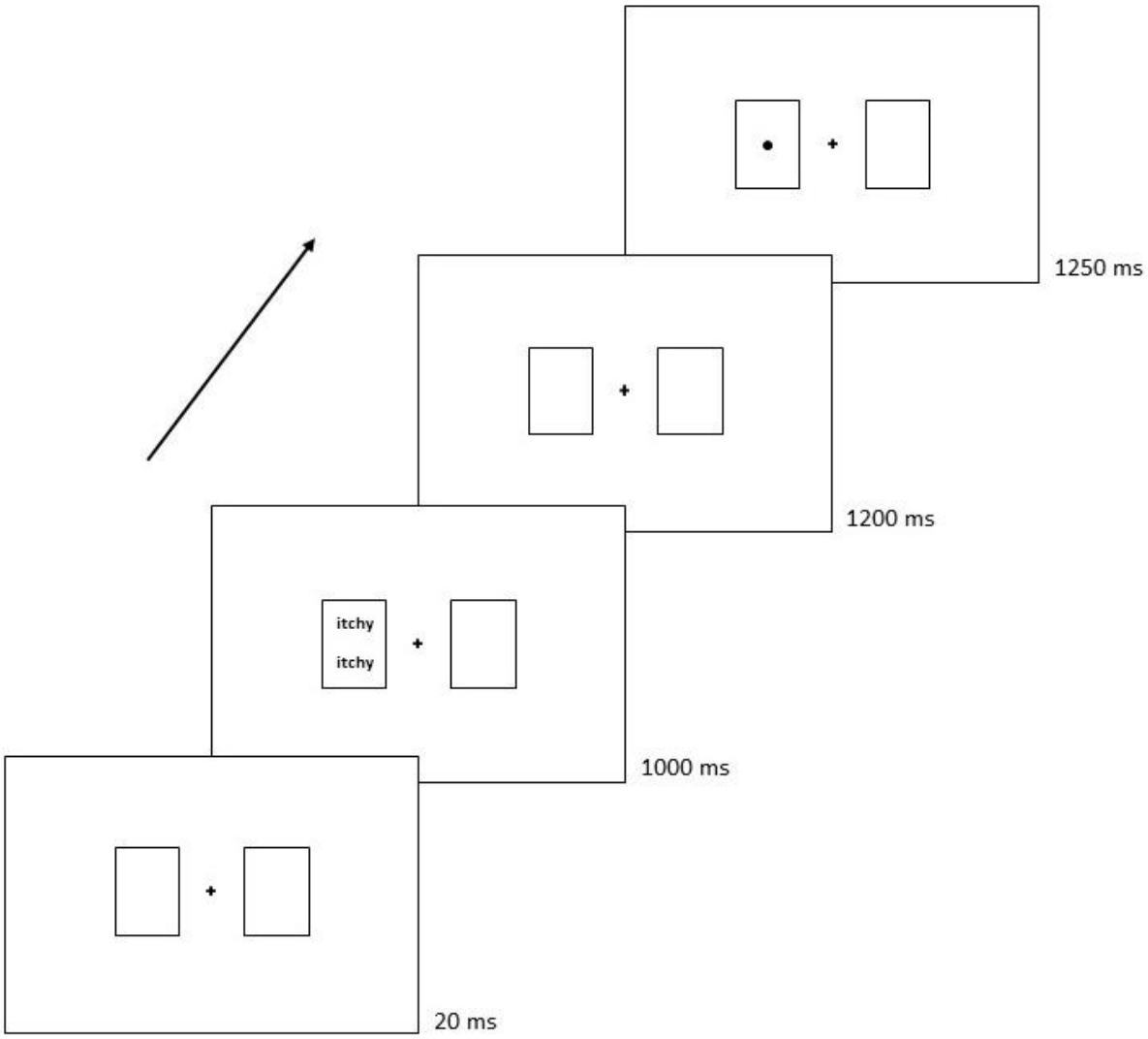


Figure 2: Diagram showing an example of a valid threat trial (dot appears on the same side of the screen as the cue).

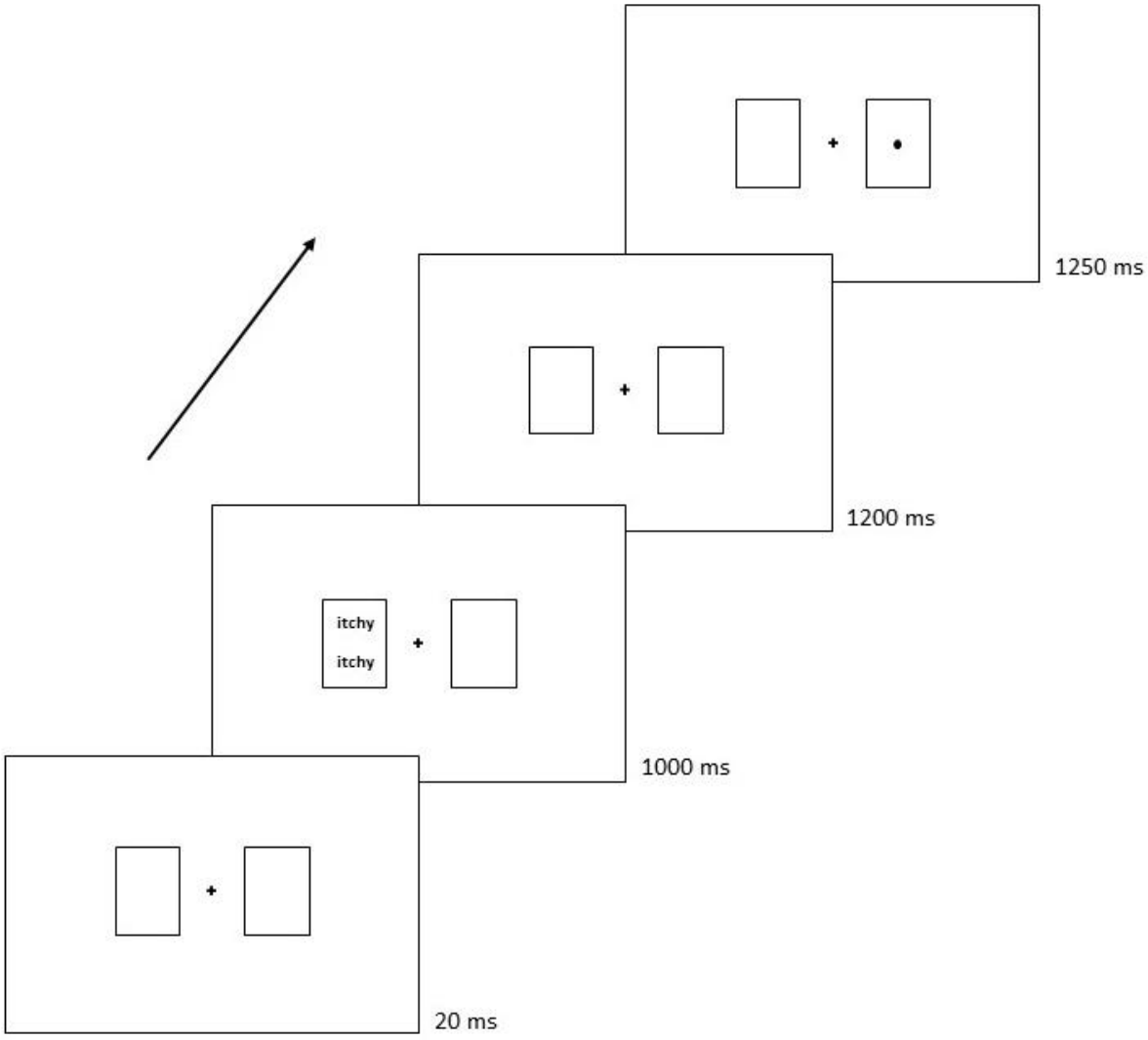


Figure 3: Diagram showing an example of an invalid threat trial (dot appears on the opposite side of the screen to the cue).

Valid trials made up 75% of trials that were presented to participants, with the remaining 25% being invalid trials. This ratio of valid to invalid trials is designed to prime participants to expect the target to appear on the same side as the cue, and therefore orient their attention towards the primed location. This priming results in a reorientation cost for invalid trials. This reorientation cost refers to the increase in reaction times for invalid trials due to the need to reorient attention away from the cue and towards the un-cued location of the target. The difference in reaction times for valid and invalid trials is referred to as the validity effect. Validity effects are calculated by

subtracting reaction times for valid trials from invalid trial reaction times (*invalid RTs – valid RTs).* If validity effects are larger for threat trials than for neutral trials, this indicates a pattern of hypervigilance. This is due to the increase in reorientation costs when the cue is threat-related; If an individual demonstrates hypervigilance, it is expected that their attention will be drawn to, and remain with, threatening cues. If this is the case, the time costs associated with reorienting attention away from the cue for invalid trials are increased due to the difficulty in disengaging attention from the threatening information, and the reduction in reaction times associated with the benefits of having the target appear in the attended location for valid trials due to enhanced attentional capture. This results in a larger validity effect. If validity effects are smaller for threat trials than neutral trials, this indicates a pattern of avoidance, as the reorientation costs are reduced, suggesting the individual's attention is drawn away from the threat rather than towards. Bias scores can also be calculated by subtracting the neutral validity effect (*neutral invalid RTs – neutral valid RTs*) from the threat validity effect (*threat invalid RTs – threat valid RTs*). A positive bias score represents hypervigilance for threat, whereas a negative bias score represents avoidance of threat.

The emotional spatial cueing task also allows the exploration into components of attentional bias, i.e., initial engagement and later disengagement. This is investigated by examining the differences between threat and neutral trial RTs within each validity type. Koster et al. (2006) described how to interpret these differences when they used this AB task in their research: The difference between threat and neutral trials within valid trials produces an engagement score *(neutral valid – threat valid),* and a disengagement score for invalid trials *(threat invalid – neutral invalid).* Positive values indicate hypervigilance for both engagement and disengagement scores, and negative values suggest avoidance. A significant difference between threat and neutral trials in valid trials indicates that AB occurred in the early engagement component of processing,

whereas a significant difference for invalid trials suggests that they occurred in the later disengagement component of processing.

- **Attentional engagement score = (Neutral valid RTs – threat valid RTs)**
    - Positive scores (neutral valid RTs *larger* than threat valid RTs) indicate enhanced attentional capture (hypervigilance)
    - Negative scores (neutral valid RTs *smaller* than threat valid RTs) indicate slower attentional engagement (avoidance)
- **Attentional disengagement score = (Threat invalid RTs – neutral invalid RTs)**
    - Positive scores (threat invalid RTs *larger* than neutral invalid RTs) indicate stronger attentional holding/difficulty to disengage (hypervigilance)
    - Negative scores (threat invalid RTs *smaller* than neutral invalid RTs) indicate facilitated disengagement from threat (avoidance)

Stimuli

The stimuli used for this experiment were 12 itch related words, and 12 matched neutral words. The words were matched for lexical frequency and word length using the subtlex-uk database (van Heuven et al., 2014). Some of the threat words used were examples gathered from previous research on itch and attention (Kosteletzky et al., 2009), and additional words were selected for use as stimuli by the research team as they describe the physical appearance of histamine induced itching skin. The words selected for use are displayed in Table 1.

Table 1: Words selected for use as threat and neutral stimuli in Experiment 1.

Neutral	Threat
Trip	Skin
Pairings	Redness
Opposing	Scratching
Atom	Rash
Basic	Sharp
Washing	Burning
Gritty	Itchy
Boasting	Stinging
Thanking	Stabbing
Hike	Scar
Importing	Pinching
Brightly	Swollen

Participants completed three blocks of the task, with 4 pairs of words in each block (4 neutral and 4 threat words). Each word was presented in 4 separate trials, twice in invalid trials and twice in valid trials appearing on both the left and right side of the screen for each. The ratio of invalid to valid trials (25%:75%) resulted in 4 neutral invalid and 4 threat invalid trials, and 12 neutral valid and 12 threat valid trials. In each block the trials were presented randomly so that the order was different for each participant.

Procedure

Participants were provided with an information sheet (Appendix A:) and given the opportunity to ask any questions before being asked to sign a consent form (Appendix B:). Once participants had provided their verbal and written consent, they completed a few trials from one block of the emotional spatial cueing task in order to become familiar with the procedure. Once participants demonstrated that they

understood the task, they were asked to allow the researcher to administer a prick test to either their left or right forearm, which involved placing a drop of a solution (either 1% histamine or an aqueous control) onto the skin and pricking the skin through the drop with a sterile lancet. Participants were then asked to put on some headphones and place their arm inside a box so they could not see the site of the prick test. This was to control for the effects of visual itch (Holle et al., 2012). Participants then listened to the sounds of scratching alternating with silence through the headphones, and continuously rated the itchiness of the area of skin affected using a computerised rating scale for approximately 10 minutes. They then completed 3 full blocks of the emotional spatial cueing task, and their reaction time data were collected. During the spatial cueing task participants were asked to place their chin in a chin rest that was placed 50cm away from the screen. This gave the circular target that participants responded to a visual angle of 0.92º. This was introduced part way through data collection as a result of researchers noticing that participants would move the chair used during the experiment which then altered their distance from the screen until the researcher then rearranged it once participants were seated. A second prick test was then administered to participants' opposite arm, and participants were asked once again to continuously rate the itchiness of their skin affected by the prick test. The second prick test and subsequent itch rating were irrelevant to the current study and the data produced not included in this report.

Counterbalancing was used to decide the order of using the left or right arm first and type of prick test administered (histamine vs placebo). Participants were not informed of the placebo until the experiment had concluded and were advised at the time that both were histamine prick tests.

Following completion of the experiment participants were verbally debriefed and advised of the placebo. Participants were also invited to ask any questions they had

either at that time or at a later time via email. The procedure for Experiment 1 is depicted in Figure 1.

Results

Data & Design

The reaction time data from the AB task were imported into and analysed using IBM SPSS statistical software (version 27). The study employed a 2×2×2 factorial design, with group (placebo or histamine) as the between-subject factor, and cue type (neutral or threat) and trial validity (valid or invalid) as within-subject factors. The data from one participant were excluded due to the notably high reaction times. This is likely to be due to this participant being part of the research team and taking more of an interest in the presented stimuli than would be expected under usual circumstances.

Incorrect responses and misses were excluded from the data set, as were very short (<150ms) and long (>1000ms) reaction times. Outliers were excluded to 2 standard deviations. The total number of participants included in the data analysis was 60 (29 in the placebo group, 31 in the histamine group). Before outliers were excluded, the total number of trials was 5760. After outliers were excluded (7.2%), the total number was reduced to 5345. The mean reaction times and standard deviations are displayed in Table 2 below.

Table 2: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (histamine and control). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Histamine	335.67 (54.86)	307.30 (46.79)	28.37 (26.66)	342.61 (51.79)	304.19 (41.94)	38.42 (28.66)	-10.05* (18.4)
Placebo	329.28 (47.22)	301.47 (34.83)	27.81 (28.7)	327.37 (43.52)	302.26 (35.44)	25.11 (27.12)	2.69 (21.58)

As a manipulation check, t-tests were used to analyse itch ratings after the initial skin prick test. Mean itch ratings were significantly higher ($t(33.8)=4.1$, $p = 0.0003$) following a histamine (14.8 ± 15.8) compared with the placebo skin prick (2.9 ± 3.8). This difference was also significant when only considering the last itch rating of the time course, immediately prior to the spatial cueing task, (histamine: 7.7 ± 12.7; placebo: 2.7 ± 4.9; $t(39.1)$, $p = 0.045$.

A 2×2×2 mixed ANOVA was conducted, with trial validity (valid and invalid) and cue type (threat and neutral) as within-subject factors, and condition (histamine and placebo) as between-subject factors. There was a significant main effect of validity F (1, 58) = 79.82, p <0.001, which showed that invalid trials had an overall larger reaction time than valid trials as can be seen in Figure 5. The ANOVA produced a significant three-way interaction of validity × cue type × group, F (1,58) = 6.09, p = 0.017. Follow-up paired t-tests were conducted to clarify the nature of this this interaction. These tests indicated that the validity effect was significantly smaller for threat trials (M = 28.37, SD = 26.66) than neutral trials (M = 38.42, SD = 28.66) in the histamine group (t(30) = -3.041, p = 0.005). No such difference was found for the placebo group (t(28) = 0.672,

p = 0.507). The differences in validity effects can be seen in Figure 4. This could indicate a pattern of avoidance for threatening stimuli when experiencing acute itch.

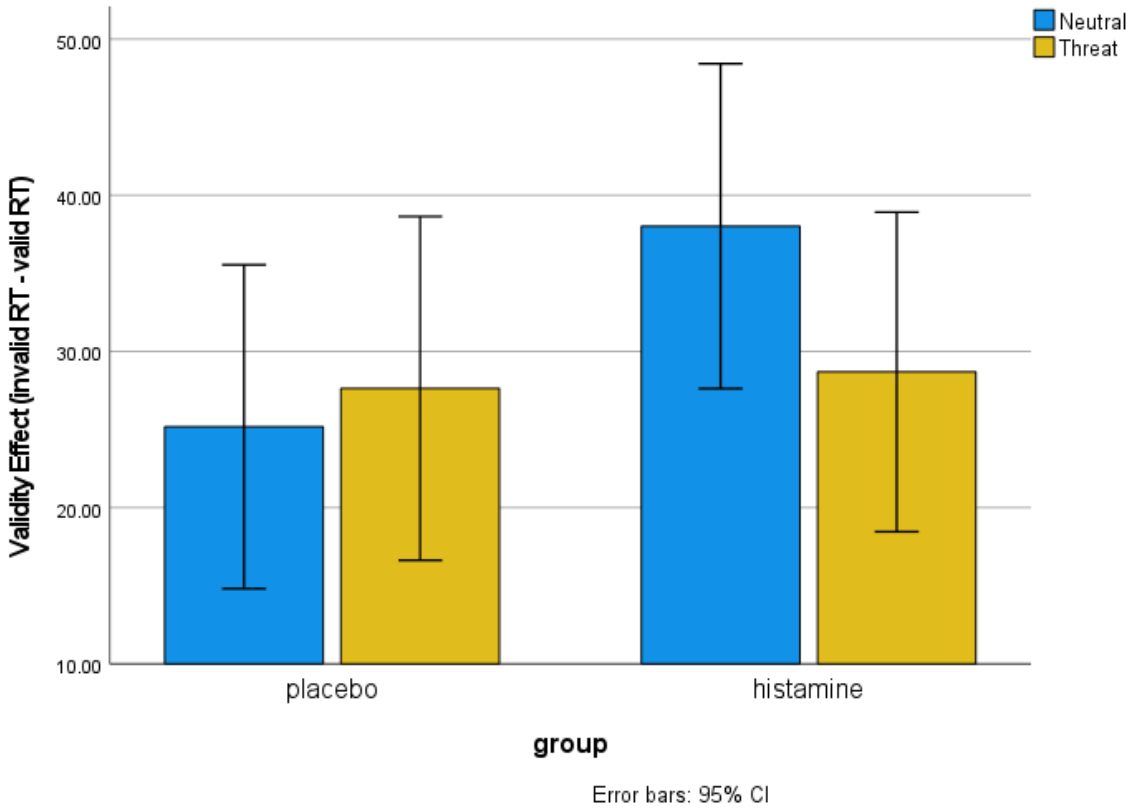


Figure 4: Bar graph showing the validity effects for both groups. The difference between validity effects was significant for the histamine group only.

Further t-tests showed a significant (t(30) = 2.123, p = 0.042) difference between invalid trials for the histamine group, which suggests that the avoidance found in the histamine group occurred in the later stages of processing. A negative attentional disengagement score of -6.6 (faster reaction times for invalid threat trials than invalid neutral trials) suggests that those in the histamine group quickly attended away from the threat for invalid trials. No significant differences were found for the placebo group between either valid trials or invalid trials.

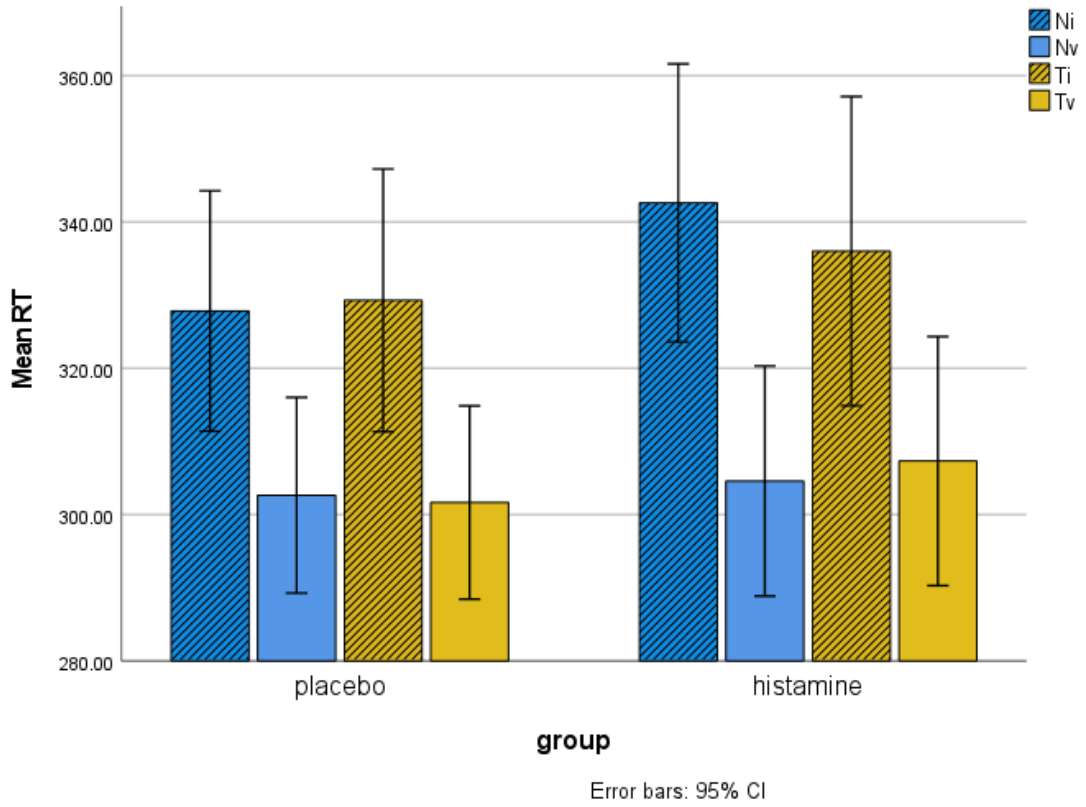


Figure 5: Bar graph depicting the RTs across all conditions in both groups.

Discussion

The current research aimed to identify whether acute itch induced AB towards itch-related words, and if so, whether it occurred in the early or later stages of processing. It also aimed to build on existing research by including a placebo group in order to try to isolate the cause of the AB. It was observed that when experiencing acute itch, participants developed an AB away from, or avoidance of, threatening information. This can be attributed to the experience of acute itch as no such effect was observed in the non-itching placebo group. Follow-up analyses suggest that this effect occurred at a late, rather than an early processing stage (i.e., facilitated disengagement).

An interesting question is why the previous study by van Laarhoven et al. (2018) reported data interpreted to reflect an AB towards itch-related stimuli, whereas the current study provided evidence for a bias away from such itch-related stimuli. Due to the lack of a placebo group in the study by van Laarhoven et al. (2018), it cannot be

ruled out that the differences between threat and neutral images in their study reflect stimulus characteristics, and are not linked to the previous physical experience of itch. In contrast, the current study *can* show that the AB effect is specific to the participants experiencing acute itch and is not present in the placebo group. Other possible explanations of the divergent findings could be the use of different types of itch-related stimuli (pictures vs. words) or different paradigms (dot-probe vs. emotional spatial cueing). The words that were selected as cues also differed in that those used for the Stroop task in the study by van Laarhoven et al. (2018) reflected itch experiences encountered in daily life such as "mosquito bite", "nettle", and "fleabite", whereas the words used in Experiment 1 were selected as they reflect the experience of histamine-induced itch. However, it may be that attentional avoidance of itch-related words did occur in the study by van Laarhoven et al. (2018), but as the Stroop task is unable to differentiate between hypervigilance and avoidance, this distinction could not be made. Another explanation could be that the stimulus onset asynchrony (SOA) used in van Laarhoven et al. (2018) study was longer, at 500ms, in comparison with the current study which used a shorter SOA of 250ms. This could indicate that the longer a stimulus is available to participants the more opportunity there is for attention to be captured. Interestingly, a study by Koster et al. (2006) manipulated the SOAs used in their experiments to examine its effects on AB in those with anxiety. They found that for AB tasks using SOAs of 200ms and 500ms produced reaction times that indicated avoidance, but hypervigilance for SOAs of 100ms. This shows that different patterns of AB may occur at different timepoints in the course of attention. The idea that this could also occur in the context of acute itch requires further exploration.

The use of the emotional spatial cueing task also strengthened the current research as it enabled further investigation into whether AB occurs in the early or later

processing stages and allowed inferences to be made regarding where participants attention would be due to the ratio of valid to invalid trials.

The significant difference between invalid trials for the histamine group suggests that the avoidance detected in this experiment occurred in the later stages of processing, as overall reaction times were smaller for invalid threat trials than for invalid neutral trials. Further research could build on the current study by maintaining the use of the modified spatial cueing task and altering the type of stimuli used from words to images. Altering the SOA used could also allow for further exploration of the different types of AB found in previous research. Continued exploration in this field would be a valuable pursuit as it could lead to the development of interventions that aim to reduce the distress associated with chronic itch conditions.

Experiment 2: Does acute itch induce an attentional bias towards itch-related images?

Introduction

The following experiment aimed to continue the investigation into the role of AB in acute itch. As Experiment 1 demonstrated that those experiencing acute itch exhibited AB away from threatening lexical information, i.e., avoidance, Experiment 2 continued this investigation by examining whether acute itch stimulates an AB when confronted with threat-related pictorial information. There is a wealth of literature documenting the differences in processing words compared with images. In memory, for example, Dual Coding Theory (Paivio, 1971) states that images have an advantage over words as they are more easily remembered than words; a phenomenon referred to as Picture Superiority Effect. In terms of information processing, De Houwer & Hermans (1994) found the associated valence can be identified more quickly for images than words. Further research has also suggested that affective faces are processed more automatically than words (Beall & Herbert, 2008). Additionally, research on attentional bias in social anxiety found no attentional bias in a dot probe task using threat words as stimuli, however they found significant attentional bias when using images of different facial expressions as stimuli (Pishyar et al., 2004). As van Laarhoven et al. (2018) found AB towards both threat-related words *and* images in those experiencing acute itch, experiment 2 aimed to add to this existing research by replacing words from experiment 1 for images as stimuli, using a modified spatial cueing task, and employing a control group to enable comparisons between those experiencing acute itch and those experiencing no itch sensation.

It was predicted that those experiencing experimentally induced itch would demonstrate AB for itch-related images, and that control participants would not. It was

therefore predicted that validity effects would significantly differ between experimental and control groups. As previous research found hypervigilance for itch-related images, it was predicted that the direction of any AB detected in experiment 2 would also be hypervigilance, and therefore validity effects would be larger for threat trials than neutral trials in the psoriasis group.

Method

Participants

Experiment 1 obtained ethical approval from the University of Hull Psychology Department Ethics Committee in order to collect data from its student population. A total of 60 undergraduate students from the University of Hull made up the sample of participants, 41 of whom were female, and 19 of whom were male (68.33% / 31.66%). As with experiment 1, this sample size was chosen because it is sufficient to detect a large effect (Cohen's $d \geq 0.8$) in a between-group design with a probability of 80% (2-tailed test, $\alpha=0.05$), as indicated by a priori power analysis (Cohen, 1992). The age range of participants was 18 to 47 years old (M = 25.12, SD = 7.93).

Procedure

The procedure for experiment 2 only differed from experiment 1 in two ways; the use of itch-related images as cues instead of words, and the addition of an extra block and a full practice block. The timeline of the experiment remained the same (see Figure 1), as did the recruitment process and study exclusion criteria. The information sheet can be found in the appendices (Appendix C:).

Stimuli

The stimuli for this experiment were images collected via Google search using terms such as "itching", "scratching" and "skin". These images were then rated for itch

appearance by 59 participants recruited via social media. Itch ratings were collected via a survey generated using JISC Online Surveys. There were 18 threat images and 18 neutral images, each threat image paired with a neutral image for content similarity (e.g., feet matched with feet, arms matched with arms). See Figure 6 and Figure 7 for a matched pair of threat and neutral images. A total of 59 participants completed the rating survey, by answering the following question: “Below are 36 images. Please rate these images individually for how itchy they make you feel when viewing them from 1 (not at all itchy) to 5 (extremely itchy).” and the highest rated for itch were used as threat images, and their matched neutral images for control images. Four pairs were used per block, with four blocks in total, and one practice block. The images with the lowest itch ratings were used for the practise block. The mean rating for all itch images used was 3.01, and for neutral images was 1.30. All images and their mean rating scores are included in the appendices (167Appendix C:).

Figure 6: Example of a threat image.

Figure 7: Example of a neutral image.

Results

Data & Design

The data were imported into and analysed using IBM SPSS statistical software (version 27). The study employed a 2×2×2 factorial design, with group (placebo or

histamine) as the between-subjects factor, and cue type (neutral or threat) and validity (valid or invalid) as within-subjects factors.

Incorrect responses and misses were excluded from the data set, as were very short (<150ms) and long (>1000ms) reaction times. Outliers were excluded to 2 standard deviations. The total number of participants included in the data analysis was 59 (29 in the placebo group, 30 in the histamine group), as one participant had to be excluded due to low accuracy (<65% of trials with correct responses). Before any outlier exclusion the total number of data entries was 13696. After incorrect responses, outliers and participants with low accuracy were excluded from the dataset, the total number of reaction times was reduced to 12313 (89.9%). The mean reaction times and standard deviations are displayed in Table 3 below.

Table 3: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (histamine and placebo). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Histamine	336.87 (47.56)	286.75 (34.56)	50.12 (30.11)	331.7 (45.76)	286.5 (36.02)	45.2 (26.55)	4.92 (16.47)
Placebo	347.32 (70.77)	305.59 (59.87)	41.73 (26.93)	342.6 (60.71)	301.63 (59.45)	40.96 (22.29)	0.77 (17.51)

As a manipulation check, t-tests were used to analyse itch ratings after the initial skin prick test. Mean itch ratings were significantly higher ($t(36.7)=-5.05$, $p < 0.0001$) following a histamine (15.0 ± 12.2) compared with the placebo skin prick (3.0 ± 4.5). This difference was also significant when only considering the last itch rating of the time course, immediately prior to the spatial cueing task, (histamine: 10.0 ± 12.2; placebo: 1.7 ± 2.8; $t(32)$, $p < 0.0001$.

As with the previous experiment, a 2x2x2 mixed ANOVA was conducted, with trial validity (valid and invalid) and cue type (threat and neutral) as within-subject factors, and condition (histamine and placebo) as between-subject factors.

The ANOVA showed a significant main effect of validity (F (1,57) = 183.13, p < 0.001, which showed that invalid trials had overall larger reactions times than valid trials. A main effect of cue type was also found (F (1,57) = 9.91, p = 0.003) which showed that threat trials had overall larger reaction times that neutral trials. These main effects can be seen in Figure 8 showing reaction times across all conditions. The ANOVA did not produce any other significant results, and crucially there was no significant three-way interaction, suggesting no AB occurred in the histamine group.

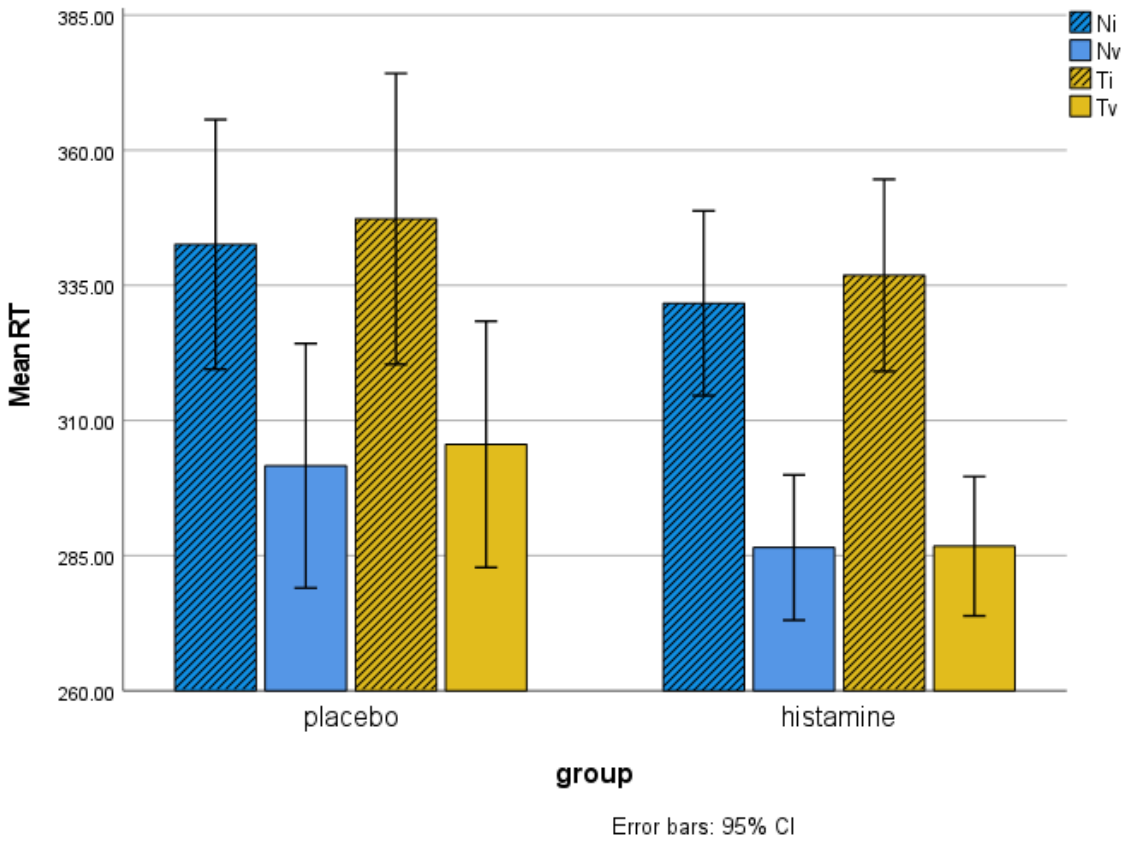


Figure 8: Bar graph depicting the RTs across all conditions in both groups.

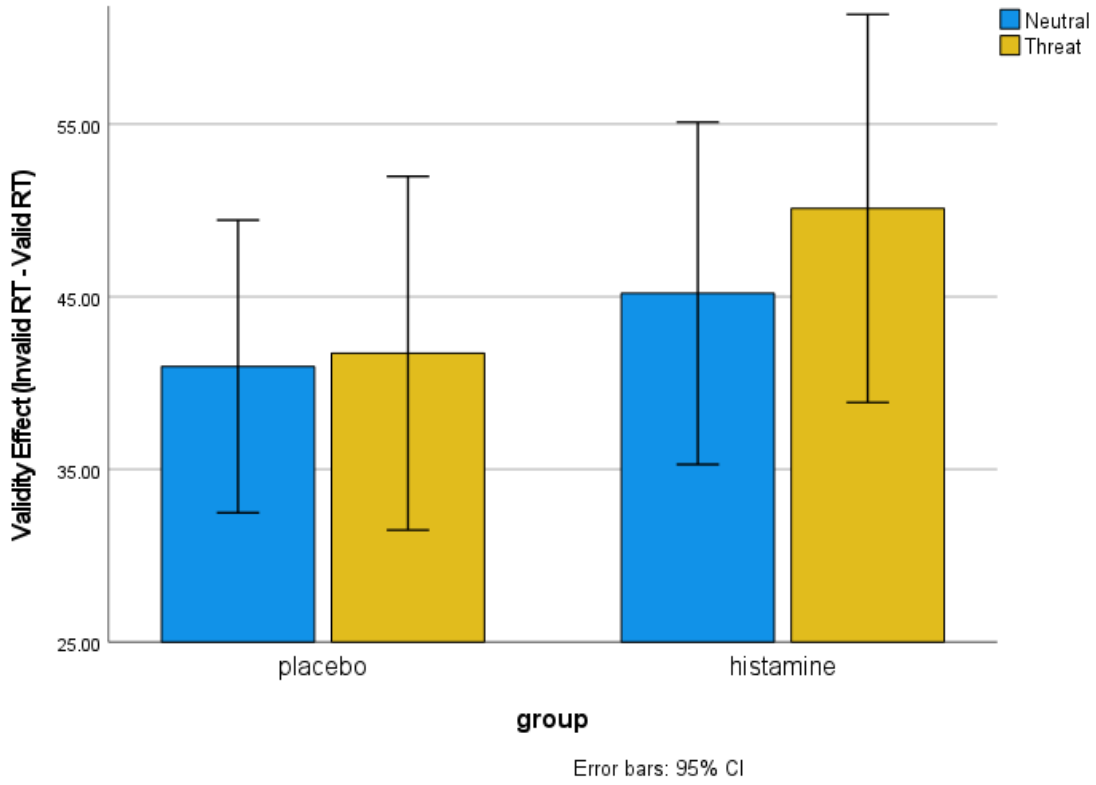


Figure 9: Bar graph showing the validity effects for both groups.

Discussion

Experiment 2 aimed to identify whether acute itch induced AB towards threatening pictorial information, and if so, whether it occurred in the early or later stages of processing. It also aimed to build on experiment 1 by altering the stimulus format from words to images, in order to identify whether the type of itch stimulus presented affects AB patterns. The absence of a three-way interaction between cue type, validity and group suggests that there is no strong AB present among participants experiencing acute itch towards a pictorial representation of itch.

AB for itch related information has been found to exist among healthy individuals not experiencing itch, however the research base in this area has mixed results and some studies have not been able to show this (Becker et al., 2020). The difference in findings from experiment 1 and experiment 2 could be explained by the change from lexical to pictorial stimuli. Research in AB and anxiety has shown that words can elicit an alternative pattern of AB to images. Specifically, a study by Lee &

Knight (2009) found that anxious older adults showed a vigilant-avoidant pattern of AB (hypervigilance in the early stages of processing and avoidance in the later stages as measured using short and long SOAs) for negative faces, but an avoidant-vigilant pattern for negative words. However, this does not explain why experiment 2 found no AB for itch-related images when van Laarhoven et al. (2018) did.

An explanation for the absence of an effect could be the quality of images used as stimuli in Experiment 2. While the stimuli were rated for how itchy they made participants feel, the matching process was not as meticulous as it perhaps should have been. Matching threat and neutral images solely for general content depicted is likely to not be sufficient for the purposes of this research, and van Laarhoven et al. (2018) included colour and complexity as characteristics to match images in their research. They also selected their images from a validated database, whereas the images for experiment 2 were obtained using a simple Google search with no further validation utilised except itch ratings. Van Laarhoven et al. (2018) used neutral images from the International affective picture system (IAPS; Lang et al., 2008), and itch images that were validated in a pilot study for itch applicability and valence. The itch and neutral images were also matched for complexity and colour, which minimises the potential differences between itch and neutral images, leaving, threat value as the remaining difference.

The type of content depicted in the images could also have affected the outcome of experiment 2. Some images depict an itch inducing stimulus (e.g., ants or a mosquito) in contact with the skin of a person, whereas other images depict the itch inducing stimulus alone (nettles not in contact with skin), and of skin showing an itch response (someone scratching their skin). The itch-related images with the two highest itch ratings were images depicting an itch inducing stimulus in contact with human skin, whereas the two itch-related images with the lowest ratings were depicting an itch

response (scratching skin). A study by (Lloyd et al., 2013) showed that images showing skin contact (a stimulus in contact with a person's skin) elicited higher itch ratings from participants than images showing itch response. As the mean itch rating for itch related images used in experiment 2 was not particularly high (3.01 when rated out of 5), using more images that show skin contact may have improved the quality of this experiment, by increasing the difference in itch-related threat value between threat images and neutral images. Using more stringent methods of selecting and matching images used as stimuli may increase the likelihood of an effect being detected.

A further explanation for these differing patterns of results could be the task used to measure AB in each study. Experiment 2 used the emotional spatial cueing task, which presents one cue at a time to participants. This, in addition to the ratio of valid to invalid trials, enables the assumption that attention will be on the cue. van Laarhoven et al. (2018) used the dot-probe task which presents both types of stimuli simultaneously, and this results in uncertainty regarding which stimulus is actually being attended to. Experiment 2 also included a control group for comparison, whereas van Laarhoven et al. (2018) did not. A similar pattern of hypervigilance might have been detected in experiment 2 had a control group not been included, as validity effects do seem to differ for the histamine group but not the control group, which can be seen in Figure 9. However, the lack of a three-way interaction allows the observation that the difference in validity effects for the histamine group are not significantly different to that of the placebo group.

Experiments 1 and 2 both investigated the effect of acute, histamine-induced itch on AB to itch-related information. Data from Experiment 1 suggest that acute itch induced an avoidance of itch related words, whereas experiment 2 suggests that acute itch had no effect on attentional processing of itch-related images. However, the quality of the stimuli used in experiment 2 could be improved. Images were matched only for

general content shown, i.e., body part or type of object (plant; nettle vs. non-stinging shrub) but did not take other characteristics into account such as saturation and background content. This is important as the differences found in reaction times for the different cue types cannot be solely attributed to the category of either itch or neutral each image was assigned to, as other differences in images were not as well controlled for. Future research could use a more rigorous screening process when selecting and matching stimuli.

Experiments 1 and 2 aimed to address limitations in existing research by comparing responses from those experiencing acute itch with those experiencing no itch in order to isolate the cause of any AB detected. However, it also intended to develop and validate an Emotional Spatial Cueing Task in order to then implement this paradigm in studies examining AB in people with psoriasis.

Experiment 3: Do people with psoriasis show an AB towards briefly presented disease-related words?

Introduction

The main objective of this thesis is to investigate the role of AB in psoriasis, and the first two experiments of this research have provided the foundation for this by establishing and validating a reaction time paradigm that can successfully measure AB, and also has the capacity to identify the direction of this AB. They have also highlighted the importance of using well selected threat cues that are able to be successfully matched with neutral cues on relevant parameters. Due to the significant findings in experiment 1 and the importance of being able to appropriately select and match stimuli, the present study will use words as cues which are better able to be successfully matched than images. Experiment 2 was also unable to detect an effect using images as stimuli, which further strengthens the rationale for continuing with words as stimuli for investigating AB in people with psoriasis. As experiment 1 was also able to detect AB using the SOA of 250ms, this may suggest that this is an optimal timeframe for capturing AB for threat and therefore experiment 3 will employ the same SOA.

Experiment 3 intends to further explore the role of AB to threat by investigating its presence among those with psoriasis, a chronic skin condition characterised by itchy, often painful skin lesions. As psoriasis has been shown to be associated with chronic itch (NHS, 2017) and heightened levels of anxiety (Narayanan et al., 2014), and both anxiety (Bar-Haim et al., 2007; Fox et al., 2001) and itch (van Laarhoven et al., 2018) associated with AB to threat, this experiment aims to identify whether those with psoriasis also display similar AB processes. AB to threat has been shown to be present in those with psoriasis in a previous study by Fortune et al. (2003), but absent in a study by van Beugen et al. (2016), both studies employing the Stroop task as a measure of

AB. These conflicting findings raise the question of why was AB found in one psoriasis population and not another? One answer to this could be the severity of psoriasis in each sample. The participants in the study by Fortune et al. (2003) had a mean PASI (Psoriasis Area and Severity Index; Fredriksson & Pettersson, 1978) score of 9.8 ±7.4, compared with the lower score of 4.56 ± 2.31 for those in the van Beugen et al. (2016) study, indicating that psoriasis was not as severe in the latter. The milder severity of psoriasis could explain the lack of AB found, but as this is still uncertain the need for replication in this area of research remains. As both studies by Fortune et al. (2003) and van Beugen et al. (2016) used a Stroop task as a measure of AB, the direction or chronology of AB was unable to be explored. Both of these aspects of AB are fundamental in the understanding of the role of AB, the importance of which was highlighted in Experiment 1.

Experiment 3 aimed to provide more clarity by continuing to explore AB in psoriasis populations with a more informative measure in the form of an emotional spatial cueing task. The employment of this paradigm as a measure of AB allowed the opportunity for the exploration of the direction of any AB detected (i.e., hypervigilance or avoidance), and also the chronology (early or late stages of processing), which the emotional Stroop task is unable to investigate. Experiment 3 investigated the effect of disease-related word threat cues on AB in those with psoriasis, with further exploration enabled into the direction and stage of processing of the AB measured.

It was predicted that people with psoriasis would demonstrate AB for disease-related threat words, and that healthy control participants would not. It was therefore predicted that there would be a significant difference in validity effects for the psoriasis group, but not for the control group. As previous research investigating AB in psoriasis

populations has not used a paradigm that allows for direction of AB to be explored, the direction of any AB could not be predicted.

Covid-19

It is important to note that in the time between experiment 2 and 3 the Covid-19 crisis began and affected daily life worldwide, including research. As face-to-face contact became a health risk, this research project like many others was compelled to move online in order to continue. Experiment 3 aimed initially to recruit participants via a dermatology department at a local hospital, however, due to the ongoing pandemic, recruitment was almost entirely online.

Method

Participants

Ethical approval for this study was obtained from the University of Hull Psychology Department Ethics Committee. The original intended sample size was to be 128 (64 participants per group) when the study was going to be conducted in NHS clinics. This sample size was selected as NICE guidelines (NICE, 2004) suggest that for an effect to be considered as potentially clinically significant it has to be of at least medium size (Cohen's $d \geq 0.5$). Based on an a-priori sample size calculation, the original sample size of 128 would provide sufficient power (80%, Cohen, 1992) to detect an effect that is at least of medium size or greater. 100 participants were recruited for each group (psoriasis and control), with a total sample size of 200. This increase in sample size was due to the wider reach that was provided by recruiting participants

online. Demographic information for each group is included in the results section (Table 6).

Participants were recruited via Prolific, an online participant recruitment platform, and a small number were directed to Prolific to enrol after responding to social media advertisements from the Psoriasis Association. Previously recruited participants from the dermatology department of Castle Hill Hospital were also invited to participate in the study, with 1 participant responding and continuing to enrol in the study via Prolific. Prolific is a large-scale online participant pool that allows researchers to connect with potential participants from all over the world. Studies are hosted on the platform, and pre-screening tools allow specific populations to be targeted, and participants sign up if they wish to take part. Prolific allows complete anonymity for participants in both data collection, compensation for participation, and follow up contact between participants and researchers. Participants were compensated at a rate of £9.00 per hour, and therefore for the experimental stage of data collection they were awarded £3.00 for 20 minutes of their time.

Inclusion criteria for the psoriasis group was a diagnosis of plaque psoriasis, to currently have active lesions present on the skin, to have no other skin conditions, and to have no other conditions with a larger self-perceived impact than the psoriasis. Inclusion criteria for the control group was to have no skin conditions, and no major health conditions. Prior to the covid-19 pandemic there was further inclusion criterion of not scoring above 10 for depression on the Hospital Anxiety and Depression Survey (HADS; Zigmond & Snaith, 1983), however, the psychological effects of a global pandemic were deemed likely to have an effect on the scores of this questionnaire, and so was no longer used as inclusion criteria.

Materials

Questionnaires

Experiment 3 used a number of surveys for both screening for recruitment (see Figure 10 and Figure 11 for process) and data collection which were all created and administered using JISC Online Surveys.

Short Health Screening

A short health screening survey was used to identify those with psoriasis and those without psoriasis, and contained only 2 questions, both of which required only yes or no responses: “Do you have a diagnosis of psoriasis?” and, if yes, “Is your psoriasis currently active (with visible lesions)?”.

Psoriasis Screening

Those who answered “yes” to both questions in the short health screening were invited to complete the psoriasis screening survey. The first part of this survey contained 9 questions on demographic information, psoriasis status, other skin conditions, major health conditions, mental health conditions, and an attention check (a question used to ensure participants are responding thoughtfully, such as “please answer yes”). An example of a question included is “do you have any other major health conditions?” which required a yes or no answer. If yes, an addendum to this question appeared which asked participants to list major health conditions. The second part of this survey was the HADS questionnaire. The psoriasis screening survey can be found in the appendices (Appendix E:).

Control Screening

Those who answered “no” to “Do you have a diagnosis of psoriasis?” in the short health screening survey were invited to complete the control screening. The control screening only differed from the psoriasis screening in two ways: the question

on psoriasis status was omitted, and a question asking for confirmation on fluency in the English language was included. This was included as some messages were sent via prolific from participants in the psoriasis group in non-fluent English. The control screening survey can be found in the appendices (Appendix F:).

HADS

The HADS (Zigmond & Snaith, 1983) uses a single questionnaire to calculate 2 scores; one for anxiety (HADS-A) and one for depression (HADS-D). There are 14 items in total, with 7 focusing on anxiety symptoms and the other 7 focusing on depression symptoms. Each item can score between 0-3, with possible scores ranging between 0-21 for each category. Scores >8 in either category are considered to be indicative of clinical anxiety or depression. An example of an item measuring depression is “I feel as if I am slowed down” with a choice of “nearly all the time”, “very often”, “sometimes”, or “not at all” as possible answers. An example of an item measuring anxiety is “I feel tense or 'wound up'” with a choice of “most of the time”, “a lot of the time”, “From time to time, occasionally” or “not at all”. In a literature review by Bjelland et al. (2002) the HADS was found to be a valid and reliable measure of anxiety and depression in a range of populations including psychiatric patients and the general population. Specifically, Cronbach’s α for the HADS-A ranged between 0.76 – 0.93, and 0.72 – 0.9 for the HADS-D. Concurrent validity was measured between the HADS-D and Beck’s Depression Inventory (Beck et al., 1997), with correlations ranging from 0.62 - 0.73. Concurrent validity was also measured for the HADS-A and the Clinical Anxiety Scale (Snaith et al., 1982) with correlations ranging from 0.69 – 0.75.

Psoriasis Evaluation

Eligible participants for the psoriasis group were directed to a psoriasis evaluation (see Appendix G:) survey which included the Dermatology Life Quality Index (Finlay & Khan, 1994), and a Psoriasis Area and Severity Index form. Both of these will be described in more detail below.

DLQI

The Dermatology Life Quality Index (DLQI; Finlay & Khan, 1994) is a commonly used questionnaire in dermatology services, and was used to measure the effect of skin condition on quality of life in the psoriasis group. The first item on the DLQI asks "Over the last week, how itchy, sore, painful or stinging has your skin been?", with "very much", "a lot", "a little", or "not at all" as the possible answers. Each item can score between 0 and 3, with a total of 10 items in the questionnaire. Possible scores can range from 0 – 30, with higher scores indicating a larger effect of skin condition on quality of life. Scores between 2-5 indicate "small effect on patient's life", 6-10 indicate a "moderate effect on patient's life", 11-20 indicate "very large effect on patient's life", and >21 indicate "extremely large effect on patient's life" (Hongbo et al., 2005). In a Hungarian psoriasis population, the mean DLQI score was 9·99 ± 7·52 (Rencz et al., 2018). This measure has been shown to be a reliable and valid measure of dermatology-specific quality of life for psoriasis patients. A clinical trial for treatment of psoriasis found that Cronbach's α ranged between 0.87 and 0.92 when measured at two different time points and across two separate groups. It also found that the DLQI was significantly correlated with clinical measures of psoriasis severity (Psoriasis Area and Severity Index, and Overall Lesion Severity Scale), and patient reported outcome measures (Psoriasis Symptom Assessment Scale, Visual Analogue Scale for itch, and National Psoriasis Foundation itch measure).

PASI

Psoriasis severity was evaluated using the PASI (Psoriasis Area and Severity Index; Fredriksson & Pettersson, 1978), which participants completed themselves as a questionnaire, rather than the usual practice of this being carried out by a qualified healthcare professional. The PASI is the recommended tool for the assessment of psoriasis in UK healthcare settings (NICE, 2012a), which calculates a score based on the surface area of skin affected by psoriasis lesions and the appearance of those lesions. PASI scores can range from 0-72 (Langley & Ellis, 2004), with scores >10 interpreted as moderate to severe psoriasis (Rencz et al., 2018). The average PASI score calculated by dermatologists from a German population of psoriasis patients was 12 (Augustin et al., 2008). The PASI is considered the gold standard with regards to the evaluation of psoriasis severity (Puzenat et al., 2010), with intraclass correlation coefficients of >81% for both intra-rater and inter-rater reliability (Berth-Jones et al., 2006). The PASI has also been found to correlate well with other commonly used measures of psoriasis severity, withcorrelations ranging from 0.83-0.87 (Langley & Ellis, 2004).

This modified PASI questionnaire asked participants to report different elements of their psoriasis in each section of their body (head, arms, trunk, and legs). One of the elements they were asked to assess and report was the area of skin affected by active lesions in each section of their body. Participants were asked to use the rule of palm (Hettiaratchy & Papini, 2004) when assessing area affected by lesions which uses the palm of your hand as a measurement equal to 1% of total body surface area, and give their answers in number of palms, e.g., “3 palms worth of skin”. Participants were also asked to rate the colour, thickness, and scaling of their psoriasis in each section of their body. An example of this is “What colour is a typical spot of psoriasis on your head?” with possible answers of “no redness”, “slight pink”, “pink”, “red”, or “dark red”, which

enabled ratings from 0-4. Answers from this were used to calculate a PASI score for each participant.

Emotional Spatial Cueing Task

AB was again measured using the emotional spatial cueing task, in a very similar task to Experiments 1 and 2. The differences between the two tasks was the software used to generate them, which was changed from Presentation to Psychopy[3] (Peirce et al., 2019) in order to allow for experiments to be completed online due to the covid-19 crisis at the time of data collection; the experiment was also hosted on a website called Pavlovia (https://pavlovia.org/.) so that it could be accessed online from anywhere; an increase in the amount of stimuli used and subsequent number of blocks; randomisation of blocks was introduced in order to combat order effects; feedback on speed and accuracy (i.e., percentage of correct trials and average speed of responses in ms) was provided at the end of each block to encourage full attention and effort; and the words used as stimuli were changed. The number of words in each category (threat and neutral) was increased from 12 to 24, and the number of blocks was increased from 3 to 6. The number of word pairs in each block remained the same at 4 (4 threat and 4 neutral). Due to the experiment being completed by participants on their own devices the size of the dimensions of the stimuli will vary depending on the size of the monitor. The stimuli were displayed using font size 0.05, which, within psychopy, means that each letter has a size of 5% of the distance from the top to the bottom of the screen. The fixation cross and target had a size of 0.03. A full training block with 32 trials was also included at the beginning of the task to enable full understanding of the procedure. The data from the training block was not included in the analysis.

Stimuli Selection and Rating

85 psoriasis-related threat words were selected by identifying relevant words from previous research (Fortune et al., 2003; van Beugen et al., 2016), and from psoriasis related websites (NHS, 2017). These 85 words were then rated by people with psoriasis, along with 21 neutral words that were also included to act as filler words. Participants volunteered to participate by responding to an advert describing this rating study by the Psoriasis Association. 28 participants were asked to rate each word from 0-10 on the following: Relatedness (how related to your experience of psoriasis the word is), Arousal (the level of emotional reaction the word provokes), and Valence (How negative or positive the word is in terms of meaning). To assist in their ratings participants were presented with the Self-Assessment Manikin (Bradley & Lang, 1994) for valence and arousal at the beginning of the survey. The rating survey was created and distributed using JISC Online Surveys (see Appendix H:). Threat words with ratings of higher than 5 for relatedness, 6 for arousal and 7 for valence were selected for use. These were then matched with neutral words for arousal and valence ratings from an online database (Warriner et al., 2013), lexical frequency using the SUBTLEX-UK database (Van Heuven, Mandera, Keuleers & Brysbaert, 2014) and word length (+/- 1 letter).

Stimuli

24 psoriasis-related threat words were paired with 24 neutral words for use in the experiment and are displayed below in Table 4. Each row represents a word pairing. 4 pairs were used per block, with 6 blocks in total.

Table 4: Words selected for use as threat and neutral stimuli, and participants' mean ratings for threat words.

Neutral	Threat	Arousal	Valence (reverse scored)	Relatedness
vacancy	scaling	6.75	7.96	8.32
chuck	scaly	6.79	7.75	8.68
warlord	lesion	6.29	7.68	7.25
deadline	irritated	6.61	7.64	7.57
nappy	scabby	6.54	8.25	7.54
paradox	flare-up	7.32	8.64	9.07
intrude	itching	7.50	8.71	9.18
pollution	repulsive	6.21	7.71	5.75
sewage	insecure	6.61	7.89	6.50
grouchy	disgust	6.68	7.93	5.57
ram	raw	6.18	7.54	7.57
zombie	stinging	6.21	7.46	6.43
dread	messy	6.54	7.29	6.68
noisy	gross	6.36	7.71	6
stricken	inflamed	6.61	7.79	8.18
drinker	burning	6.29	7.46	6.75
spoil	sore	6.79	7.96	8.32
disable	flaking	6.93	8.25	9.21
dump	scalp	6.50	7.54	8.75
greed	ugly	6.68	7.93	6.36
outbreak	bleeding	6.11	7.50	7.57
blast	stare	6.18	7.04	5.82
seasick	unhappy	6.36	8.39	6.32
fatal	pain	6.68	7.93	7.46

Procedure

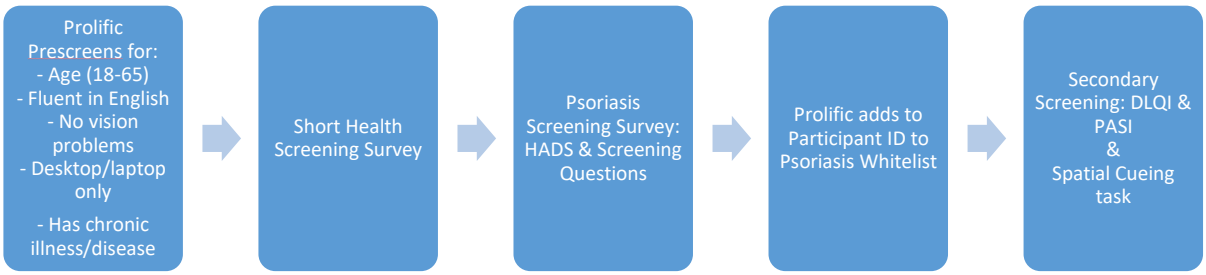


Figure 10: Flow chart depicting each step of the recruitment process for the psoriasis group.

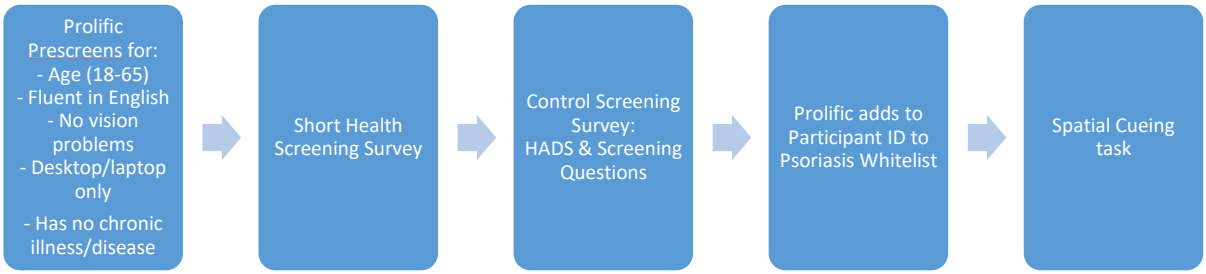


Figure 11: Flow chart depecting each step of the recruitment process for the control group.

Participants were recruited based on their responses to the short health screening survey which collected information on diagnosis of plaque psoriasis and current condition of the disease if present. If participants met the criteria, they were then allocated to either the psoriasis group or control group and invited to complete a second screening survey that administered the HADS questionnaire and collected further information on physical and psychological health.

Eligible participants in the psoriasis group were then added to a Prolific Whitelist (a list of participants that meet the necessary criteria) invited to take part in the main experiment, with a survey containing the DLQI and PASI preceding it.

Once 100 psoriasis participants had completed the experiment correctly, 100 control participants were then matched for age, gender, and levels of anxiety and depression. These 100 control participants were then invited to complete the

experiment. If any of the matched controls declined to complete the experiment, another matched control was put in their place and invited instead. 25 participants from the psoriasis group and 10 from the control group were excluded due to completing the task incorrectly (>25% incorrect responses indicating low accuracy, low concentration or guessing; incomplete responses). Numbers of participants who completed each stage and were identified as eligible are presented in Table 5. In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 6).

Table 5: Participants identified during each stage of recruitment process.

	Completed	**Eligible Psoriasis**	**Eligible Control**
Short Health Screening	2998	227	2710
Psoriasis Screening	224	205	N/A
Control Screening	298	N/A	279
Spatial Cueing Task	235	100	100

Results

Table 6: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	39 Female 61 Male	39 Female 60 Male 1 Non-binary	N/A
Age	31.81 [18-62, SD = 9.944]	31.8 [18-59, SD = 10.556]	0.995
HADS Anxiety	8.76 [0-20 SD = 4.159]	8.43 [0-19, SD = 4.288]	0.581
HADS Depression	6.41 [0-19, SD = 4.351]	5.86 [0-21, SD = 3.6]	0.332
PASI	5.68 [0-17.4, SD = 4.07]	N/A	N/A
DQLI	8.71 [0-26, SD = 5.89]	N/A	N/A

The reaction time data from the AB task were imported into and analysed using IBM SPSS statistical software (version 27). The study employed a 2x2x2 factorial design, with group (psoriasis or control) as the between-subject factor, and word type (neutral or threat) and trial validity (valid or invalid) as within-subject factors. The mean

reaction times and standard deviations are displayed in Table 7 below. Reaction times can also be seen in graph form in Figure 12.

Table 7: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	381.76 (52.49)	334.66 (47.59)	47.09 (27.4)	382.41 (55.24)	336.02 (47.18)	46.39 (27.73)	0.7 (13.9)
Control	368.08 (51.48)	327.05 (43.23)	41.03 (23)	367.42 (49.02)	327.87 (43.53)	39.54 (23.4)	1.49 (12.49)

Incorrect responses and misses were excluded from the data set, as were trials with very short (<150ms) and long (>1500ms) reaction times. Outliers were excluded to 2 standard deviations. A 2×2×2 mixed ANOVA was conducted, with trial validity (valid and invalid) and cue type (threat and neutral) as within-subject factors, and group (psoriasis and control) as the between-subject factor. The analysis showed a significant main effect of validity $F(1,198) = 625.68$, $p < 0.001$, which showed that invalid trials had overall larger reaction times than valid trials. It also showed a near significant 2 way interaction between group and validity ($F(1,198) = 3.443$, $p = 0.065$), with larger validity effects for the psoriasis group across both neutral and threat cues (see Figure 13). No other significant results were found from the mixed ANOVA, including no significant three-way interaction which indicates that no AB occurred in the psoriasis group.

Further analyses were applied to the data in order to explore whether the disease severity of the psoriasis group contributed to the lack of a three-way interaction. Another 2×2×2 mixed ANOVA was conducted, only including participants from the psoriasis group with a PASI of ≥ 5, again with trial validity (valid and invalid) and cue type (threat and neutral) as within-subject factors, and group (psoriasis and control) as the between-subject factor. Excluding participants from the psoriasis group with a PASI of ≥ 5 did not affect the results of the ANOVA, which again showed a significant main effect of validity $F(1,145) = 466.65$, $p < 0.001$, and no other significant results including no significant three-way interaction between trial validity, cue type, and group.

A 2×2×2 mixed ANOVA was applied to just the psoriasis group, with trial validity (valid and invalid) and cue type (threat and neutral) as within-subject factors, and disease severity (PASI < 5 and PASI ≥ 5) as the between-subject factor. The analysis showed a significant main effect of validity $F(1,98) = 302.65$, $p < 0.001$, and no other significant results including a three-way interaction between trial validity, cue type, and disease severity.

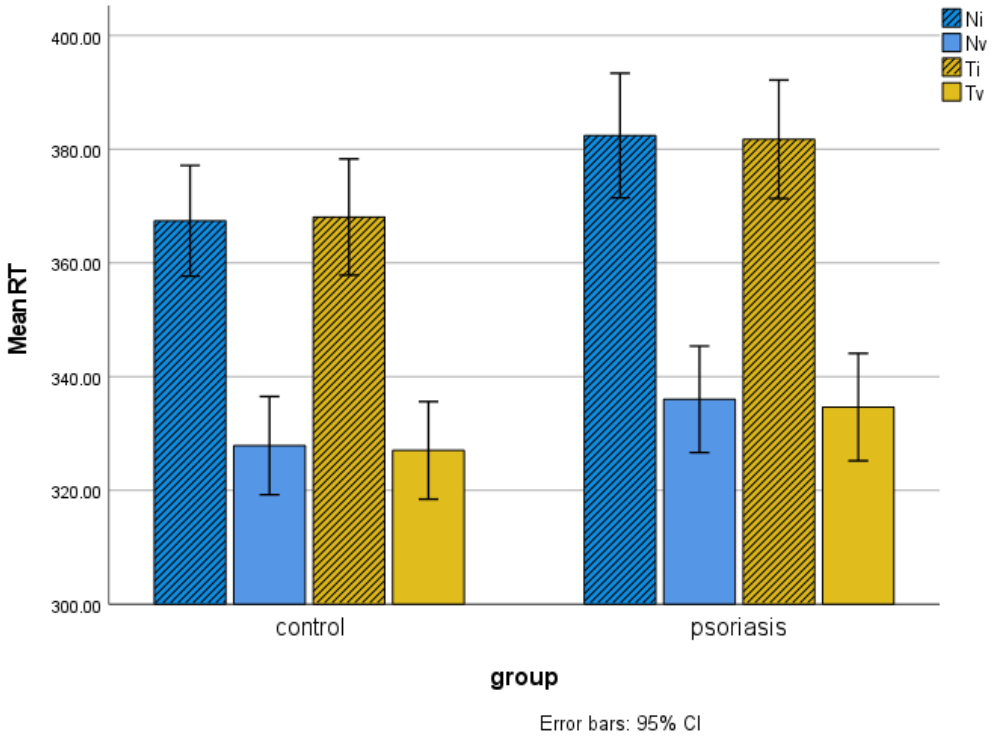


Figure 12: Bar graph showing reaction times across all conditions in both groups.

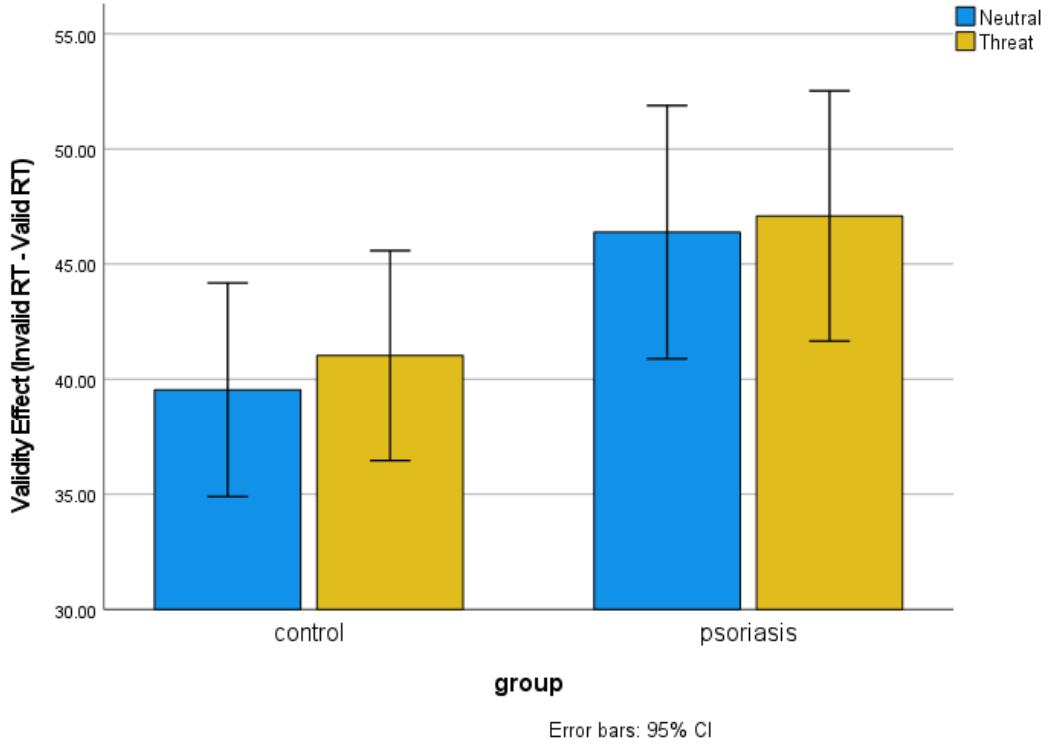


Figure 13: Bar graph showing validity effects for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 8. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,97) = 0.732$, $p = 0.484$) with an R^2 of 0.02, and model 2 ($F(4,95) = 0.504$, $p = 0.733$) with an R^2 of 0.02. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 14.

Table 8: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	-1.04 (-6.44, 4.357)	2.72		$p = 0.702$
DLQI	0.33 (-0.21, 0.87)	0.27	.14	$p = 0.231$
PASI	-0.20 (-0.98, 0.59)	0.40	-.06	$p = 0.619$
Step 2				
Constant	-0.37 (-7.48, 6.74)	3.58		$p = 0.918$
DLQI	0.29 (-0.31, 0.89)	0.30	.12	$p = 0.344$
PASI	-0.17 (-0.97, 0.62)	0.40	-.05	$p = 0.666$
HADS-A	-0.29 (-1.20, 0.62)	0.46	-.09	$p = 0.528$
HADS-D	0.33 (-0.58, 1.23)	0.46	.10	$p = 0.477$

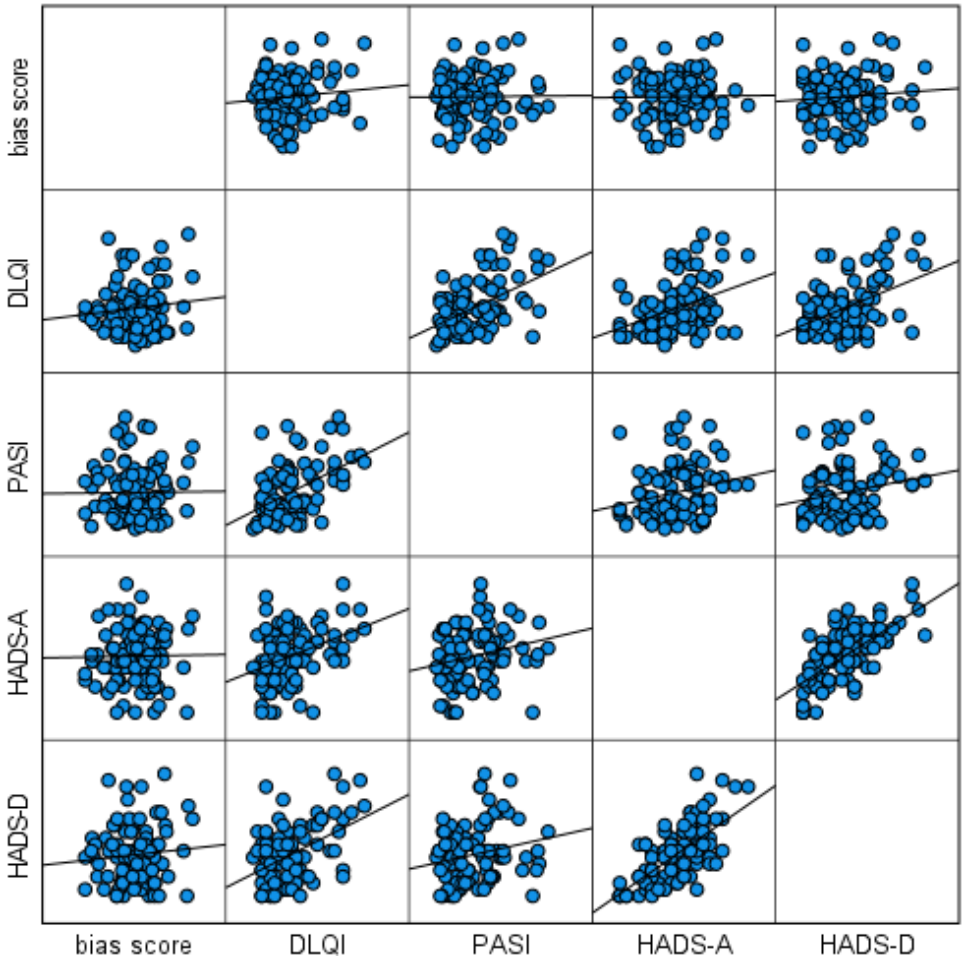


Figure 14: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 3 aimed to identify whether those with psoriasis displayed an AB for disease-related words over neutral words and compare responses to those from healthy control participants. It also aimed to identify the stage in which any bias occurred (early engagement or later disengagement). The results of this experiment indicate that no AB exists in the current sample for psoriasis-related threat words. The results also suggest that psoriasis severity, dermatological quality of life, anxiety, and depression are not good predictors of AB.

The lack of any AB found could be explained by the psoriasis severity in the current sample. Van Beugen et al. (2016) found no evidence of AB for disease-specific threat stimuli in psoriasis participants with a relatively mild mean PASI score of 4.56,

whereas Fortune et al. (2003) did find evidence for AB in psoriasis participants with a higher mean PASI score of 9.8. The mean PASI score for psoriasis participants in Experiment 3 was higher than that of participants in the study by van Beugen et al. (2016), but the disease severity may not be high enough in the current sample to have an effect on AB. If AB does occur in psoriasis populations, it may be that psoriasis severity has to be at a certain level for AB to be activated. However, as PASI score was not a significant predictor of bias score, it is likely that the relationship between psoriasis and AB is not linear. Additionally, the ANOVA applied to just the psoriasis group, with disease severity (PASI < 5 and PASI ≥ 5) as a between-subject factor showed no significant results other than a main effect of validity, and the ANOVA that excluded participants with low disease severity (PASI < 5) did not affect the result. This could suggest that disease severity is not a relevant component in AB in this population.

Another explanation for the absence of any AB in experiment 3 could be the SOA that was used (250 ms). The concept of there being two major attentional systems (Corbetta & Shulman, 2002; Posner, 1980; Posner & Petersen, 1990) is important when considering the time course of attentional bias. The first of these attentional systems is widely regarded as being involuntary, stimulus driven, and automatic/reflexive (and therefore influenced by bottom-up processing), whereas the second is more voluntary and driven by the individual's goals (top-down processing) in the slightly later stages of processing. The short SOA used in the present study may only be able to detect automatic and involuntary attentional bias, and not later, goal-driven attentional bias. As participants in the psoriasis group may share similar goals with regards to the management of their condition, AB within this population could occur in the later, goal-driven stages of attentional processing. Research in this area by Fortune et al. (2003) utilised a Stroop task as a measure of AB, which does not have a specific SOA for the stimuli, as they are presented for as long as it takes for participants to respond. A study

by Koster et al. (2005) investigating AB in anxiety found that participants in both the high trait anxiety group and low trait anxiety group showed hypervigilance towards threat at 100ms SOA, whereas only those in the high trait anxiety group demonstrated significant avoidance at a longer SOA of 1250ms. This could indicate that the SOA of 250 ms used in the current experiment may not be long enough for later, goal-driven AB processes to be activated, and perhaps even too late for early automatic AB. In order to establish if the relatively short SOA of 250ms was too short for AB to be detected, a longer SOA should be employed. Experiment 4 aimed to explore this by increasing the SOA to 1050ms, therefore allowing for later AB to be captured.

Experiment 4: Do people with psoriasis show a late AB towards disease-related words?

Introduction

Experiment 3 showed that attentional bias to disease-specific information was not detected in psoriasis participants in the earlier stages of processing. Experiment 4 investigated whether this attentional bias occurs in the later stages of processing by increasing the previous SOA of 250ms to 1050ms. A longer stimulus presentation may allow more voluntary, goal-driven processing to be activated which, if attentional bias occurs at this later stage, means it may be detected by the emotional spatial cueing task. Wells & Matthews' (1994) theory of AB in anxiety suggests that early AB does not exist, and AB can only be found in the later stages of processing. This theory may also apply to different populations, such as those with psoriasis, rather than specific to anxiety populations. A meta-analysis exploring AB in pain (Crombez et al., 2013) showed that when stimuli were presented subliminally effect sizes were not significant, whereas effect sizes for stimuli presented at supraliminal duration times *did* reach significance. In addition, research has also shown that direction of AB can differ depending on the stage of processing (Blicher & Reinholdt-Dunne, 2019; Koster et al., 2005; Onnis et al., 2011). This highlights the importance of exploring AB in both early and later stages of processing.

As in experiment 3, it was predicted for experiment 4 that people with psoriasis would demonstrate AB for disease-related threat words, and that healthy control participants would not. It was therefore predicted that results would show a significant difference between validity effects in the psoriasis group, but not in the control group. As previous research investigating AB in psoriasis populations has not used a paradigm

that allows for direction of AB to be explored, the direction of any AB could not be predicted.

Method

Participants

The same sample of participants from the previous study (Experiment 3) were invited to complete experiment 4, but due to drop out further participants had to be recruited. Of the original sample, 74% of the psoriasis group and 95% of the control group completed experiment 4. A further 30 psoriasis participants and 9 control participants were recruited which brought the total sample size to 208. The recruitment process was the same as Experiment 3, with psoriasis participants completing all stages of the study (short health survey, psoriasis screening survey, DLQI & PASI & spatial cueing task), before controls completed the short health survey and control screening. Eligible control participants were then matched based on age, gender and HADS scores. Matched controls were then invited to complete the spatial cueing task. Existing participants recruited from Experiment 3 did not repeat any surveys and were directed straight to the spatial cueing task.

The current study uses an identical method and procedure as the previous experiment (Experiment 3), with only 1 difference. This difference is the SOA used in the spatial cueing task, with this being increased from 250ms to 1050ms.

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 9).

Table 9: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	42 Female 61 Male 1 Non-Binary	39 Female 64 Male 1 Non-Binary	N/A
Age	32.9 [18-62, SD = 10.33]	31.9 [18-59, SD = 10.57]	0.491
HADS Anxiety	8.45 [0-18 SD = 4.07]	8.4 [0-19, SD = 4.25]	0.541
HADS Depression	5.96 [0-17, SD = 3.77]	5.66 [0-21, SD = 3.24]	0.934
PASI	6.56 [0-22.4, SD = 5.02]	N/A	N/A
DQLI	7.64 [0-23, SD = 5.25]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 10 below.

Table 10: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	393.63 (60.24)	365.14 (56.38)	28.48 (24.82)	392.65 (61.87)	364.77 (56.76)	27.88 (23.99)	0.6 (17.3)
Control	365.63 (45.25)	341.34 (48.81)	24.28 (21.7)	364.61 (45.16)	341.73 (48.88)	22.88 (20.01)	1.41 (16.54)

The analysis showed a significant main effect of validity $F(1,206) = 313.67$, $p < 0.001$, which showed that invalid trials had an overall larger reaction time than valid trials. It also showed a main effect of group ($F(1,206) = 12.81$, $p < 0.001$) which showed that the psoriasis group had significantly longer reaction times across all conditions. Both of these main effects can be seen in Figure 15. No other significant results were found from the mixed ANOVA, with the absence of a three way

interaction, and minimal difference between neutral and threat validity effects (see Figure 16) being indicative of no AB in the psoriasis group.

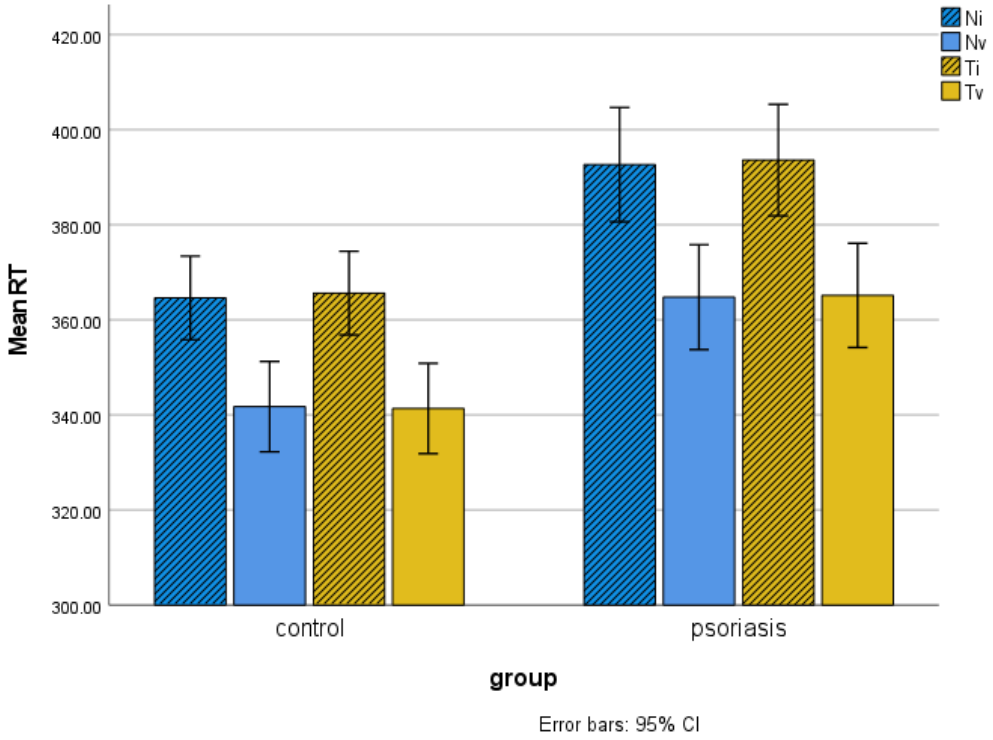


Figure 15: Bar graph showing reaction times across all conditions in both groups.

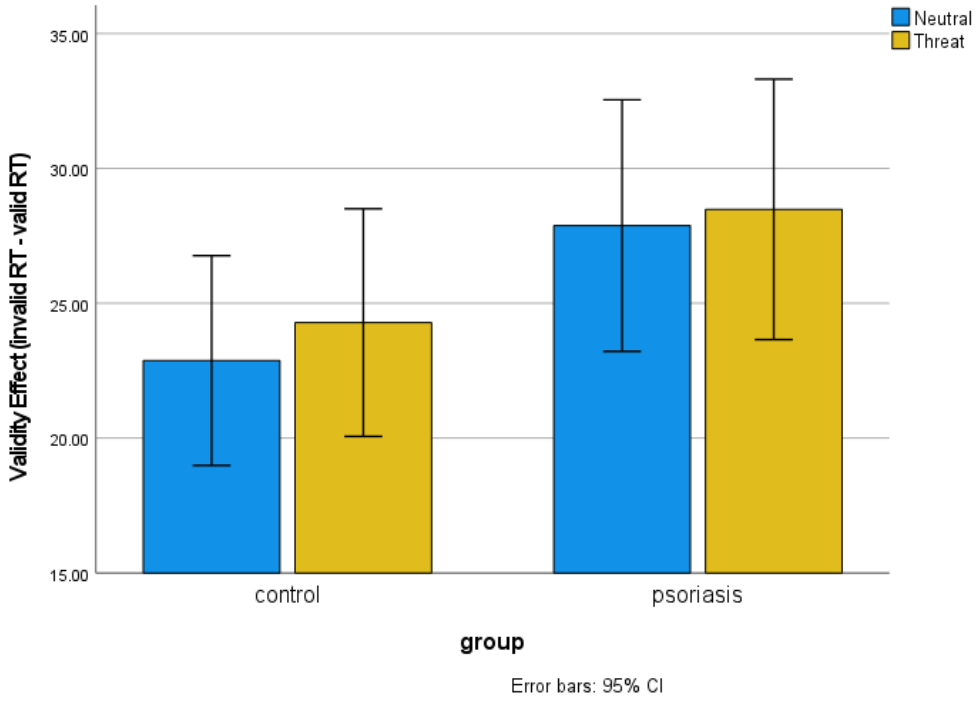


Figure 16: Bar graph showing validity effects for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 11. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. A significant regression equation was found for model 1 ($F(2,101) = 6.09$, $p = 0.003$), with an R^2 of 0.11. A significant regression equation was also found for model 2, $F(4,99) = 3.131$, $p = 0.018$, with an R^2 of 0.11. As can be seen in Table 11, the only significant predictor in both regression models was PASI score, with a negative *b* value indicating that as PASI score increases by 1 unit, bias score decreases by 1.15ms. Figure 17 shows scatterplots for the relationships of all individual variables with bias score, and Figure 18 shows the nature of the significant relationship between bias score and disease severity in more detail.

Table 11: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	7.83 (1.73, 13.95)	3.09		$p = 0.013$*
DLQI	0.04 (-0.66, 0.74)	0.35	.01	$p = 0.903$
PASI	**-1.15 (-1.88, -0.42)**	**0.37**	**-.33**	***p* = 0.002***
Step 2				
Constant	8.73 (0.48, 16.98))	4.16		$p = 0.038$*
DLQI	0.13 (-0.61, 0.88)	0.38	.04	$p = 0.728$
PASI	**-1.16 (-1.91, -0.42)**	**0.38**	**-.34**	***p* = 0.003***
HADS-A	0.10 (-0.96, 1.17)	0.54	.02	$p = 0.847$
HADS-D	-0.40 (-1.58, 0.79)	0.60	-.09	$p = 0.507$

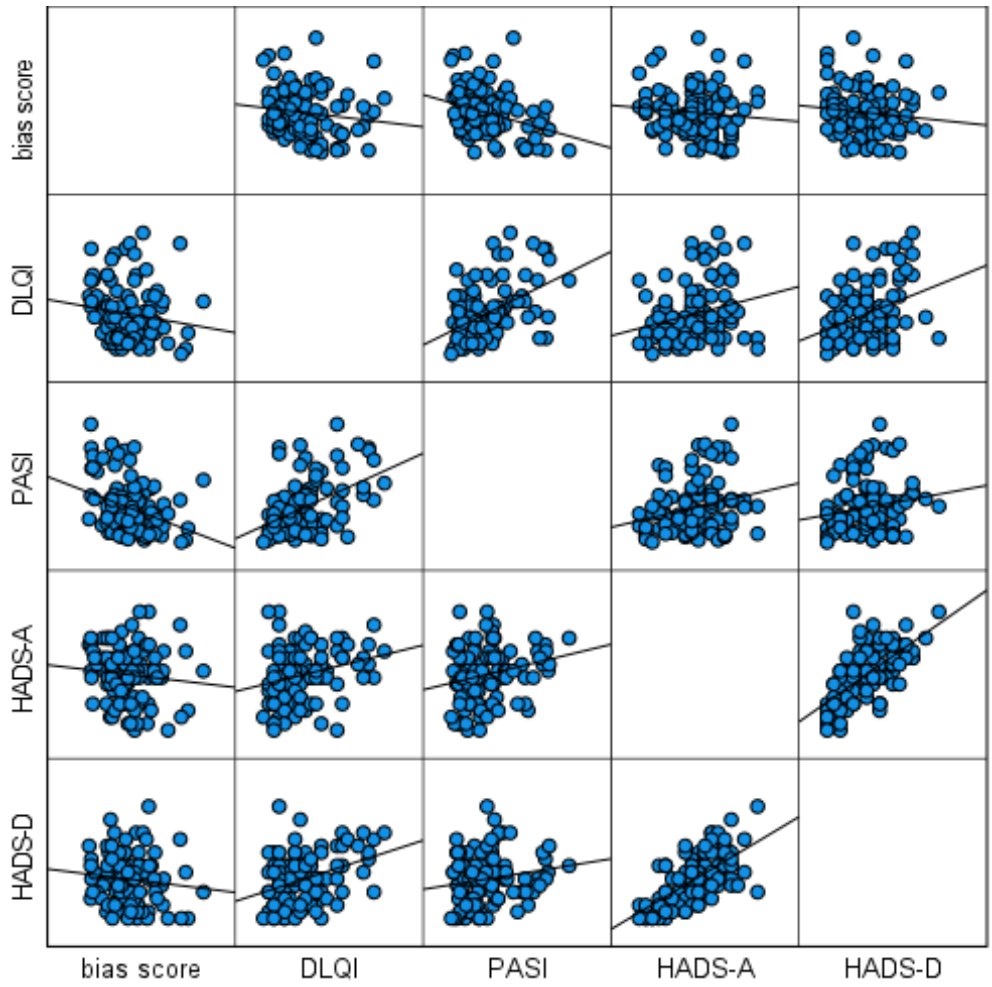


Figure 17: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

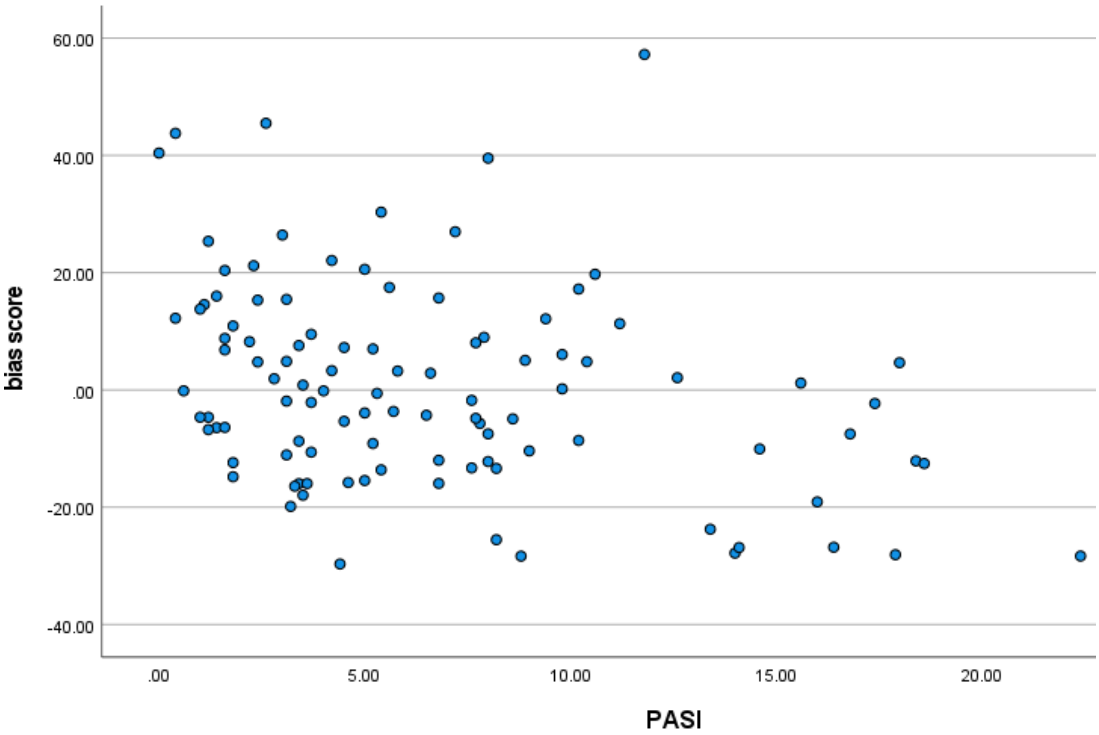


Figure 18: Scatter graph showing the relationship between PASI and bias score.

Discussion

Experiment 4 further explored AB for disease-specific threat words in a psoriasis sample by altering the presentation duration of stimuli. A short duration of 250 ms was used for stimuli in experiment 3, with no AB for disease-specific threat detected in the psoriasis group. Therefore, a long duration of 1050 ms used in experiment 4, in order to examine whether an extended presentation duration allowed later attentional processing biases to be detected. The SOA of 250 ms was selected in response to the work of Fox et al. (2001). Their study was the first to use the modified spatial cueing task to measure AB to threat in anxious populations. Their study found AB in the form of difficulty to disengage, using a 250 ms SOA, but not a shorter SOA of 100 ms. The longer SOA of 1050 ms was selected in order to simply extend the SOA to longer than 1000 ms, so that later attentional processing could be investigated.

No AB was found in the current sample of psoriasis participants, however the general slowing of reaction times in the psoriasis group in experiment 3 occurred again in experiment 4 and became a significant main effect. The findings of experiment 4 suggest that late AB for disease-specific threat does not occur in psoriasis populations. This finding shares similarities with the research by van Beugen et al. (2016), who also found no AB for threat in psoriasis participants, however, it still does not clarify why Fortune et al. (2003) *were* able to identify AB in their psoriasis sample. One explanation, as previously mentioned, could be the disease severity of the participants in each study. The overall PASI score for the psoriasis group in experiment 4 (M = 6.56) is closer to the level recorded in the sample from van Beugen et al.'s (2016) study in which no AB was found, than from Fortune et al.'s (2003) study. This could indicate that only more severe levels of psoriasis induce AB to disease-related threat. However,

excluding participants with a PASI of <5 did not alter the results of the ANOVA, so this may not be the case.

Interestingly, a significant regression showed that disease severity was negatively associated with overall bias score, which suggests that the more severe the psoriasis is, the lower the bias score. As negative bias scores from the emotional spatial cueing task are indicative of avoidance, this suggests that people with more severe psoriasis may be more likely to demonstrate avoidance of disease-related threat words in later stages of processing. However, Figure 18 shows that this is not a particularly strong relationship, with a large spread.

Disease severity is not the only factor that may have affected the outcome of this experiment; the words selected for stimuli in this experiment may also have contributed to the lack of AB detected. Experiment 4 found that across all conditions, reaction times in the psoriasis group were significantly larger than the control group. It can also be seen from Figure 16 that validity effects for the psoriasis group did not differ between cue types (threat or neutral), but that they are larger than the validity effects for the control group. This pattern could suggest that an AB for threat may exist in the psoriasis group, but that the cues did not differ enough in threat value to be able to adequately assess this. As mentioned in the method section of experiment 3, the cue words were matched for valence, arousal, word length, and lexical frequency. Examples of the neutral words used in experiments 3 and 4 included “outbreak”, “fatal”, and “dread”. The interpretation of these words during a global pandemic in which these kinds of words may hold more relevant and immediate threat meaning than under normal circumstances may have affected the data of this experiment. Another important consideration that experiments 1 and 2 highlighted is that the format of a stimulus may affect whether AB occurs or not. It was observed that when experiencing acute itch,

itch-related words induced attentional avoidance, whereas itch-related images did not draw any attentional bias. The opposite may be the case for psoriasis participants, in that images may better represent disease-related threat within this population and be more likely to affect AB processes.

The next two experiments aim to examine whether people with psoriasis demonstrate an AB for disease-related threatening pictorial stimuli, as experiments 1 and 2 have shown that different types of stimuli (i.e., words versus pictures) can elicit different attentional responses. All other variables such as the paradigm and the SOA will remain the same in order to isolate the change in stimuli as the cause for any change in attentional processing if an effect is detected.

Experiment 5: Do people with psoriasis show an AB towards briefly present facial expressions of disgust?

Introduction

Experiments 3 and 4 showed that participants with psoriasis did not demonstrate AB for disease-specific threat information in the form of words at either early (250 ms) or late (1050 ms) stages of processing. These findings, in addition to the findings of no AB for threat in psoriasis participants in research by van Beugen et al. (2016), raise the question of why AB was found in the research by Fortune et al. (2003). The only remaining shared difference between experiments 3 and 4 and the research by van Beugen et al. (2016) is the lower psoriasis severity of participants. As this cannot be manipulated in this research, other avenues must be explored. Experiments 1 and 2 showed that different formats of threat cues can elicit different attentional responses. Specifically, experiencing acute itch induced attentional avoidance for itch-related threat words but did not induce any attentional bias for itch-related threat images. Research has shown that affective faces are processed more automatically than words (Beall & Herbert, 2008). Additionally, people with psoriasis have demonstrated a behavioural avoidance of faces showing expressions of disgust (van Beugen et al., 2016). This could be due to the documented belief of people with psoriasis that they will be solely judged on the basis of their skin, coupled with the tendency to adopt anticipatory/avoidance coping behaviours designed to limit the socio-cognitive effects of psoriasis (Fortune et al., 1997). This links with a disease-avoidance model (Oaten et al., 2011) that claims that visible cues of disease such as skin lesions activate disgust, which is likely to strengthen the belief of those with psoriasis that they will be evaluated first and foremost by the condition of their skin, and met with general disgust. Research has also shown that people with psoriasis show diminished neural and cognitive

responses to facial expressions of disgust (Kleyn et al., 2009). It is therefore logical that faces depicting expressions of disgust are appropriate disease-related threat cues for people with psoriasis in the measurement of AB in this population, and arguably more relevant as threat cues than lexical information. Experiment 5 aimed to further examine AB for threat in psoriasis participants by using more socially relevant stimuli in the form of faces depicting expressions of disgust. It was predicted that people with psoriasis would demonstrate AB for disease-related images, and that healthy control participants would not. This would be reflected in the results as a significant difference between threat and neutral validity effects for the psoriasis group, but not for the control group. Previous research investigating AB in psoriasis populations has not used a paradigm that allows for direction of AB to be explored, and therefore the direction of any AB could not be predicted.

Method

Participants

The original sample of participants from Experiment 3 were invited to complete experiment 5, but again, due to drop out further participants had to be recruited in order to top up the sample. Of the original sample, 68% of the psoriasis group and 88% of the control group completed experiment 5. A further 36 psoriasis participants and 16 control participants were recruited which brought the total sample size to 208. The recruitment process was the same as Experiment 3 for the newly recruited participants, with psoriasis participants completing all stages of the study (short health survey, psoriasis screening survey, DLQI & PASI & spatial cueing task), before controls completed the short health survey and control screening. Eligible control participants were then matched with newly recruited psoriasis participants based on age, gender and

HADS scores. Matched controls were then invited to complete the spatial cueing task for experiment 5. Existing participants recruited from Experiment 3 did not repeat any surveys and were directed straight to the spatial cueing task for experiment 5.

Stimuli

The stimuli selected for cues in experiment 5 were faces depicting expressions of disgust and neutral expressions. Images show a person wearing a grey t-shirt, against a plain, dark grey background, showing either neutral expressions, or expressions of disgust. These were obtained from the FACES database (Ebner et al., 2010), using disgust accuracy ratings to inform selection. Faces with the highest accuracy ratings for both disgust and neutral expressions were selected for use as stimuli. Accuracy ratings were collected in a validation study (Ebner et al., 2010), in which 154 participants were asked "Which facial expression does this person primarily show", and had to select one option from six (happiness, anger, fear, sadness, neutral, disgust). Accuracy ratings were provided for each image in the form of a percentage, and so the most accurately rated images were selected. Participants in the current research were not asked to rate the images as it was important to ensure that desensitisation did not occur, and stimuli remained as novel as possible. 24 pairs of faces in total were used (12 neutral faces, 12 faces with expressions of disgust, the same model used per pair. See Appendix I: for all images). Models used for the images in the FACES database were categorised into one of three age groups; young (*M* = 24.3 years, *SD* = 3.5; age range, 19–31; 51% women), middle aged (*M* = 49.0 years, *SD* = 3.9; age range, 39–55; 48% women), and older (*M* = 73.2 years, *SD* = 2.8; age range, 69–80; 50% women). Table 12 shows how many male and female faces were used across age groups.

Table 12: Categories and gender split of models used in stimuli.

	Female	Male	Total
Young	5	8	13
Middle-aged	5	5	10
Older	2	3	5

Spatial Cueing Task

The spatial cueing task used the original 250ms SOA from experiment 3 but used the new images of faces showing neutral and disgust expressions as cues. On a 23.8 inch monitor, stimuli measured 52mm × 74mm. All other dimensions remained the same as described in experiment 3. Other alterations were made to the spatial cueing task in order to ensure participants fully understood the task and allocated their full attention to it. These alterations were feedback on incorrect trials (this prompted the word "incorrect" to appear on screen when participants pressed the wrong button), and a 2000ms limit to how long participants had to respond to each trial. If participants did not respond, feedback appeared as "failed to respond" and then moved onto the next trial.

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 13).

Table 13: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	40 Female 63 Male 1 Non-Binary	39 Female 64 Male 1 Non-Binary	N/A
Age	32.9 [18-62, SD = 10.10]	31.9 [18-61, SD = 10.80]	0.499
HADS Anxiety	8.29 [0-18 SD = 3.93]	8.10 [0-19, SD = 4.38]	0.739
HADS Depression	6.12 [0-17, SD = 3.75]	5.58 [0-21, SD = 3.66]	0.296
PASI	6.64 [0-22.4, SD = 5.03]	N/A	N/A
DQLI	7.79 [0-23, SD = 5.51]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 14 below.

Table 14: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	387.44 (61.89)	352.6 (58.95)	34.84 (22.45)	386.67 (62.5)	351.38 (61.06)	35.29 (22.68)	-0.45 (15.91)
Control	367.5 (54.54)	330.07 (51.1)	37.43 (18.75)	366.59 (55.41)	329.8 (52.3)	36.79 (19.27)	0.64 (13.66)

The analysis showed a significant main effect of validity $F(1,206) = 712.15$, $p < 0.001$, which showed that invalid trials had an overall larger reaction time than valid trials. It also showed a main effect of group ($F(1,206) = 7.26$, $p = 0.008$) which showed that the psoriasis group had significantly longer reaction times across all conditions. RTs for all conditions can be seen in Figure 19. No other significant results were found from the mixed ANOVA, and again, no significant three way interaction was found. Figure 20 shows that the difference between validity effects for each group did not

differ between groups. This suggests no AB for faces showing disgust was found in the psoriasis group.

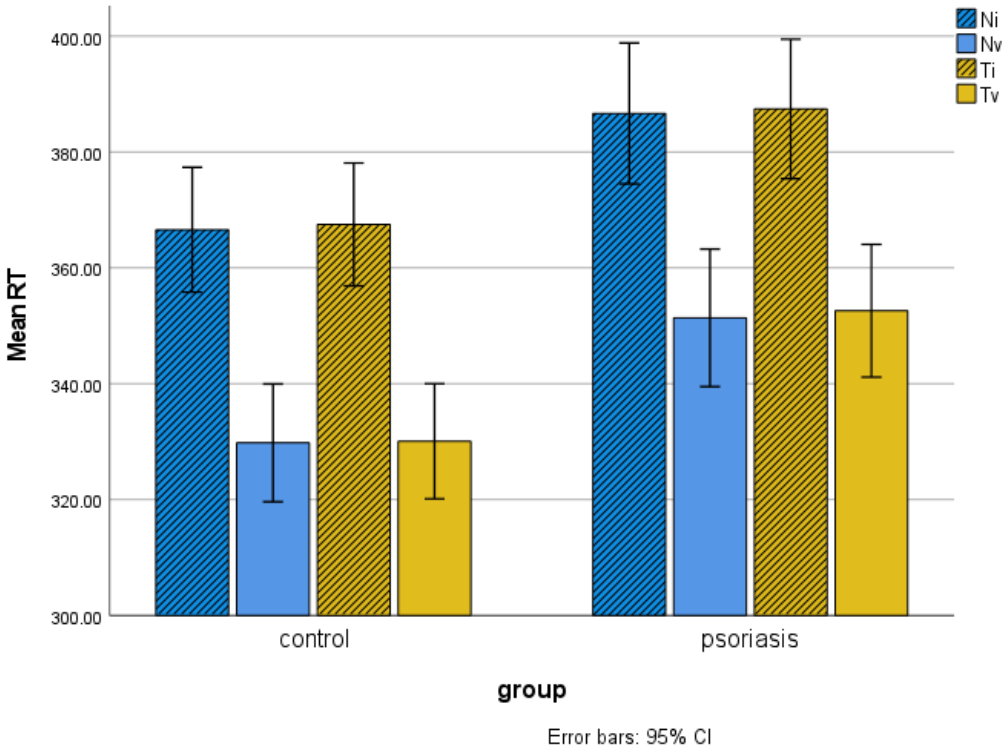


Figure 19:Bar graph showing reaction times across all conditions in both groups

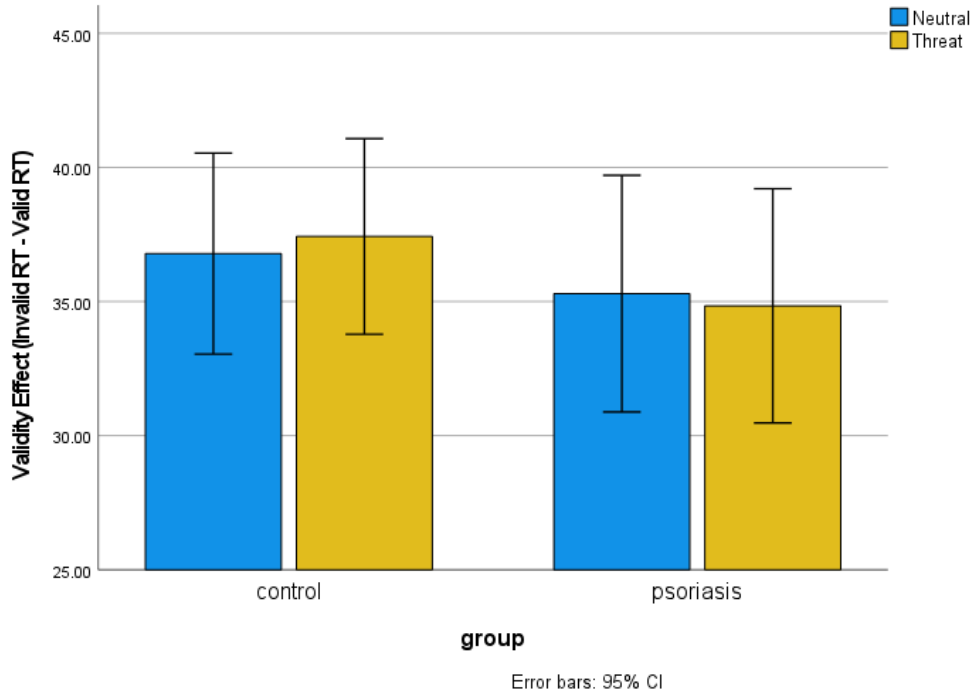


Figure 20: Bar graph showing validity effects for both groups

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 15.

For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,101) = 1.744$, $p = 0.180$) with an R^2 of 0.03, and model 2 ($F(4,99) = 1.030$, $p = 0.396$) with an R^2 of 0.04. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 21.

Table 15: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	-4.86 (-10.64, 0.93)	2.92		$p = 0.099$
DLQI	0.47 (-1.72, 1.13)	0.32	.16	$p = 0.149$
PASI	0.11 (-0.59, 0.81)	0.35	.04	$p = 0.754$
Step 2				
Constant	-2.78 (-10.50, 4.93)	3.89		$p = 0.476$
DLQI	0.55 (-0.15, 1.24)	0.35	.19	$p = 0.120$
PASI	0.16 (-0.57, 0.88)	0.36	.05	$p = 0.667$
HADS-A	-0.36 (-1.47, 0.75)	0.56	-.09	$p = 0.517$
HADS-D	0.01 (-1.15, 1.17)	0.58	.00	$p = 0.987$

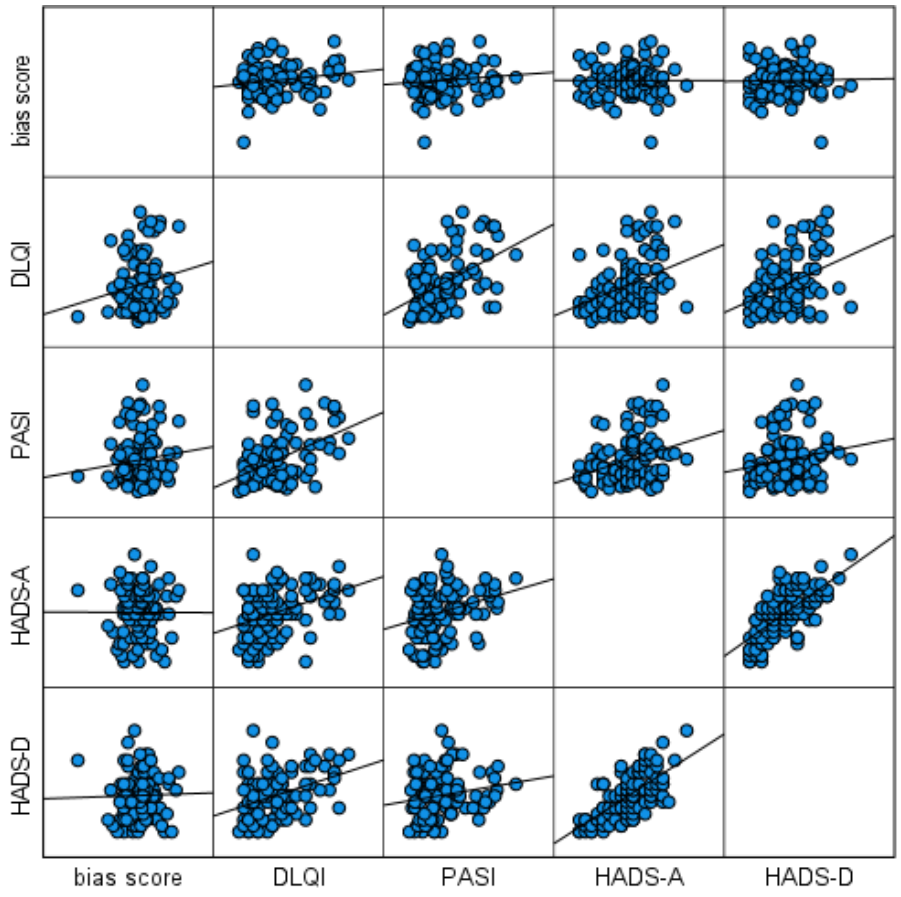


Figure 21: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 5 continued the exploration into AB in people with psoriasis, by examining this AB for facial expressions of disgust. The original shorter SOA of 250ms was employed with the intention of extending this to 1050ms in experiment 6. The results of experiment 5 suggest that AB for disease-related threat images does not occur in people with psoriasis in the earlier stages of processing. The main effect of group found in experiment 4 was also found in experiment 5, suggesting a general disruption to overall attention that was not modulated significantly by cue type (threat vs neutral). As images of facial expressions were depicted by the same person in each pair, in the same environment, in images of the same size and quality, it can be safely assumed that images were extremely well matched and therefore the stimuli themselves cannot be responsible for the lack of AB detected in psoriasis sample. A study by Bannerman et al. (2010) found that healthy participants showed a difficulty to disengage from fearful faces at 100ms but not at 20ms. This could suggest that 100ms is an optimal SOA to detect hypervigilance in the disengagement component of AB, and that 250ms is too long and misses the crucial timepoint. It could also be inferred from this finding that AB for fearful faces during the engagement phase does not occur in healthy participants, as it was not detected at either 20ms or 100ms, but a disengagement component of AB *was* detected at 100ms.

As behavioural avoidance has been demonstrated by people with psoriasis (van Beugen et al., 2016), and attentional avoidance was demonstrated by people with anxiety with a much longer SOA of 1250ms (Koster et al., 2005), it may be that attentional avoidance is more likely to occur in the later stages of processing, which a shorter SOA of 250ms would be unlikely to capture as well as an SOA of 1050ms.

Experiment 6: Do people with psoriasis show a late AB towards facial expressions of disgust?

Introduction

Experiment 5 showed that facial expressions of disgust did not elicit an AB in people with psoriasis when using an SOA of 250ms. As previous research has shown that different patterns of AB can be demonstrated with different SOAs (Koster et al., 2005), experiment 6 aimed to explore this by increasing the SOA from experiment 5 from 250ms to 1050ms so that later AB processing could be examined. Differences in patterns of AB at different processing times have also been demonstrated in populations with fibromyalgia, another long-term health condition. Research by Vago & Nakamura (2011) found that when examining AB for pain-related threat words using a dot-probe task, people with fibromyalgia showed hypervigilance at 100ms and avoidance at 500ms. This finding supports the vigilance-avoidance hypothesis of AB (Mogg & Bradley, 1998), which contends that increased anxiety levels result in a sensitive threat evaluation system, which initially causes early hypervigilance, followed by later avoidance. This hypothesis has found support in a number of studies that have also found the vigilance-avoidance pattern (Blicher & Reinholdt-Dunne, 2019; Onnis et al., 2011). Experiment 6 aimed to extend the exploration of AB to pictorial threat in people with psoriasis by repeating experiment 5 with a longer SOA of 1050ms so that later stage AB could be investigated.

It was predicted that people with psoriasis would demonstrate AB for disease-related images in the later processing stages, and that healthy control participants would not. The direction of AB in previous research has not been explored due to the choice of paradigm, and therefore the direction of AB in experiment 6 could not be predicted.

Method

The original sample of participants from Experiment 3 were invited to complete experiment 6, but again, due to drop out further participants had to be recruited in order to top up the sample. Of the original sample, 58% of the psoriasis group and 86% of the control group completed experiment 6. A further 44 psoriasis participants and 16 control participants were recruited which brought the total sample size to 204. The recruitment process was the same as Experiment 3 for the newly recruited participants (Figure 10 and Figure 11).

The only alteration to the procedure of experiment 6 was the increase of SOA from 250ms to 1050ms.

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 16).

Table 16: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	43 Female 58 Male 1 Non-Binary	37 Female 64 Male 1 Non-Binary	N/A
Age	33.33 [18-62, SD = 10.51]	32.12 [18-61, SD = 10.81]	0.417
HADS Anxiety	8.75 [0-18 SD = 4.20]	7.85 [0-19, SD = 4.36]	0.138
HADS Depression	5.86 [0-17, SD = 3.75]	5.46 [0-21, SD = 3.67]	0.440
PASI	7.35 [0-22.4, SD = 5.34]	N/A	N/A
DQLI	7.41 [0-23, SD = 5.29]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 17 below.

Table 17: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			Neutral Stimuli			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	380.61 (53.36)	348.37 (54.11)	32.24 (23.2)	380.33 (54.43)	348.54 (55.35)	31.78 (24.76)	0.45 (16.14)
Control	365.5 (49.18)	332.01 (45.05)	33.49 (21.28)	366.3 (49.55)	331.54 (43.46)	34.75 (21.81)	-1.27 (14.92)

A 2×2×2 factorial ANOVA showed a significant main effect of validity $F(1,202) = 485.36$, $p < 0.001$, which showed that invalid trials had an overall larger reaction time than valid trials. It also showed a main effect of group ($F(1,202) = 5.144$, $p = 0.024$) which showed that the psoriasis group had significantly longer reaction times across all conditions. Figure 22 shows both main effects, and RTs across all conditions. No other significant results were found from the ANOVA, with no significant three way interaction suggesting no AB in the psoriasis group (can also be seen with little difference in validity effects in Figure 23).

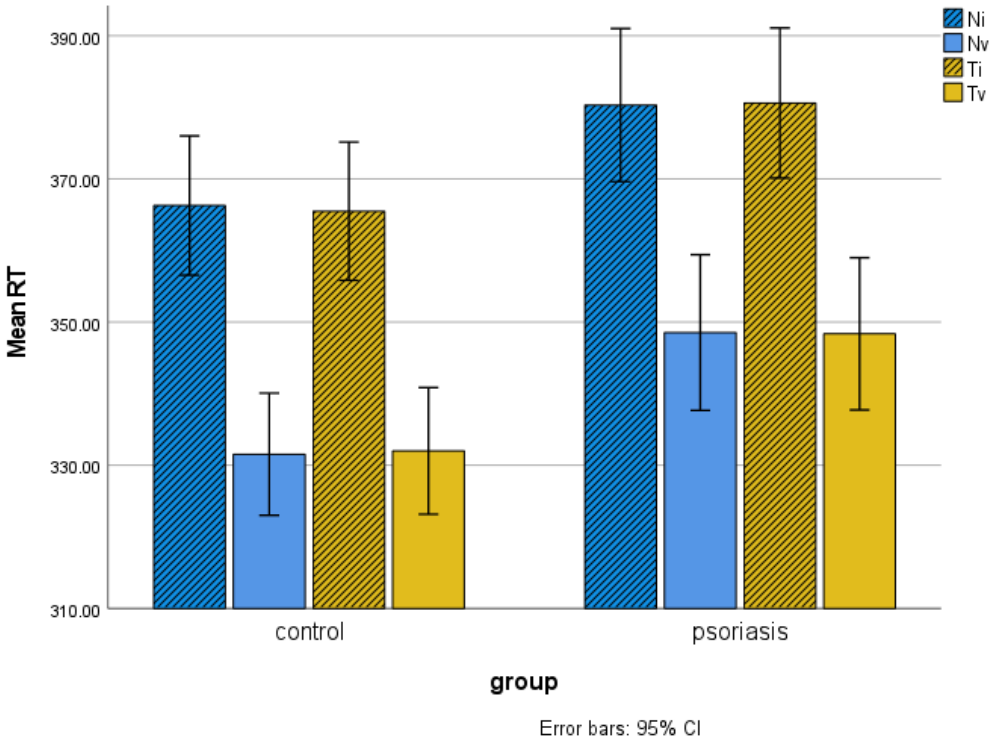


Figure 22: Bar graph showing reaction times across all conditions in both groups.

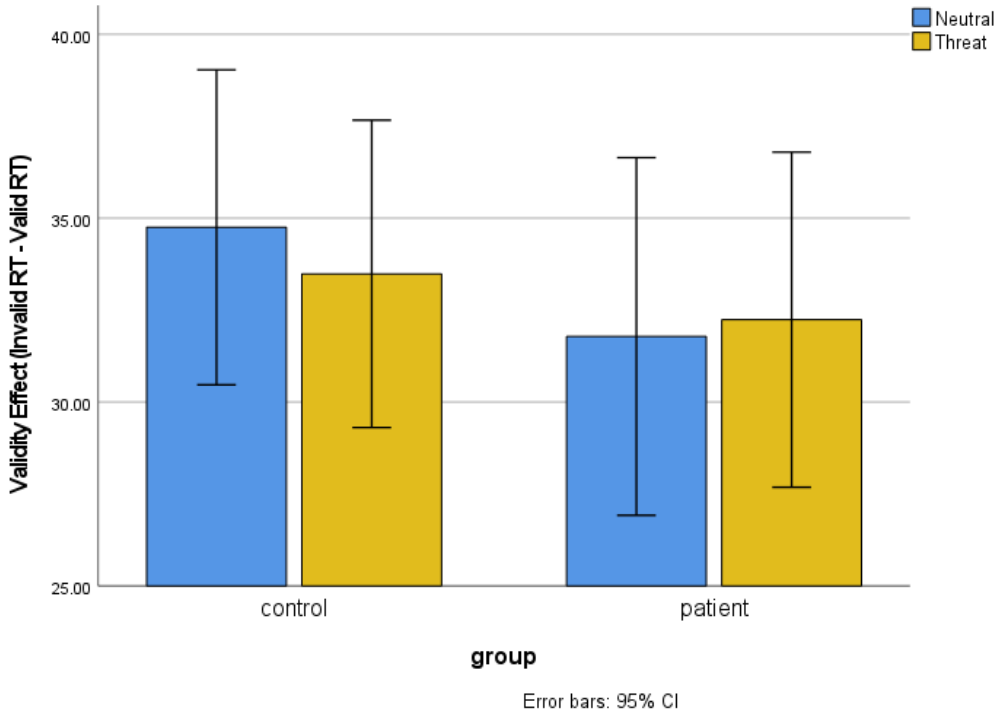


Figure 23: Bar graph showing validity effects for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear

regressions were applied, the results of which can be seen in Table 18. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,99) = 0.189$, $p = 0.828$) with an R^2 of 0.004, and model 2 ($F(4,97) = 0.433$, $p = 0.784$) with an R^2 of 0.02. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 24.

Table 18: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	1.39 (-4.58, 7.36)	3.01		$p = 0.645$
DLQI	0.10 (-0.64, 0.84)	0.37	.03	$p = 0.799$
PASI	-0.22 (-0.96, 0.51)	0.37	-.07	$p = 0.546$
Step 2				
Constant	4.71 (-3.53, 12.96)	4.15		$p = 0.259$
DLQI	0.16 (-0.62, 0.95)	0.40	.05	$p = 0.682$
PASI	-0.19 (-0.93, 0.56)	0.37	-.06	$p = 0.617$
HADS-A	-0.45 (-1.50, 0.60)	0.53	-.12	$p = 0.400$
HADS-D	-0.03 (-1.25, 1.19)	0.62	-.01	$p = 0.961$

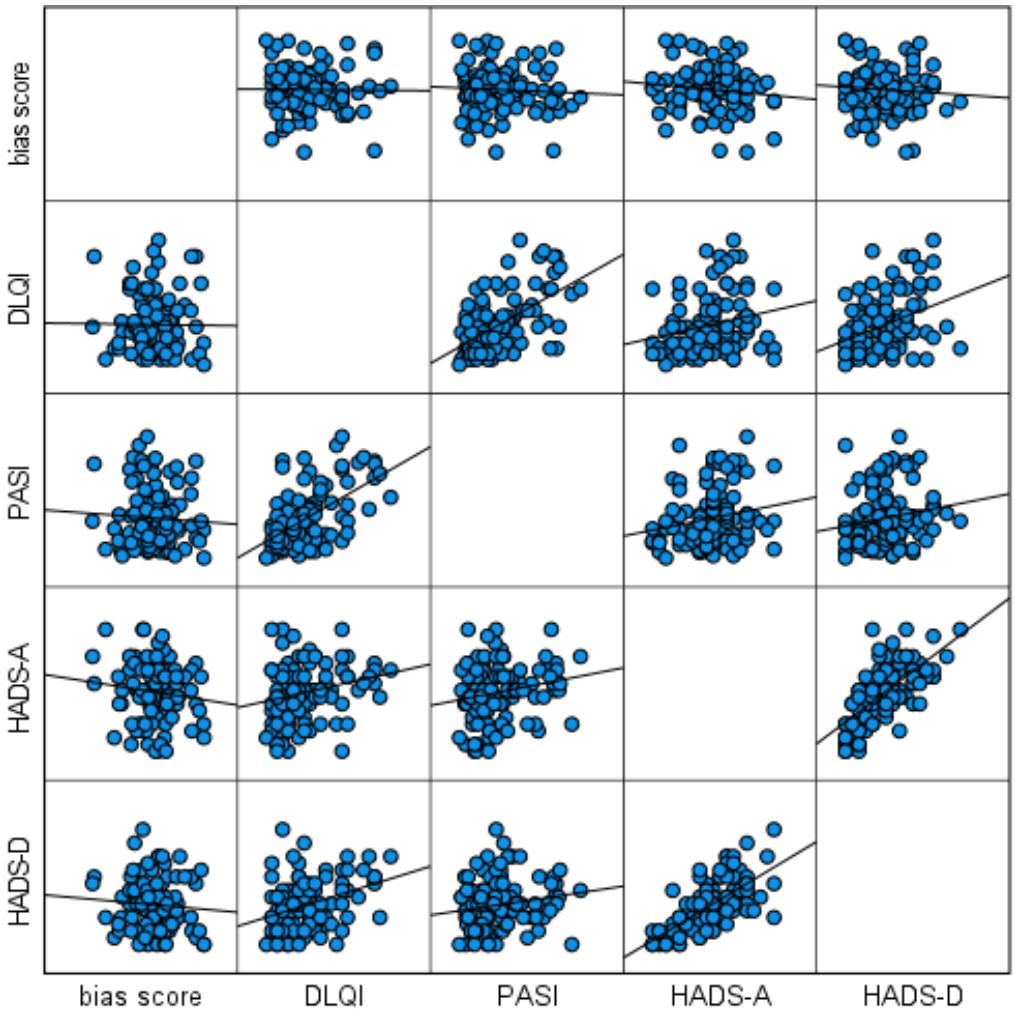


Figure 24: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 6 continued the investigation into AB for threat in the form of facial expressions of disgust, in people with psoriasis. It extended the investigation by increasing the SOA from 250ms to 1050ms, in order to allow any AB in the later stages of processing to be observed. A main effect of group occurred again in experiment 6 with longer reaction times across all conditions for psoriasis participants, suggesting a general disruption to attention for this group that was not affected by stimulus type. No AB for threat related images was found in psoriasis participants in experiment 6, and disease severity, associated quality of life, and depression and anxiety levels were not significant predictors of attentional bias score. The results from experiments 5 and 6

suggest that AB for facial expressions of disgust does not occur in psoriasis populations, and that psoriasis severity, dermatological quality of life, and levels of depression and anxiety are not good predictors of AB for these types of stimuli.

There are a number of reasons that could explain why no evidence of AB was found in this psoriasis population in experiments 5 and 6. One reason could be that faces depicting expressions of disgust are not as relevant to people with psoriasis as images depicting the appearance of psoriatic skin. A study by Lee et al. (2014) found that people with acne showed a stronger attentional bias for acne lesions and focused their fixation more on the acne lesions over acne-free regions than healthy control participants did. This could suggest that people with psoriasis are more likely to show an AB for images of psoriatic lesions than for facial expressions of disgust.

Another reason for the lack of AB detected in the psoriasis group in experiments 5 and 6 is the neutral stimuli. It could be argued that psoriasis participants do not interpret "neutral" expressions as non-threatening. A study by Yoon & Zinbarg (2008) found that socially anxious individuals interpret neutral faces in a negative, threatening manner. Peschard & Philippot (2017) also found that people with high levels of social anxiety were more likely to misattribute anger to neutral faces than people with low levels of social anxiety. These findings by Peschard & Philippot (2017) and Yoon & Zinbarg (2008), in conjunction with the findings of Fortune et al. (1997) that people with psoriasis believe they are likely to be judged purely on the appearance of their skin, may suggest that the stimuli depicting neutral facial expressions in experiments 5 and 6 were not sufficiently different from the more universally threatening stimuli depicting facial expressions of disgust from the perspective of someone with psoriasis.

A further important factor to consider is the lack of a social context in the presentation of socially threatening stimuli. Faces showing expressions of disgust may

not be interpreted as threatening by people with psoriasis as they have not been placed in a social context, which would allow for the disgust expression to be attributed to the person observing it. This may mean that participants in the psoriasis group did not interpret the faces showing disgust as threatening, as they may not have perceived the disgust as aimed towards them. If this is the case, then disgust and neutral expressions are likely to represent similar threat value, which would explain the lack of an effect detected.

As experiments 5 and 6 showed that AB for threat in the form of facial expressions of disgust does not differ between people with psoriasis and health control participants, the next two experiments aimed to further explore AB for threat in the form of disease-specific words. It aimed to investigate this further by addressing the limitations of the stimuli used in experiments 3 and 4, in that the neutral words could be interpreted as too threatening to be used as control words.

Experiment 7: Do people with psoriasis show an AB towards briefly present disease-related words over positive control words?

Introduction

Experiments 3-6 showed that people with psoriasis do not demonstrate AB for disease-related words or facial expressions of disgust at either a long or short stimulus exposure time. However, in experiments 5 and 6 the neutral expressions may not have been interpreted as neutral by participants, as previous research has shown that people with social anxiety interpreted neutral faces as either negative, angry, or threatening (Peschard & Philippot, 2017; Yoon & Zinbarg, 2008). This may also be the case for the lexical stimuli used in experiments 3 and 4, as the disease-specific threat words were matched for valence as well as arousal, word length, and lexical frequency. This resulted in negatively valenced words such as "outbreak", "fatal" and "dread" being used as neutral words which may have caused inadvertent AB to both threat *and* neutral words. A recent study showed that during the COVID-19 pandemic, people showed AB for COVID-19 related words such as "lungs", "ventilator", and "isolation" (Albery et al., 2021). AB for these kinds of words may not ordinarily have been found within a representative UK sample, but this recent study shows that the global pandemic has had an effect on how different words can be interpreted. This may also explain why AB was found in the study by Fortune et al. (2003), as the words they used were much less negative in valence (e.g., "tree" and "seating") and could therefore arguably be considered as less emotive than the neutral words used in experiments 3 and 4. This is likely to be due to the words in the research by Fortune et al. (2003) being matched for word length only. It could be argued that the AB found in the research by Fortune et al. (2003) could be due to the fact that their threat words had higher arousal and more negative valence than their neutral words. In order to rule out the matched valence

levels of the words used as stimuli in experiments 3 and 4 as the reason no AB has been detected so far, experiment 7 repeated experiment 3 with new neutral words with more positive valence ratings, but with the remaining factors of arousal, word length, and lexical frequency still being matched with the existing threat words. The new word set can be seen in Table 19.

It was hypothesised that people with psoriasis would demonstrate AB for disease-related words over positive control words, and that healthy control participants would not demonstrate any difference in attentional processing between threat and control words. Previous research investigating AB in psoriasis populations has not used a paradigm that allows for direction of AB to be explored, and therefore the direction of any AB could not be predicted.

Method

Participants

The original sample of participants from Experiment 3 were invited to complete experiment 7, but again, due to drop out further participants had to be recruited in order to top up the sample. Of the original sample, 62% of the psoriasis group and 85% of the control group completed experiment 7. A further 50 psoriasis participants and 27 control participants were recruited which brought the total sample size to 224. The recruitment process was the same as Experiment 3 for the newly recruited participants (Figure 10 & Figure 11).

Stimuli

The stimuli used for experiment 7 are the threat words used in experiments 3 and 4, but with new neutral words with more positive valence ratings. The new neutral control words were still matched for arousal ratings, word length, and lexical frequency.

Spatial Cueing Task

The spatial cueing task remains the same as experiment 6, with a SOA of 250ms and feedback on accuracy and speed of responses being provided.

Table 19: Threat words with matched neutral words with more positive valence ratings.

Neutral	Threat
charming	itching
ambition	flare-up
fluffy	flaking
safety	scaly
neat	sore
pudding	scaling
cuddle	scalp
sunlight	inflamed
gentle	scabby
fun	pain
limitless	irritated
new	raw
jackpot	lesion
delighted	bleeding
amusing	unhappy
talented	insecure
wise	ugly
merry	messy
lovable	burning
courage	disgust
winnings	stinging
enjoy	gross
romantic	repulsive
smile	stare

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 20).

Table 20: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	48 Female 63 Male 1 Non-Binary	40 Female 71 Male 1 Non-Binary	N/A
Age	33.15 [18-62, SD = 10.26]	31.45 [18-61, SD = 10.89]	0.229
HADS Anxiety	8.54 [0-18 SD = 4.29]	8.03 [0-19, SD = 4.40]	0.382
HADS Depression	5.94 [0-17, SD = 3.80]	5.59 [0-21, SD = 3.73]	0.489
PASI	7.05 [0-22.4, SD = 5.26]	N/A	N/A
DQLI	7.42 [0-23, SD = 5.38]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 21 below.

Table 21: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			**Neutral Stimuli**			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	390.49 (68.02)	341.87 (60.97)	48.61 (26.65)	389.27 (67.65)	342.94 (63.05)	46.33 (26.91)	2.29 (13.82)
Control	365.5 (45.21)	319.45 (42.01)	46.05 (23.02)	364.33 (44.45)	320.62 (41.47)	43.71 (20.83)	2.34 (10.57)

A 2×2×2 factorial ANOVA showed a significant main effect of validity $F(1,222) = 850.61$, $p < 0.001$, which showed that invalid trials had an overall larger reaction time than valid trials. It also showed a main effect of group ($F(1,222) = 5.14$, $p = 0.001$) which showed that the psoriasis group had significantly longer reaction times

across all conditions. Both main effects can be seen in Figure 25 which shows RTs across all conditions.

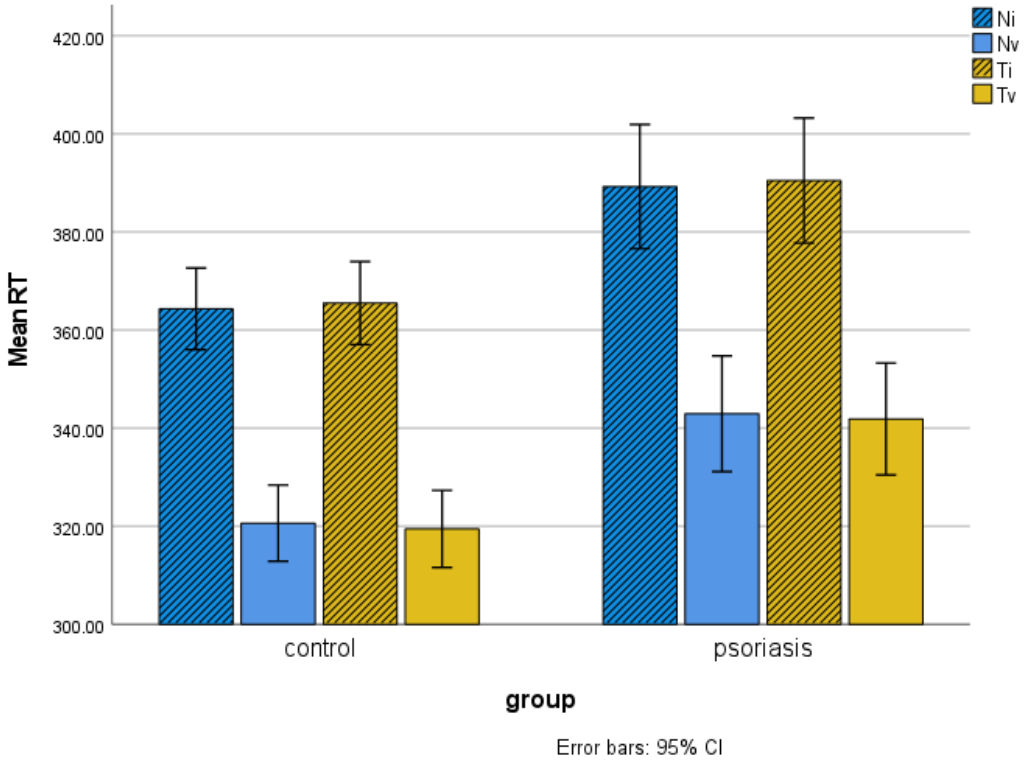


Figure 25: Bar graph showing reaction times across all conditions in both groups.

A significant two way interaction was found between cue type and validity ($F(1,222) = 7.93$, $p = 0.005$), which show that the validity effect for threat trials is larger than for neutral trials, across both groups. This can be seen in Figure 26. Similar positive bias scores in both groups (see in Table 21) suggest mild hypervigilance patterns in both psoriasis and control participants. No other significant results were found from the ANOVA.

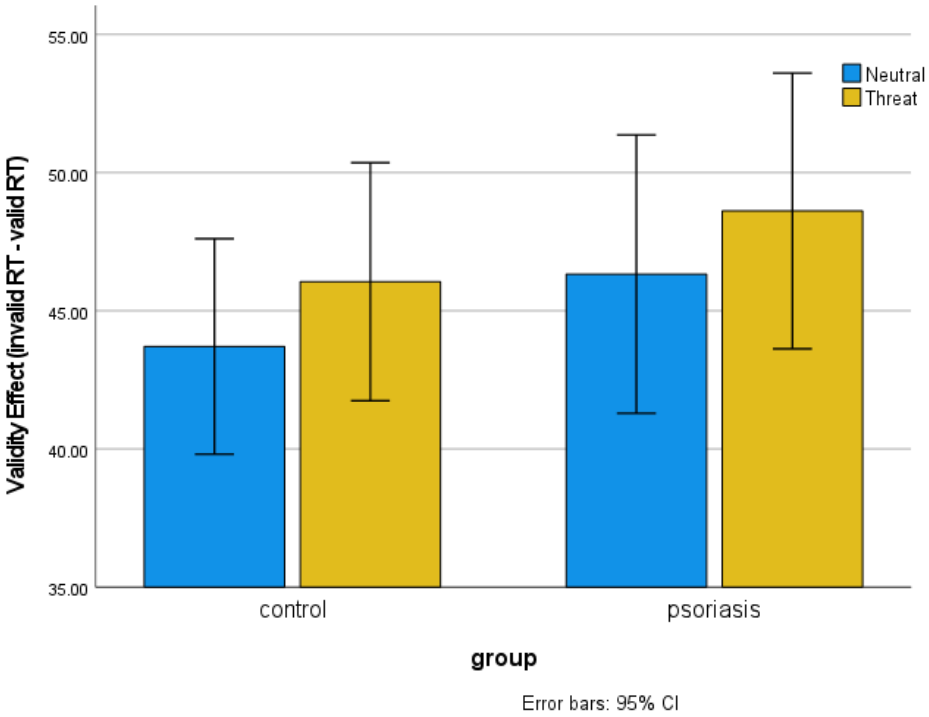


Figure 26: Bar graph showing validity effects for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 22. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,109) = 0.076$, $p = 0.927$) with an R^2 of 0.001, and model 2 ($F(4,107) = 0.038$, $p = 0.997$) with an R^2 of 0.001. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 27.

Table 22: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	1.82 (-2.96, 6.61)	2.42		*p* = 0.452
DLQI	0.12 (-0.48, 0.71)	0.30	.05	*p* = 0.699
PASI	-0.06 (-0.67, 0.55)	0.31	-.02	*p* = 0.853
Step 2				
Constant	1.72 (-4.70, 8.15)	3.24		*p* = 0.596
DLQI	0.12 (-0.52, 0.75)	0.32	.05	*p* = 0.718
PASI	-0.06 (-0.68, 0.56)	0.32	-.02	*p* = 0.849
HADS-A	0.02 (-0.83, 0.87)	0.43	.01	*p* = 0.955
HADS-D	-0.01 (-0.98, 0.95)	0.49	-.00	*p* = 0.980

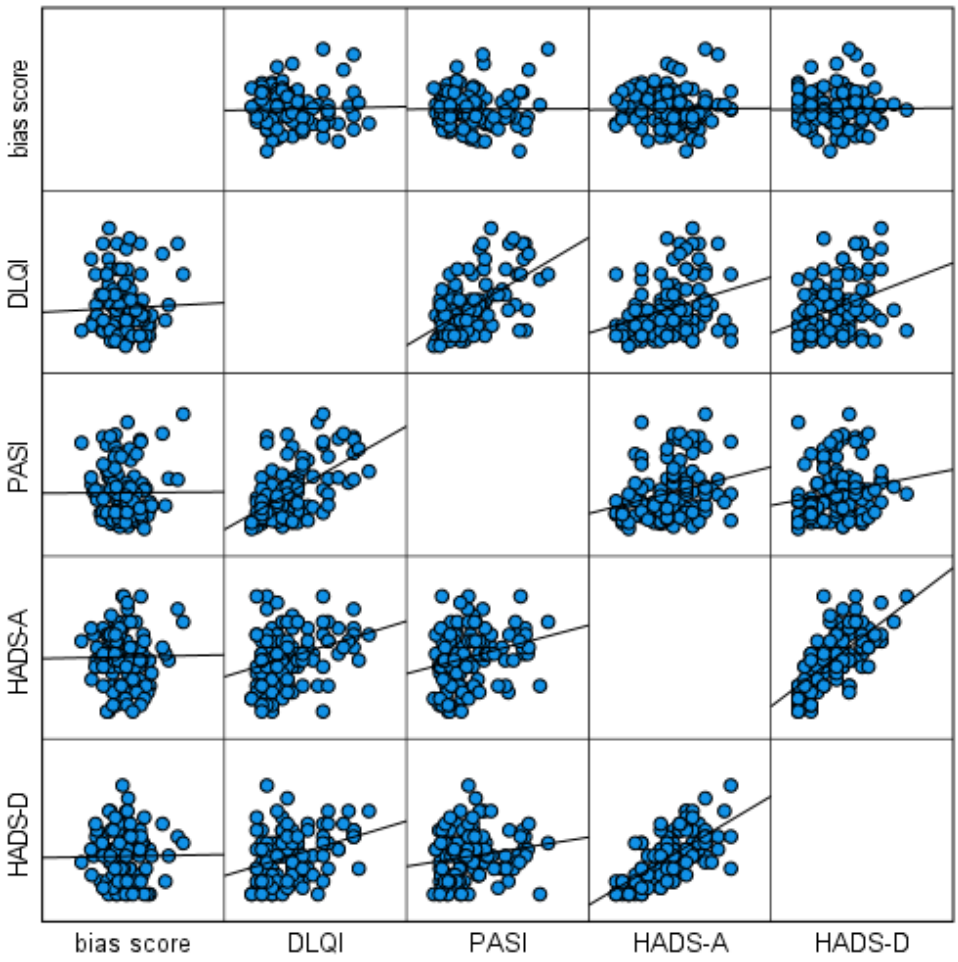


Figure 27: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 7 further explored AB for disease-related threat words in people with psoriasis by comparing psoriasis-specific threat words to different control words with more positive valence ratings, with a shorter SOA of 250ms. Experiment 7 showed that both the psoriasis group and the control group showed a small level of hypervigilance for briefly shown disease-related threat words relative to more positive control words, and the main effect of group showed that the psoriasis group demonstrated a general attentional disruption across all conditions. This could indicate that hypervigilance for psoriasis-specific threat words occurs in healthy populations as well as the psoriasis population. This begs the question of why healthy participants would show hypervigilance for threat words that are arguably not relevant to them. As hypervigilance was not demonstrated in either group in experiments 3 or 4, it could be argued that hypervigilance for any threat words may be induced by the presence of positive control words, regardless of health status. However, another interpretation is that the threat words are of a high threat value to the majority of people regardless of health status. For example, the words “bleeding”, “pain”, and “burning” may be a relevant threat word to someone with or without psoriasis.

Experiment 7 also showed that psoriasis severity, dermatological quality of life, and levels of anxiety or depression are not good predictors of AB for briefly shown threat words relative to positive control words in people with psoriasis. This could suggest that the hypervigilance observed in both groups is driven by some other unknown factor, or that it is a normal human trait to be hypervigilant for threat words over positive words.

Experiment 8: Do people with psoriasis show a late AB towards disease-related words over positive control words?

Introduction

Experiment 7 showed that both psoriasis participants and control participants showed a small effect of hypervigilance for briefly shown psoriasis-specific threat words when compared with positive control words. Previous research has shown different patterns of AB occurring at different processing stages in anxious individuals (Koster et al., 2005), and therefore extending the SOA from 250ms to 1050ms will allow the exploration of this phenomenon in individuals with plaque psoriasis. This longer stimulus presentation may allow more voluntary, goal-driven processing to be activated, which may differentiate the attentional processing of people with psoriasis from healthy individuals, as their goals are likely to diverge in some way.

It was predicted that people with psoriasis would demonstrate AB for disease-related images in the later processing stages, and that healthy control participants would not. The direction of AB in previous research has not been explored due to the choice of paradigm, and therefore the direction of AB in experiment 8 could not be predicted.

Method

Participants

The original sample of participants from Experiment 3 were invited to complete experiment 8, but again, due to drop out further participants had to be recruited in order to top up the sample. Of the original sample, 58% of the psoriasis group and 78% of the control group completed experiment 8. A further 47 psoriasis participants and 27 control participants were recruited which brought the total sample size to 214.

Experimenter error resulted in a larger sample size for the control group (N = 109) than for the psoriasis group (N = 105). The recruitment process was the same as Experiment 3 for the newly recruited participants (Figure 10 and Figure 11).

Spatial Cueing Task

The only change from experiment 7 was the SOA that was increased from 250ms to 1050ms.

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 23).

Table 23: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	48 Female 63 Male 1 Non-Binary	40 Female 71 Male 1 Non-Binary	N/A
Age	33.15 [18-62, SD = 10.26]	31.45 [18-61, SD = 10.89]	0.229
HADS Anxiety	8.54 [0-18 SD = 4.29]	8.03 [0-19, SD = 4.40]	0.382
HADS Depression	5.94 [0-17, SD = 3.80]	5.59 [0-21, SD = 3.73]	0.489
PASI	7.05 [0-22.4, SD = 5.26]	N/A	N/A
DQLI	7.42 [0-23, SD = 5.38]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 24 below.

Table 24: Mean reaction times in milliseconds and standard deviations for all trials (neutral valid and invalid, and threat valid and invalid), and for both groups (psoriasis and control). Also included are validity effects and overall bias score.

	Threat Stimuli			Neutral Stimuli			
	Invalid (Ti)	**Valid (Tv)**	**Validity Effect (Ti-Tv)**	**Invalid (Ni)**	**Valid (Nv)**	**Validity Effect (Ni-Nv)**	**Bias Score [(Ti-Tv) – (Ni-Nv)]**
Psoriasis	386.61 (67.05)	357.7 (64.77)	28.91 (26.84)	384.99 (67.43)	358.56 (64.54)	26.43 (25.13)	2.48 (14.76)
Control	367.67 (50)	336.08 (42.62)	31.59 (23.54)	368.6 (47.43)	336.42 (41.66)	32.18 (24.45)	-0.59 (15.59)

A 2×2×2 factorial ANOVA showed a significant main effect of validity $F(1,212) = 334.3$, $p < 0.001$, which showed that invalid trials had an overall larger reaction time than valid trials. It also showed a main effect of group ($F(1,212) = 6.94$, $p = 0.009$) which showed that the psoriasis group had significantly longer reaction times across all conditions. Figure 28 shows RTs across all conditions, and with both main effects able to be observed. No other significant effects were found from the ANOVA, with no crucial three way interaction suggesting no AB occurred in the psoriasis group. This can also be seen in Figure 29, with little difference between validity effects both within and between groups.

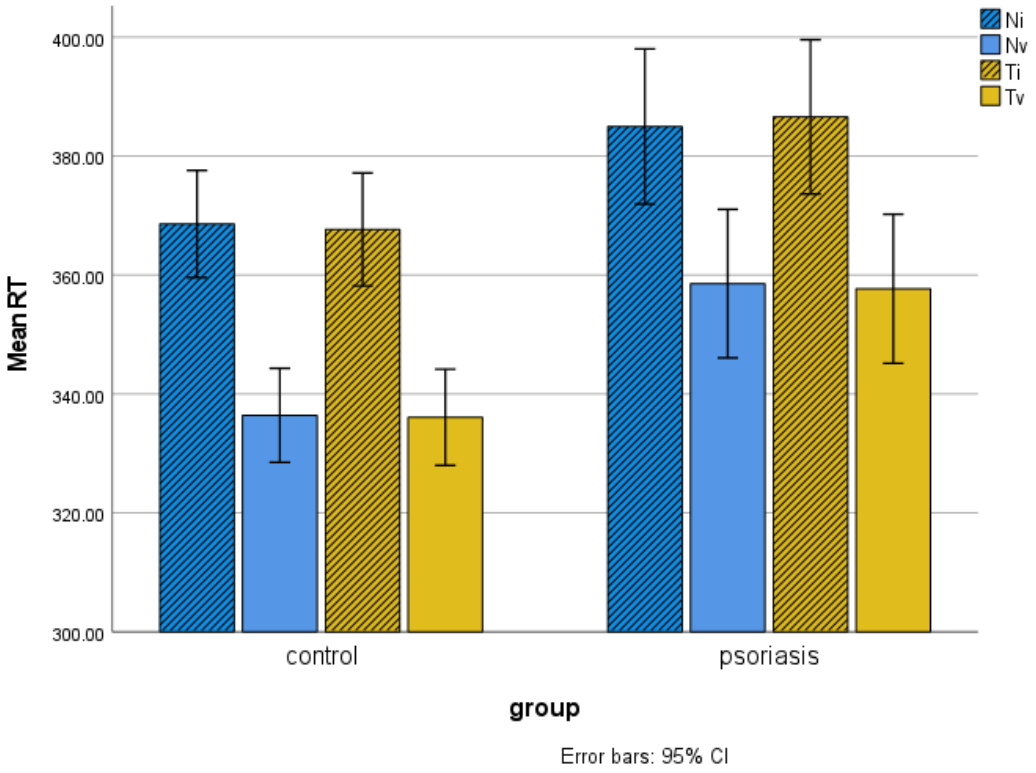


Figure 28: Bar graph showing reaction times across all conditions in both groups.

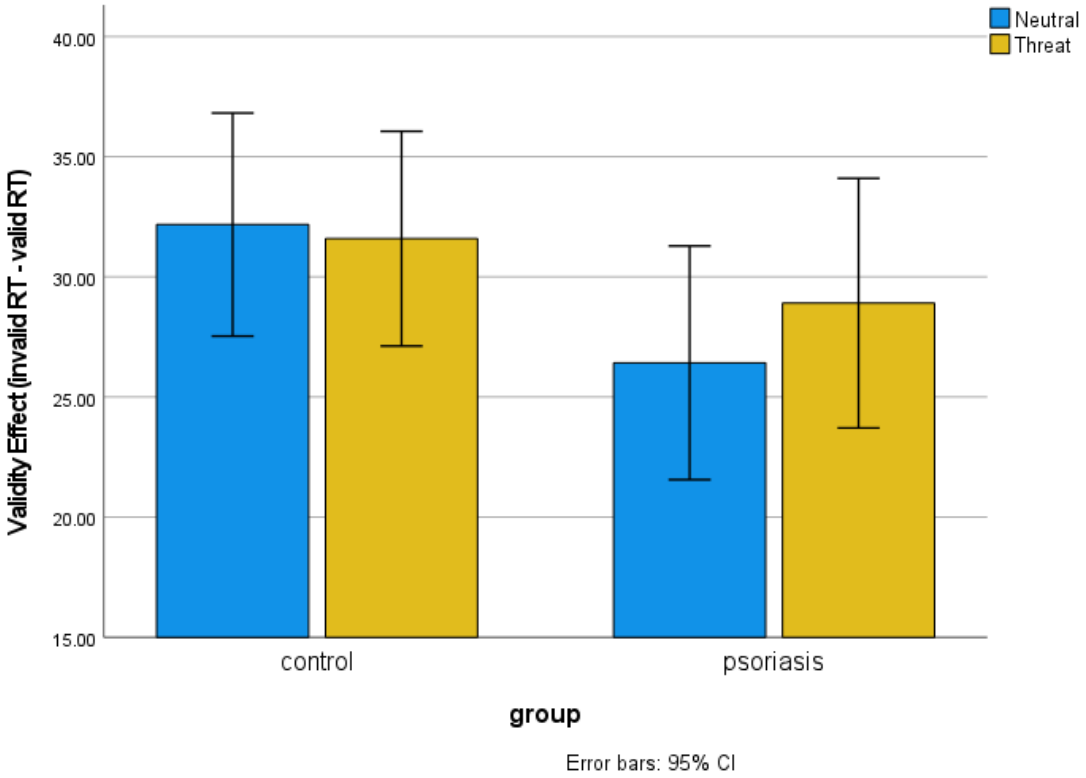


Figure 29: Bar graph showing validity effects for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 25. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the bias score ([Ti-Tv]-[Ni-Nv]) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,102) = 0.002$, $p = 0.998$) with an R^2 of 0.000, and model 2 ($F(4,100) = 0.257$, $p = 0.905$) with an R^2 of 0.01. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 30.

Table 25: Linear model of predictors of bias score with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	2.32 (-3.14, 7.78)	2.75		$p = 0.401$
DLQI	0.02 (-0.71, 0.75)	0.37	.01	$p = 0.964$
PASI	0.01 (-0.67, 0.68)	0.34	.002	$p = 0.986$
Step 2				
Constant	3.82 (-3.44, 11.07)	3.66		$p = 0.299$
DLQI	0.003 (-0.75, 0.75)	0.38	.001	$p = 0.994$
PASI	0.07 (-0.62, 0.76)	0.35	.03	$p = 0.840$
HADS-A	-0.47 (-1.40, 0.46)	0.47	-.14	$p = 0.315$
HADS-D	0.38 (-0.69, 1.44)	0.54	.10	$p = 0.483$

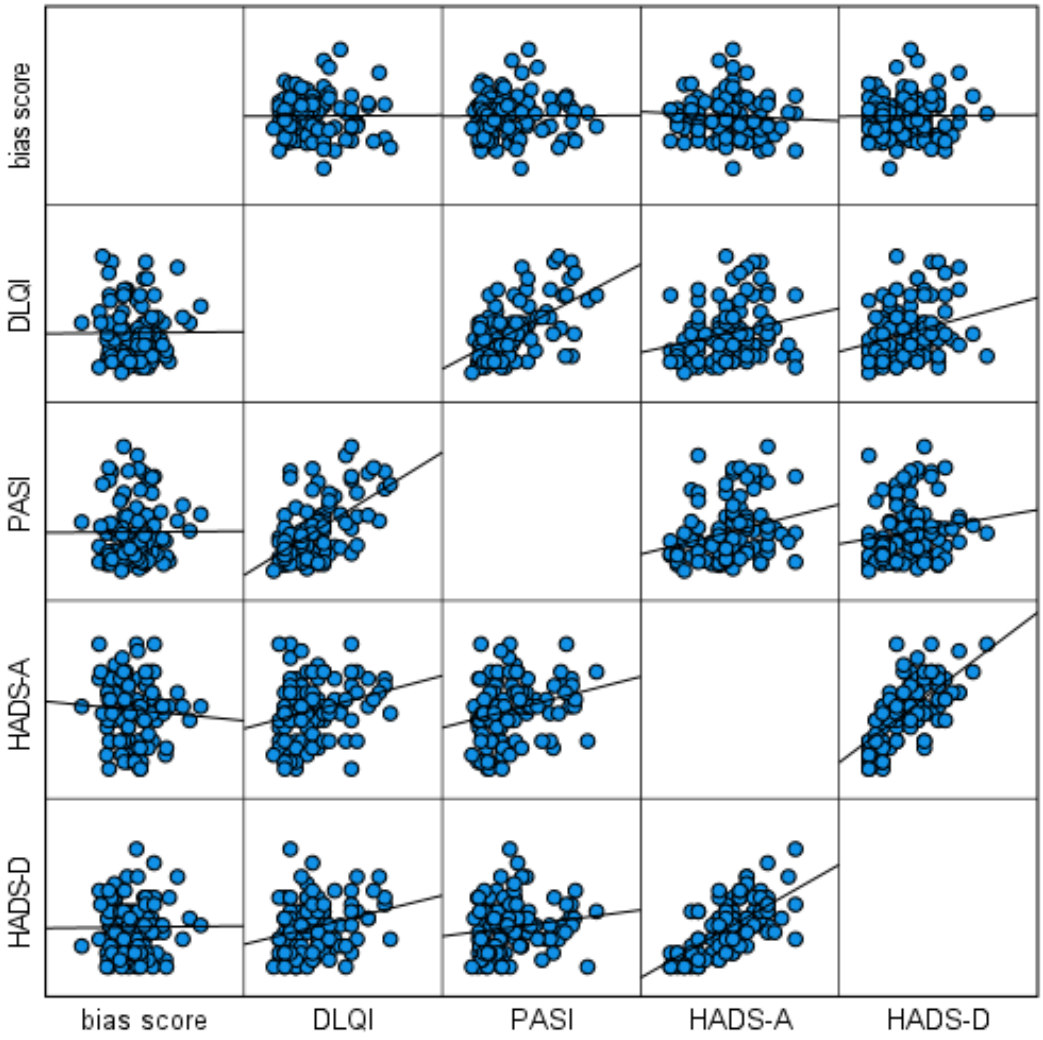


Figure 30: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 8 suggests that neither healthy participants nor psoriasis participants demonstrate any AB for disease-related threat words over positive control words at later stages of processing. This is in contrast with experiment 7 which suggests that both groups demonstrate hypervigilance for briefly shown disease-related threat words over positive control words. As the only difference between experiments 7 and 8 was short and long SOAs respectively, this may indicate that a universal AB occurs for these threat words when compared with positive control words, but only in the earlier stages of processing which was able to be captured with a 250ms SOA. However, AB may

also occur in the later stages of processing but was not captured in experiment 8 as perhaps 1050ms was not the optimum SOA to capture this, as we know that avoidance was detected in anxious individuals at a longer SOA of 1250ms (Koster et al., 2005). As experiments 3 and 4 did not detect any AB despite using the same threat words as experiments 7 and 8, it could also be deduced that the effect detected across both groups in experiment 7 only occurs when the threat words are compared with control words that have a more positive valence rating. This is interesting as it may suggest that the presence of more positive stimuli increases the threat value of negative stimuli.

A further consideration is that the task itself is not able to detect any AB for threat that occurs in psoriasis populations. As it was able to detect facilitated disengagement in healthy participants experiencing experimental itch in experiment 1, this may suggest that if any AB does exist in psoriasis populations, the effect is of a small size. Experiments 3-8 have manipulated SOA, stimuli format, and quality of stimuli, with still no AB detected. A remaining difference between studies that have found AB in people with psoriasis and the current research is the task used. Therefore, the next experiment aims to investigate this by measuring AB with a different task that has been used in studies researching AB in people with psoriasis.

Experiment 9: Do people with psoriasis show an AB towards disease-related words using the Emotional Stroop Task?

Introduction

Experiments 3-8 have shown that people with psoriasis do not exhibit AB for threat stimuli, except when compared with positive stimuli at early stages of processing. This, however, does not differ from healthy controls, who also demonstrated the same pattern of early hypervigilance for threatening information relative to positive information. The question of why AB was detected in the study by Fortune et al. (2003) remains, and one of the few remaining differences between this study and the current research is the task used to measure AB. The emotional Stroop task has been very widely used in AB research (Bar-Haim et al., 2007), however, MacLeod et al. (1986) suggested that the response latencies for threat trials in the emotional Stroop may not be representative of AB but rather how much a threat stimulus produces a negative affective state which then impairs reaction times. However, the emotional Stroop task is still a common measure of AB, but less so now with other options available such as the dot-probe and emotional spatial cueing tasks. As an AB of disease-related threat words was detected in a psoriasis sample using the Emotional Stroop task (Fortune et al., 2003), Experiment 9 aimed to replicate this by employing the same task with a sample of psoriasis participants. This experiment employed a 2×2 factorial design, with cue type as the within-subjects factor, and group as the between-subjects factor. Participants were asked to respond to the colour each cue is presented in, and their reaction times were collected. It was predicted that reaction times would be longer for threat cues than neutral cues in the psoriasis group, and that there would be no difference in reaction times for the control group.

Method

Participants

The original sample of participants from Experiment 3 were invited to complete experiment 9, but again, due to drop out further participants had to be recruited in order to top up the sample. Of the original sample, 59% of the psoriasis group and 73% of the control group completed experiment 9. A further 44 psoriasis participants and 30 control participants were recruited which brought the total sample size to 206. The recruitment process was the same as Experiment 3 for the newly recruited participants (Figure 10 and Figure 11).

Stimuli

The stimuli used in experiment 9 were the word pairs from experiments 7 and 8 (see Table 19).

Emotional Stroop Task

The emotional Stroop task was created using Psychopy[3] (Peirce et al., 2019) and hosted on Pavlovia (https://pavlovia.org/) as was the emotional spatial cueing task. The emotional Stroop task used for experiment 9 presented threat and neutral words one at a time in a random order in one of four possible colours (red, green, blue, or orange, see Table 26 for RGB values), and required participants to press a keyboard button that corresponded to the colour of the word presented on screen (i.e., “r” for red, “g” for green, “b” for blue, and “o” for orange) as quickly and as accurately as possible. Participants were also asked to use their left hand for red and green responses, and their right hand for blue and orange responses. Words remained on screen until either a response was made, or if no response was made the word disappeared after 3000ms and “failed to respond” appeared for 500ms (see Figure 31). If an incorrect response was made, “incorrect” appeared on screen also for 500ms. For the cue words, on a 23.8inch

monitor the height of shortest letters such as “n” measured 17mm, and tallest letters such as “d” measured 20mm. The measurements change depending on the size of the monitor.

Like the emotional spatial cueing tasks in experiments 3-8, six blocks were used with 32 trials per block, and an initial training block for participants to become accustomed to the experiment. Four word pairs were used per block, with each word appearing four times per trial, once in each colour. Trials were presented randomly within each block so that the order was not the same for each participant, and the order that blocks were presented was also randomised.

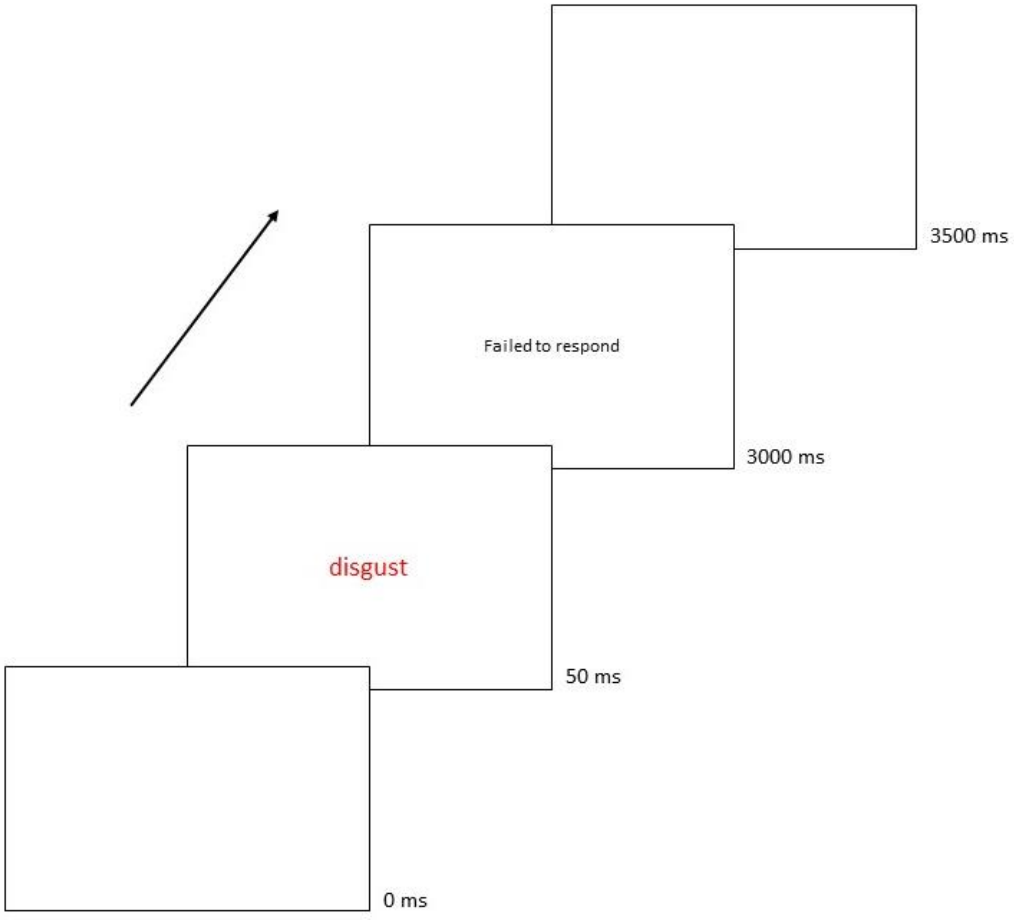


Figure 31: Emotional Stroop Task trial without a response.

Table 26: RGB Values of colours used for emotional Stroop task.

Colour	RGB Value
Blue	(0, 0, 1)
Green	(0, 0.5020, 0)
Orange	(1, 0.6471, 0)
Red	(1, 0, 0)

Results

In order to ensure groups did not differ significantly in depression, anxiety, or age, *t*-tests were applied. *P* values of >0.05 suggest that groups were not significantly different for these variables (see Table 27).

Table 27: Demographics, questionnaire scores, and p values from t-tests comparing the values between groups.

	Psoriasis	**Control**	***p* value**
Gender	44 Female 58 Male 1 Non-Binary	34 Female 68 Male 1 Non-Binary	N/A
Age	33.60 [18-62, SD = 10.19]	31.80 [18-61, SD = 11.07]	0.224
HADS Anxiety	8.40 [0-18 SD = 4.33]	7.99 [0-19, SD = 4.39]	0.503
HADS Depression	5.90 [0-17, SD = 3.75]	5.69 [0-21, SD = 3.80]	0.685
PASI	6.68 [0-22.4, SD = 5.29]	N/A	N/A
DQLI	7.19 [0-21, SD = 5.10]	N/A	N/A

Reaction time data underwent the same outlier exclusion process and statistical analysis as Experiment 3. The mean reaction times and standard deviations are displayed in Table 28 below.

Table 28: Mean reaction times in milliseconds and standard deviations for all trials (neutral and threat), and bias score for both groups.

	Threat	Neutral	Difference (Threat – Neutral RT)
Psoriasis	733.9 (128.07)	729.01 (126.35)	4.89 (26.89)
Control	667.89 (103.37)	669.45 (101.53)	-1.56 (18.48)

A 2×2 factorial ANOVA showed a significant main effect of group $F(1,204) = 15.37$, $p < 0.001$, which showed that participants in the psoriasis group had significantly longer reaction times across all conditions, which can be observed in Figure 32. A significant two-way interaction between cue type and group was found ($F(1,204) = 4.03$, $p = 0.046$, which shows that the difference in reaction times (threat RT – neutral RT) for the psoriasis group is significantly larger than for the control group (see Figure 33), with longer reaction times for threat trials ($M = 733.90$, $SD = 128.08$) than for neutral trials ($M = 729.01$, $SD = 126.35$).

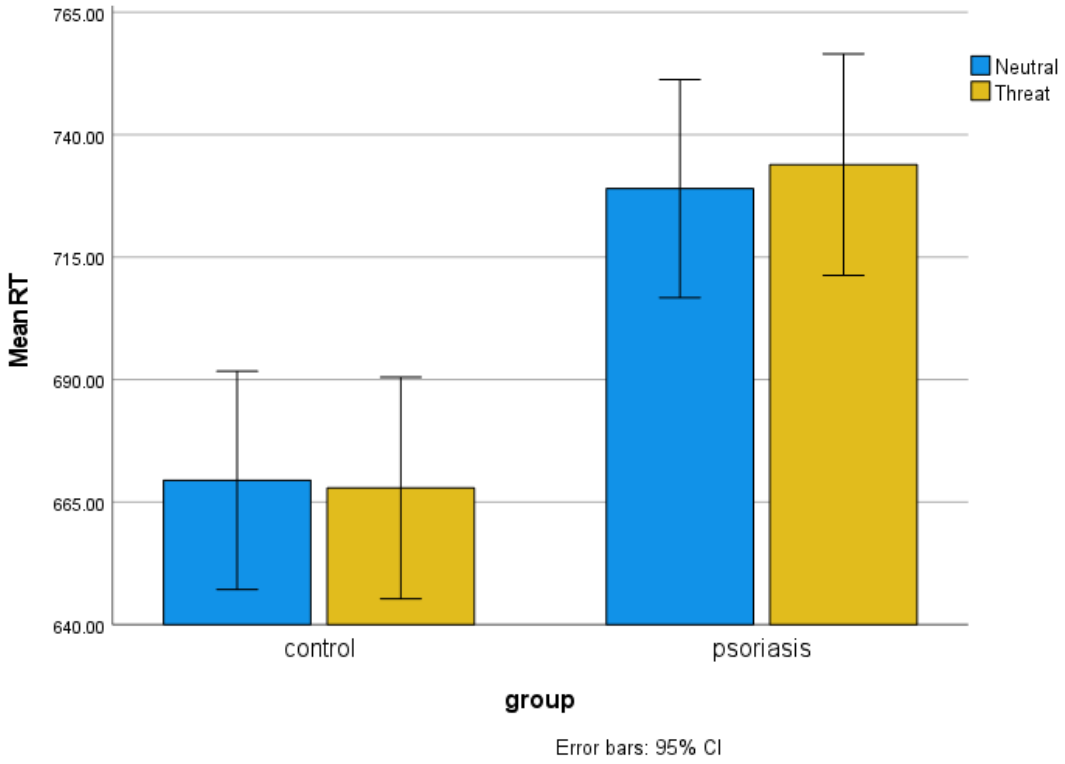


Figure 32: Bar graph showing reaction times across all conditions in both groups.

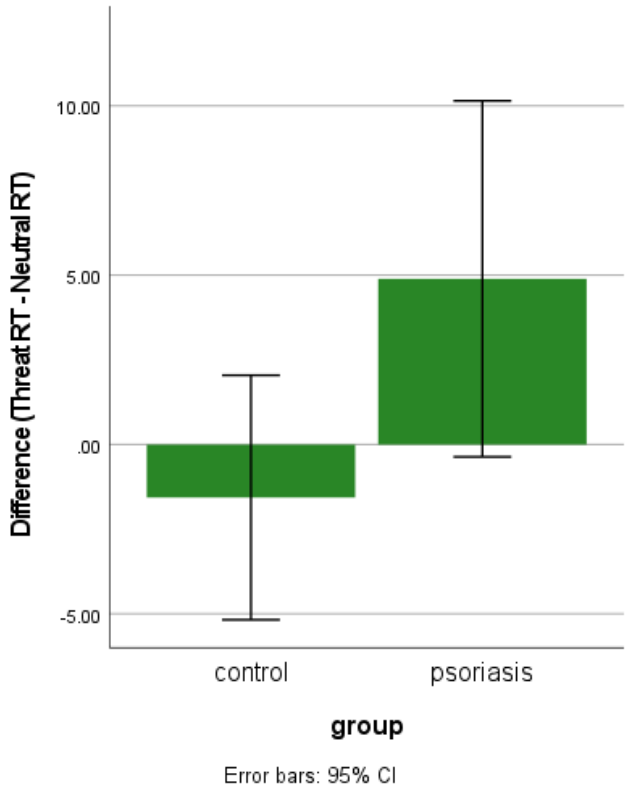


Figure 33: Bar graph showing differences in RTs (Threat RTs - Neutral RTs) for both groups.

In order to evaluate whether disease severity, dermatological quality of life, anxiety or depression level were good predictors of overall bias score, multiple linear regressions were applied, the results of which can be seen in Table 29. For the psoriasis group, a hierarchical multiple linear regression was calculated to predict the difference in RTs (Threat RTs – Neutral RTs) based on DLQI and PASI for model 1, and then DLQI, PASI, and HADS (HADS-A and HADS-D) for model 2. Non-significant regressions were found for model 1 ($F(2,100) = 0.443$, $p = 0.643$) with an R^2 of 0.01, and model 2 ($F(4,98) = 0.623$, $p = 0.647$) with an R^2 of 0.03. None of the variables included in the multiple regression (disease severity, dermatological quality of life, anxiety and depression levels) were significantly associated with bias score, as can be seen in the scatterplots in Figure 34.

Table 29: Linear model of predictors of difference in RTs with confidence intervals reported in parentheses.

	b	*SE B*	*β*	*p*
Step 1				
Constant	5.26 (-4.42, 14.93)	4.88		$p = 0.284$
DLQI	0.46 (-0.79, 1.71)	0.63	.09	$p = 0.469$
PASI	-0.55 (-1.75, 0.66)	0.61	-.11	$p = 0.370$
Step 2				
Constant	9.92 (-3.04, 22.87)	6.53		$p = 0.132$
DLQI	0.53 (-0.77, 1.83)	0.66	.10	$p = 0.418$
PASI	-0.44 (-1.67, 0.79)	0.62	-.09	$p = 0.482$
HADS-A	-1.00 (-2.65, 0.66)	0.83	-.16	$p = 0.234$
HADS-D	0.41 (-1.50, 2.32)	0.96	.06	$p = 0.669$

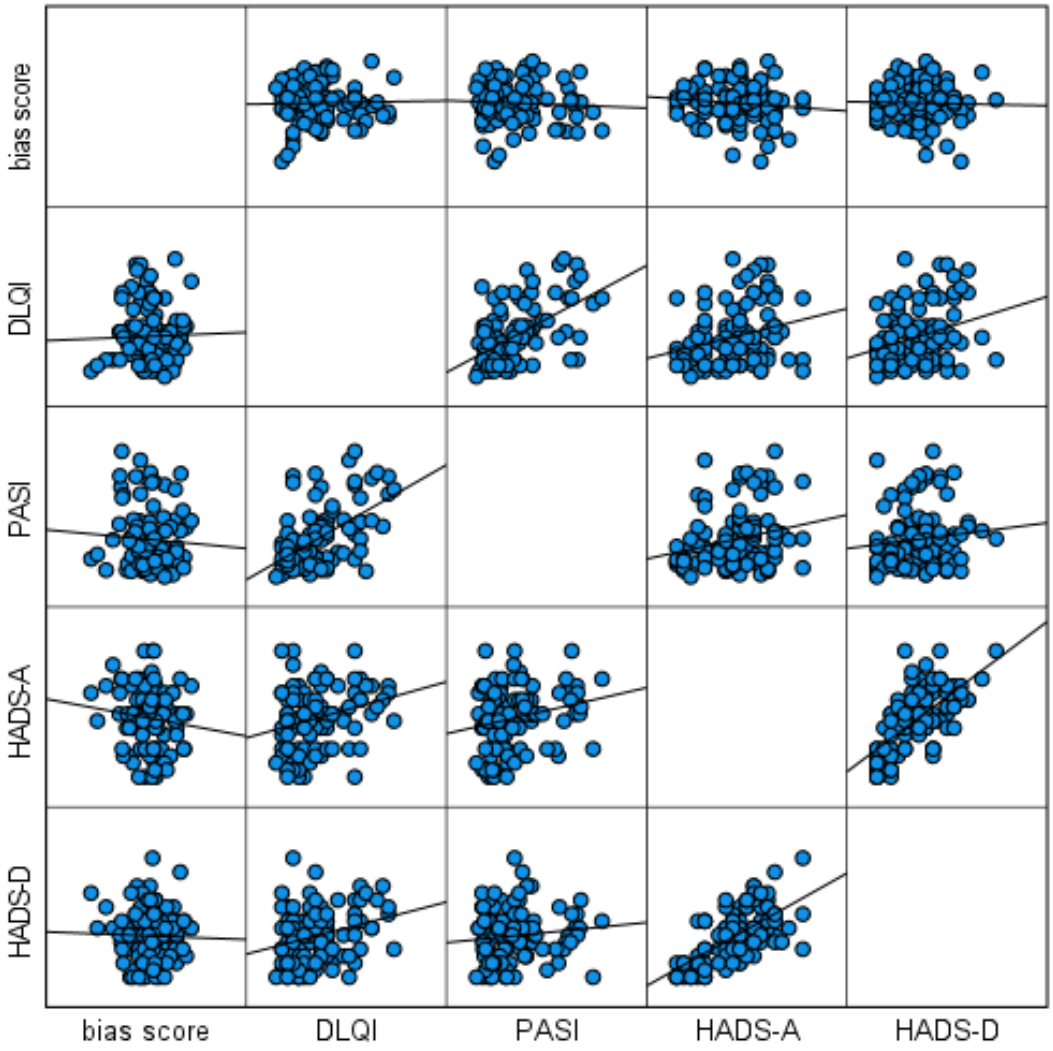


Figure 34: Matrix scatterplot of the relationships between DLQI, PASI, HADS, and bias score.

Discussion

Experiment 9 showed that psoriasis participants showed a general AB for disease-specific threat words relative to positive control words. This finding is comparable to that of Fortune et al.'s (2003) research, in that both studies found longer response latencies for disease-related threat words in the psoriasis group than in the control group, using the emotional Stroop task. This suggests that people with psoriasis do demonstrate a general AB for disease related threat words, even with a generally milder presentation of psoriasis. Another similarity to the findings of Fortune et al. (2003) is that experiment 9 found that disease severity was not correlated with

performance in the emotional Stroop task. This absence of a correlation between these two variables is interesting, as the main effect of group suggests that the reason AB occurs is due to the experience of psoriasis, however, as the disease severity and overall performance do not correlate, this suggests that some other factor associated with psoriasis could be contributing to the altered attentional processing of threat.

A factor associated with psoriasis that could be important to understanding why a difference in AB was found in those with psoriasis and not in the control group is the treatment of the condition. As discussed in the introduction, treatments for psoriasis can be associated with difficult side effects. One particular side effect that could be relevant to this study's findings is drowsiness, which is a side effect associated with non-biological (or small molecule) therapies. Drowsiness may slow down response time, which is something that can be seen in the psoriasis group reaction times across experiments 3-9. This slowing of response time may allow longer for the meaning and valence of the stimulus to be processed, which may account for why longer reaction times for threat words are seen in the psoriasis group, and not the control group. Unfortunately, information on the treatment of psoriasis for each participant in the psoriasis group was not collected, so it cannot be ascertained whether this is in fact the case. Future research could ensure to collect this information so that this can be explored.

Alternatively, the mere experience of psoriasis itself, rather than the severity of the disease, may account for the AB detected in experiment 9. Psoriasis is associated with heightened levels of anxiety, self-consciousness and social isolation, and patient descriptions of their appearance indicated disgust (Narayanan et al., 2014). It may be the presence of these difficulties and emotional states that prompt differences in attentional processing of psoriasis-specific threat, rather than the severity of the condition. This

could be investigated by collecting information from psoriasis participants regarding their experience of their condition, and examining whether the presence of any of the above difficulties is associated with differences in performance on the Emotional Stroop task. The AB detected in experiment 9 was not able to be detected using the Emotional Spatial Cueing Task except for in experiment 7 which used disease-related threat words compared with positive control words and a shorter SOA of 250ms. However, this AB was observed in both the psoriasis group and the control group, suggesting that the AB detected using the spatial cueing task was a more universal early hypervigilance for psoriasis-related threat words when compared with positive control words. As the word pairs used in experiment 9 were the same for experiment 7, the finding of AB in the psoriasis group but not in the control group in experiment 9 could suggest that the emotional Stroop is measuring something that only the psoriasis group is experiencing such as a negative emotional arousal induced by the presence of disease-related threat words. It may be the case that this negative emotional arousal also occurred in experiments 3-8, which is represented by the longer reaction times displayed by the psoriasis group for all conditions, which then became a main effect for experiments 4-8. However, an alternative explanation for these main effects of group could be that psoriasis is associated with impaired reaction times, and that the presence of threat stimuli does not affect this pre-existing symptom. A further consideration is that the Emotional Spatial Cueing task and the Emotional Stroop task differ in a number of ways. While both are reaction time tasks, what participants are required to do for each of the tasks differs greatly. For the Emotional Spatial Cueing task, participants are simply required to respond to the location, of which there are only two possible options of a neutral target using a keyboard button press. In comparison, for the Emotional Stroop task, participants are required the identify the colour a word is presented in, of which there were four possible options, which demands a different cognitive process of

colour recognition, rather than spatial location identification, and may measure interference with the cognitive process of colour recognition rather than an AB. Additionally, the average reaction times from Experiment 9 compared with the reaction times collected from all experiments using the Emotional Spatial Cueing task are much longer, indicating that the process of colour recognition is a more complex and lengthier process than spatial location recognition. The difference in the type of cognitive processing required for each task may account for the finding of an effect in experiment 9, and the absence of effects found using the Emotional Spatial Cueing task. Another key difference between the tasks is that the Emotional Stroop task cannot utilise different SOAs, as stimuli remain available to participants until a response is made. The Emotional Spatial Cueing task is able to change the SOA it employs depending on the time course of AB it is aiming to investigate. The availability of stimuli until participants respond may enable the task to capture attentional differences than the Emotional Spatial Cueing is able to. Additionally, participants are responding directly to an emotional stimulus with the Emotional Stroop, whereas the target that participants are required to respond to for the Emotional Spatial Cueing task is neutral. This may more effectively capture attentional differences prompted by the exposure to a negative emotional stimulus than a task that requires a response to a non-emotive stimulus.

General Discussion

The experiments presented in this thesis investigated attentional bias to threat and how it presents itself in healthy populations experiencing experimentally induced itch, and people with plaque psoriasis. The aims of the thesis were to identify if attentional bias for threat occurs in healthy people experiencing novel itch and people with psoriasis, and if so which type of AB this is and which component of attention it affects. Research on AB in these areas is still limited, and mostly using tasks that offer incomplete information. The experiments in this thesis contribute to filling the remaining knowledge gap with regards to AB in itch and psoriasis.

Thesis Overview

Experiments 1 and 2

Experiments 1 and 2 investigated the effects of histamine-induced acute itch on early AB to threat in healthy participants. Both experiments used a histamine prick test to induce acute itch, the emotional spatial cueing task to measure AB, an SOA of 250ms, and a sample of 60 healthy psychology undergraduates split randomly into either the experimental or control group. The control group received a placebo of sterile water instead of histamine. Experiment 1 used words describing the experience of histamine-induced itch as threat cues, and unrelated, non-threatening words matched for length and lexical frequency as neutral cues. Experiment 2 used itch-related images matched with neutral images as cues. Experiment 1 provided evidence that acute itch induced AB in the form of facilitated disengagement, or avoidance in the later disengagement stage of attention. Experiment 2 did not find any significant differences in the attentional processes between those experiencing acute itch and those that were not. However, a general pattern of hypervigilance was present in the histamine group

for itch-related images, but this did not reach significance. This small effect could potentially be detected with a larger sample size.

Experiments 3 and 4

Experiment 3 began the investigation into AB in people with psoriasis. 100 participants with a self-reported diagnosis of plaque psoriasis were recruited and matched with 100 healthy control participants via an online recruitment platform. Both the psoriasis group and control group completed the HADS in order to obtain anxiety and depression levels, and the psoriasis group completed additional questionnaires that gave information on dermatological quality of life and psoriasis severity. Both groups then completed the emotional spatial cueing task for experiment 3, which used psoriasis-specific threat words and control words matched for valence, arousal, word length and lexical frequency as stimuli, and a 250ms SOA. Experiment 4 was identical in procedure except for SOA which was extended to 1050ms in order to investigate AB in the later stages of processing. Experiment 3 did not find evidence to suggest that people with psoriasis demonstrate AB for disease-related threat words in the earlier stages of processing. It also found that excluding psoriasis participants with low disease severity (PASI < 5) did not alter the pattern of results in a second ANOVA, and that using disease severity as a between groups variable for an ANOVA applied to data from psoriasis participants alone did not show significant differences in AB. Experiment 4 was unable to detect any AB in the psoriasis group, however, it did show that psoriasis severity was a significant predictor of overall bias score, with a negative relationship suggesting that higher psoriasis severity predicts late avoidance of disease-related threat words. Psoriasis severity was not a significant predictor of bias score for experiment 3, nor was dermatological quality of life, depression, or anxiety levels.

Experiments 5 and 6

Experiments 5 and 6 examined AB for threat in the form of images depicting facial expressions of disgust, versus neutral facial expressions. Images were obtained from the FACES database (Ebner et al., 2010), and disgust expressions used as threat stimuli, and neutral expressions as neutral stimuli. As with the previous 2 experiments, SOA was manipulated for experiments 5 and 6 with 250ms and 1050ms respectively. No evidence for early or late AB was detected for facial expressions of disgust. Multiple linear regressions showed that psoriasis severity, dermatological quality of life, depression and anxiety levels were not significant predictors of bias score for either experiment 5 or 6.

Experiments 7 and 8

Experiments 7 and 8 employed the same threat words used in experiments 3 and 4, however used new, more positively valenced control words instead of the previous control words that were matched for valence ratings. SOA was again manipulated, with the shorter SOA of 250ms used to explore earlier stages of processing in experiment 7, and a longer SOA of 1050ms to explore later stages of processing in experiment 8. Experiment 7 showed that both groups demonstrated an AB for disease-related threat words over positive control words in the earlier stages of processing. As this effect was present across both groups, this suggests that the hypervigilance pattern observed is more of a universal AB rather than one specific to people with psoriasis. This effect was not present in experiment 8, suggesting that the hypervigilance observed in both groups in experiment 7 only occurs during the earlier stages of processing. This could suggest that the disease-related threat words were not specific enough to psoriasis to only be threat related to the psoriasis group, or that comparison of any negative words with positive words produces an early hypervigilance for the threat words regardless of

health status. Psoriasis severity, dermatological quality of life, depression and anxiety levels were again not significant predictors of bias score for either experiment 7 or 8.

Experiment 9

Experiment 9 used the emotional Stroop task to measure AB for disease-related threat using the same word pairs as experiments 7 and 8. Reaction times were significantly larger overall for the psoriasis group than the control group, and reaction times for threat trials were significantly larger than for neutral trials for the psoriasis group only, indicating a general AB for threat in people with psoriasis. The emotional Stroop is unable to distinguish between hypervigilance and avoidance but is able to offer information on the presence of a general AB for threat.

Implications

Acute Itch

One previous study has investigated the effects of acute itch on attentional bias (van Laarhoven et al., 2018) which found that participants that had been exposed to acute itch immediately prior to AB measurement demonstrated a general attentional bias for itch related words and hypervigilance for itch related images. Unfortunately, as no control group was utilised for comparison, these findings cannot be attributed to the experience of acute itch. However, the finding of late avoidance (facilitated disengagement) for itch-related threat words in experiment 1 can be attributed to the experience of acute itch as this effect was not found in the control group that was included. This is important as it shows that the experience of acute itch changes attentional processing of itch-related information. The use of a placebo also strengthens this conclusion as participants in the placebo group were advised that they would be receiving histamine, and were therefore expecting acute itch to occur, rendering the solution used for the prick test (histamine or sterile water) as the only difference

between groups. This absence of an effect in the placebo group is in line with previous research that found that healthy participants did not demonstrate attentional bias for itch and pain related information over neutral information (Becker et al., 2020).

This finding of facilitated disengagement, or faster attending away from itch-related threat stimuli implies that the later disengagement component of attention was affected by the experience of acute itch, whereas the lack of significant differences between valid trials suggest that the engagement component of attention was unaffected. This could mean one of two things; the experience of acute itch does not affect the engagement component of attention, or an SOA of 250ms was too long to capture any attentional biases that may occur in this earlier engagement component.

Interestingly, when observing Figure 4 it can be seen that the neutral validity effect for the histamine group is larger than all other validity effects for both groups. This could be interpreted as acute itch inducing avoidance of threat stimuli in the form of slower disengagement from non-threatening stimuli. This slower disengagement from neutral stimuli could be seen as participants seeking solace in non-threatening words by using them as distractions from the physical sensation of itch they were experiencing at the time. As participants were requested not to scratch the location of the histamine prick test, this avoidance of itch words and hypervigilance for neutral words may have been a cognitive way of coping with the unpleasant sensation of acute itch, by allocating attention away from itch-related information and towards distracting information. This is a particularly interesting possibility as distraction in the form of virtual reality has been shown to reduce itch intensity in people with pruritus from either dermatitis or psoriasis (Leibovici et al., 2009).

Some of the words used as itch-related threat cues could be interpreted as lexically ambiguous. For example, “skin”, “sharp”, “redness”, and “pinching” are

arguably only relevant as itch-related words in the context of experiencing histamine-induced itch. This may mean that those experiencing acute itch in experiment 1 assigned itch-related meaning to these words, and then avoided them. This could suggest that the attentional bias observed in experiment 1 was a result of top-down processing, using individual goals and experiences to inform attentional allocation.

The finding of no evidence to suggest AB for itch-related images in experiment 2 could be due to a number of reasons. It may be that acute itch does not induce an AB for itch related images. If this is the case, this could be due to the images depicting itch occurring in other people, rather than words, such as in experiment 1, that are simply descriptive and therefore attributable to participants' own experience of acute itch. However, it could also be that hypervigilance for itch-related images does occur as was demonstrated by van Laarhoven et al. (2018), however the sample used in experiment 2 may not have been large enough for this to be detected. It may also be due to the intensity of acute itch waning over time, which is likely to have occurred due to a delay of approximately 10 minutes between histamine administration and AB measurement. The reduced sensation may have resulted in only a small effect being measured. A stronger effect may have been observed if the spatial cueing task had been completed immediately after the histamine prick test was administered. However, this does not explain the finding of hypervigilance found by van Laarhoven et al. (2018), as participants were unlikely to be itching at the time of AB measurement as the electrical itch stimulus had been removed prior to AB tasks being completed. It also does not explain why an effect was found in experiment 1, in which the experimental procedure was almost identical. The only known differences between experiment 1 and 2 were the stimuli used as cues in the spatial cueing task, and the inclusion of an extra block and full practice block. As words are simpler to match and were matched in experiment 1 for word length and lexical frequency, it is likely that the images used in experiment 2

were not of sufficient quality for use in experimental research. Images were obtained using a basic internet search and matched only for object shown, i.e., feet, back, plant. Stimuli also differed in the type of itch-related information represented. The words used in experiment 1 were representative of the experience of histamine-induced itch, whereas the images used in experiment 2 depicted everyday experiences of itch such as ants and nettles. This could suggest that the AB detected in experiment 1 is specific to the experience of histamine-induced itch and may not occur for other types of itch, such as that induced from an insect bite or nettle sting.

However, the inclusion of an extra block and full practice block may have also affected the outcome of experiment 2, as this may have allowed more time for the experience of acute itch to decay. This could also explain why hypervigilance does appear to be present in the histamine group but did not reach significance.

Psoriasis

Only two studies have examined AB in people with psoriasis. The earliest by Fortune et al. (2003) in which an AB for disease-related threat words was detected using the emotional Stroop task, and a more recent study by van Beugen et al. (2016) in which no evidence for AB in psoriasis participants was found. These findings leave the question of whether people with psoriasis demonstrate AB for disease-related threat largely unanswered, and this thesis aimed to provide further information on this by measuring AB in this population, using a task that doesn't only detect AB, but can also offer further information on direction, time course, and components of AB.

Across all experiments measuring AB in psoriasis participants, those in the psoriasis group demonstrated longer reaction times across all conditions, and this difference became a significant main effect in experiments 4-9. Additionally, in all experiments with a main effect of group, the psoriasis group's mean PASI score was

>6.56, whereas for experiment 3 in which there was no main effect of group found, the mean PASI score was 5.68. This is interesting as it raises the question of whether more severe psoriasis affects reaction time speed. One study examined cognitive functioning in people with psoriasis, and found that they experience significant impairment in attention and concentration (Padma et al., 2020). This could explain the main effect of group found in experiments 4-9, in that reaction times across all conditions were longer and reflective of an attentional impairment. This impairment might simply be a symptom of psoriasis itself, or it could also be a side effect of treatment for psoriasis. Non-biological systemic treatments have various side effects including drowsiness, a symptom which is likely to affect reaction times. Unfortunately, information on medication was not collected from psoriasis participants so this cannot be confirmed.

Experiments 3-8 provide evidence that people with psoriasis do not demonstrate any attentional bias for threat compared with healthy populations, however, experiment 9, in which the emotional Stroop task was employed as an AB measure, provides evidence that they do. This prompts the question of why the emotional Stroop task was able to detect an AB but the emotional spatial cueing task was not? There are two possible explanations for this: The first is that the emotional Stroop task is a more sensitive measure of AB, and able to detect smaller effects. If this is the case, its ability to detect an AB unable to be detected with the emotional spatial cueing task should indicate that the effect found in experiment 9 was small. This was in fact the case, as shown with a partial eta squared. This, in turn, could suggest that the emotional spatial cueing task is only able to detect larger effects, which may exist but with the correct stimuli. The second explanation is that, as others have speculated (Bar-Haim et al., 2007), longer reaction times for threat stimuli as measured with the emotional Stroop task may not be representative of AB but of some other process that occurs as a result of exposure to threatening information, such as a negative emotional arousal or brief tonic

immobility (freeze response). This would explain why a similar effect was found by Fortune et al. (2003), as the presence of threat words used as stimuli for the emotional Stroop in their study would have produced the same result of longer reaction times.

The main implications of the current research for people with psoriasis is that attentional processing does appear to differ between those with psoriasis and healthy control participants. The lack of a correlation between performance on the attentional bias task that detected a significant effect and psoriasis severity suggests that some other factor contributes to this difference in attentional processing detected in experiment 9, such as treatment of psoriasis or the individual experience of psoriasis. This is important as it highlights the need for further research in this area, as this could lead to interventions that aim to improve the psychosocial burden of psoriasis with an attentional bias approach.

Furthermore, psoriasis severity was shown to be associated with overall performance in the Emotional Spatial Cueing task in experiment 4, which used the original word set and a longer SOA of 1050 ms. While no significant difference between the attentional processing of psoriasis participants and healthy control participants was detected in experiment 4, the correlation found between disease severity and attentional bias score suggests that the two variables are connected, and that the severity of psoriasis affects attentional processing. As the severity of psoriasis varied widely among participants in the psoriasis group, this could account for the lack of a significant difference in AB found between the psoriasis and control group. The correlation between psoriasis severity and bias score could indicate that AB is altered in people with psoriasis, and that psoriasis severity directly affects the magnitude and the direction of that AB. These findings further highlight the importance of research in this field, and the need for further exploration into this area. Further investigation could lead

to a better understanding of psoriasis in terms of its severity, impact, and chronicity, and therefore open doors to alternative treatments and methods of managing this difficult condition. As discussed in the introduction, ABMT is being shown to be a promising intervention for reducing anxiety in anxious populations, and the association found between bias score and disease severity in experiment 4 suggests that there is the potential for ABMT to be a useful option for reducing the impact of psoriasis.

Itch & Psoriasis

A question that arises from the findings of this thesis is why AB was detected in healthy participants experiencing acute itch, but not in people with an itchy skin condition. There are several possibilities when considering the reason for this, one of which is that it may be the novelty of the acute itch experienced by the healthy participants in experiment 1 that provokes an altered AB, which was not seen in the control group. The novel experience of acute itch in people with no skin conditions is likely to be a vastly different experience to the chronic itch experienced by those with psoriasis. People with psoriasis, and indeed other chronic itchy skin conditions such as eczema, are likely to have habituated to the sensation of pruritus. Habituation is known to happen with the experience of pain (De Paepe et al., 2019; Rennefeld et al., 2010), and it could therefore be argued that AB was found to be present among healthy people experiencing novel itch but absent in people with psoriasis using the emotional spatial cueing task because people with psoriasis were not experiencing a novel somatosensory symptom at the time of AB measurement. The idea of AB in experiment 1 being the result of an unusual sensory experience could be tested by administering repeated histamine prick tests daily, and then measuring AB at the first and final administrations.

However, another reason AB was not detected using the spatial cueing task in people with psoriasis may be because the stimuli were disease-specific, rather than itch-specific. Three of the itch-related threat words (or versions of) from experiment 1 were used as threat cues in the psoriasis experiments, however the remainder of words described the experience of psoriasis specifically. It may be that people with psoriasis do demonstrate an AB for itch-related information, but as we used stimuli that represented both the social experience, treatment, and physical appearance of psoriasis, this was not identified.

Limitations & Future Research

Acute Itch

During the data collection for experiments 1 & 2, data was also collected for a separate study examining the effect of auditory itch stimuli on the perceived intensity of histamine-induced itch. This resulted in a delay of approximately 10 minutes between the histamine administration and the measurement of attentional bias, during which a separate rating task was completed. This means that by the time the spatial cueing task was completed, itch intensity had diminished. However, the rating data not reported here provided evidence that itch was still present at the initiation of attentional bias measurement, albeit not as strong as immediately after the histamine prick test. Future research could ensure that measurement of AB occurs much sooner after the acute itch stimulation is administered, so that the effect of acute itch at its peak on AB can be observed.

Another limitation of the acute itch experiments is that only one SOA of 250ms was used in the measurement of AB. Early hypervigilance patterns of AB might have been missed with this SOA, and the manipulation of this variable may have allowed further AB observations to be made in the context of acute itch. Very short SOAs could

be implemented in future research so that very early stages of processing can be examined for attentionally biased processing.

A previously mentioned weakness of experiment 2 is the images used as cues. The images were obtained using a simple internet search and were only matched for basic content depicted. If this experiment was to be repeated, the selection of images and subsequent matching procedure would be more rigorous, and follow the example of previous research that employed such systematic methods when selecting their pictorial stimuli, such as van Laarhoven et al. (2018), who obtained their neutral images from International Affective Picture System (IAPS) database and matched for complexity and colour with their itch-related images, which were validated in a pilot study.

Psoriasis

Experiments 3-9 make up the bulk of this thesis and were all conducted during the Covid-19 pandemic. This meant that all research on psoriasis and AB had to be completed online. This method of research, as expected, comes with advantages and disadvantages. An advantage that is likely to appeal to most researchers is the volume of data that can be obtained in a short period of time. Instead of having to collect data in person, one participant at a time, hundreds of participants can complete a study in the space of a few hours. This is a very attractive notion but is not without its drawbacks. Experiments completed online may not be completed exactly as intended by the researcher, for example, in a quiet, distraction-free room with the full attention of the participant. This is something that can, for the most part, be controlled with face to face data collection.

The research on psoriasis and AB was originally intended to be completed in person via a local NHS dermatology clinic, and an inclusion criterion was a dermatologist-confirmed diagnosis of psoriasis. When the research moved online this

was not a condition that could reasonably be continued, and so a self-reported diagnosis of psoriasis was used instead. This requires a level of trust that participants are being completely honest in their responses, which can be difficult in light of the fact that participants are financially compensated for their time. Another inclusion criterion of the originally planned NHS research was a PASI score of ≥5. Approximately only half of psoriasis participants in the online experiments met this previous cut-off, which means that the disease severity of the sample was only mild.

Another drawback to the research on AB in psoriasis is the collection of survey data regarding disease severity, dermatological quality of life, and levels of anxiety and depression. This information was only collected once, upon initial recruitment of each participant. This means that the survey data from a participant that completed all 7 studies was collected around June 2020, whereas the reaction time data for experiment 9 (using the Stroop task) was collected for the majority of participants in June 2021, leaving a year between data collection time points. This allows a for a great deal of time to pass, during which any number of changes could have occurred for a participants' levels of anxiety and depression across both the psoriasis and control groups, especially as the initial effects caused by the global pandemic may have lessened over this time. Additionally, for psoriasis participants, psoriasis severity may have changed dramatically. As non-urgent health services were halted at the beginning of the pandemic, this resulted in huge backlogs of patients requiring treatment for a variety of different conditions. Psoriasis severity may have significantly worsened during this time, however, as information regarding disease severity was only collected upon initial recruitment into the research, this cannot be confirmed. The repeated collection of this information at each stage of the study (each time a new experiment was completed) would allow for more up to date information, but also further exploration into how AB may change alongside disease severity, and also anxiety and depression levels.

One final limitation of the psoriasis studies is the absence of a measure of social anxiety. This thesis examined AB for disease-related threat in people with psoriasis, which includes social threat associated with the experience of psoriasis. The inclusion of a measure of social anxiety such as the Social Phobia Inventory (Connor et al., 2000) would have been a particularly interesting addition to the multiple linear regressions applied to each experiment, as it would have allowed further exploration into the link between the experience of psoriasis and its associated psychosocial burden, and how this contributes to AB in this population.

Future research could focus on measuring AB for threat in people with psoriasis by recruiting participants with more severe levels of the disease, and with a dermatologist-confirmed diagnosis. Data collection could also be completed in a laboratory setting so that extraneous variables can be better controlled for, and could include collection of information on social anxiety levels so that this aspect of the experience of psoriasis can be investigated.

An important continuation of this thesis would be to expand upon the findings of experiment 9, which found a general AB for disease-related threat words over positive control words in psoriasis participants using the emotional Stroop task. This experiment could be repeated using the word set from experiments 3 and 4, so that conclusions can be made as to whether AB was found in experiment 9 due to the threatening nature of the disease-related words, or due to the comparison with positive control words. Using the original word set from experiments 3 and 4 would enable this distinction to be made, in that if a similar effect is found for the original word set this would suggest that the AB found in experiment 9 was due to the relatedness to psoriasis of the threat words, rather than their negative valence over the positive control words. A similar manipulation could also be done for experiments 5 and 6, by swapping the neutral faces

for positive faces, as neutral faces are likely to have been interpreted as threatening by people with psoriasis and were therefore unlikely to have been sufficiently different enough in threat value from the disgust faces to produce an effect.

Conclusions

This thesis aimed to investigate attentional bias for threat in both acute itch and in psoriasis. Specifically, it aimed to explore whether these groups demonstrated an attentional bias for threat, and if so, whether this bias was hypervigilance or avoidance, whether it occurred in the early or late stages of processing, and which component of attention was affected. It can be concluded that when experiencing acute itch, healthy people demonstrate late avoidance of itch-related threat words, in the form of facilitated disengagement. It can also be concluded that people with psoriasis may demonstrate an AB for disease-related threat, but that this is only able to be detected with the emotional Stroop task. This may suggest either that the emotional Stroop is a highly sensitive measure of AB, or that it does not measure AB but rather an alternative process that causes delayed reaction times, such as negative emotional arousal.

References

Abuabara, K., Azfar, R. s, Shin, D. b, Neimann, A. l, Troxel, A. b, & Gelfand, J. m. (2010). Cause-specific mortality in patients with severe psoriasis: A population-based cohort study in the U.K. *British Journal of Dermatology*, *163*(3), 586–592. https://doi.org/10.1111/j.1365-2133.2010.09941.x

Agustí, A. I., Satorres, E., Pitarque, A., & Meléndez, J. C. (2017). An emotional Stroop task with faces and words. A comparison of young and older adults. *Consciousness and Cognition*, *53*, 99–104. https://doi.org/10.1016/j.concog.2017.06.010

Albery, I. P., Spada, M. M., & Nikčević, A. V. (2021). The COVID-19 anxiety syndrome and selective attentional bias towards COVID-19-related stimuli in UK residents during the 2020–2021 pandemic. *Clinical Psychology & Psychotherapy*, 10.1002/cpp.2639. https://doi.org/10.1002/cpp.2639

Aue, T., & Okon-Singer, H. (2015). Expectancy biases in fear and anxiety and their link to biases in attention. *Clinical Psychology Review*, *42*, 83–95. https://doi.org/10.1016/j.cpr.2015.08.005

Augustin, M., Krüger, K., Radtke, M., Schwippl, I., & Reich, K. (2008). Disease severity, quality of life and health care in plaque-type psoriasis: A multicenter cross-sectional study in Germany. *Dermatology*, *216*(4), 366–372.

Bannerman, R. L., Milders, M., & Sahraie, A. (2010). Attentional bias to brief threat-related faces revealed by saccadic eye movements. *Emotion*, *10*(5), 733–738. https://doi.org/10.1037/a0019354

Bar-Haim, Y., Lamy, D., Pergamin-Hight, L., bakermans-kranenburg, M., & van IJzendoorn, M. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. [Meta-Analysis Research

Support, Non-U.S. Gov't]. *Psychological Bulletin*, *133*, 1–24. https://doi.org/10.1037/0033-2909.133.1.1

Bar-Haim, Y., Morag, I., & Glickman, S. (2011). Training anxious children to disengage attention from threat: A randomized controlled trial. *Journal of Child Psychology and Psychiatry*, *52*(8), 861–869. https://doi.org/10.1111/j.1469-7610.2011.02368.x

Beall, P. M., & Herbert, A. M. (2008). The face wins: Stronger automatic processing of affect in facial expressions than words in a modified Stroop task. *Cognition & Emotion*, *22*(8), 1613–1642. https://doi.org/10.1080/02699930801940370

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behaviour Research and Therapy*, *35*(1), 49–58. https://doi.org/10.1016/S0005-7967(96)00069-1

Beck, A. T., Guth, D., Steer, R. A., & Ball, R. (1997). Screening for major depression disorders in medical inpatients with the Beck Depression Inventory for Primary Care. *Behaviour Research and Therapy*, *35*(8), 785–791. https://doi.org/10.1016/S0005-7967(97)00025-9

Becker, J., Vreijling, S., Dobbinga, S., Giesbers, J., Evers, A., Veldhuijzen, D., & Laarhoven, A. (2020). Attentional Bias Towards Visual Itch and Pain Stimuli in Itch- and Pain-free Individuals? *Acta Dermato Venereologica*, *100*(14), adv00199. https://doi.org/10.2340/00015555-3537

Berth-Jones, J., Grotzinger, K., Rainville, C., Pham, B., Huang, J., Daly, S., Herdman, M., Firth, P., & Hotchkiss, K. (2006). A study examining inter- and intrarater reliability of three scales for measuring severity of psoriasis: Psoriasis Area and Severity Index, Physician's Global Assessment and Lattice System Physician's Global Assessment. *British Journal of Dermatology*, *155*(4), 707–713. https://doi.org/10.1111/j.1365-2133.2006.07389.x

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale An updated literature review. *Journal of Psychosomatic Research*, 9.

Blicher, A., & Reinholdt-Dunne, M. L. (2019). Components of Attentional Bias to Threat in Clinically Anxious Children: An Experimental Study Using the Emotional Spatial Cueing Paradigm. *Cognitive Therapy & Research*, *43*(5), 884–892. https://doi.org/10.1007/s10608-019-10008-z

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*(1), 49–59. https://doi.org/10.1016/0005-7916(94)90063-9

Broadbent, D. E. (1958). *Perception and communication*. Pergamon. https://go.exlibris.link/LC1KmjHg

Broadbent, P., Liossi, C., & Schoth, D. E. (2021). Attentional bias to somatosensory stimuli in chronic pain patients: A systematic review and meta-analysis. *Pain*, *162*(2), 332–352. https://doi.org/10.1097/j.pain.0000000000002040

Brown, K. K., Rehmus, W. E., & Kimball, A. B. (2006). Determining the relative importance of patient motivations for nonadherence to topical corticosteroid therapy in psoriasis. *Journal of the American Academy of Dermatology*, *55*(4), 607–613. https://doi.org/10.1016/j.jaad.2005.12.021

Cherry, E. C. (1953). Some Experiments on the Recognition of Speech, with One and with Two Ears. *The Journal of the Acoustical Society of America*, *25*(5), 975–979. https://doi.org/10.1121/1.1907229

Christophers, E. (2001). Psoriasis − epidemiology and clinical spectrum. *Clinical and Experimental Dermatology*, *26*(4), 314–320. https://doi.org/10.1046/j.1365-2230.2001.00832.x

Cisler, J. M., & Koster, E. H. W. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical Psychology Review*, *30*(2), 203–216. https://doi.org/10.1016/j.cpr.2009.11.003

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159. https://doi.org/10.1037//0033-2909.112.1.155

Connor, K. M., Davidson, J. R. T., Churchill, L. E., Sherwood, A., Weisler, R. H., & Foa, E. (2000). Psychometric properties of the Social Phobia Inventory (SPIN): New self-rating scale. *British Journal of Psychiatry*, *176*(4), 379–386. https://doi.org/10.1192/bjp.176.4.379

Corbetta, M., & Shulman, G. (2002). Control of Goal-Directed and Stimulus-Driven Attention in the Brain. *Nature Reviews. Neuroscience*, *3*, 201–215. https://doi.org/10.1038/nrn755

Crombez, G., Van Ryckeghem, D. M. L., Eccleston, C., & Van Damme, S. (2013). Attentional bias to pain-related information: A meta-analysis. *Pain*, *154*(4), 497–510. https://doi.org/10.1016/j.pain.2012.11.013

De Houwer, J., & Hermans, D. (1994). Differences in the affective processing of words and pictures. *Cognition & Emotion*, *8*(1), 1–20.

De Paepe, A. L., Williams, A. C. de C., & Crombez, G. (2019). Habituation to pain: A motivational-ethological perspective. *Pain*, *160*(8), 1693–1697. https://doi.org/10.1097/j.pain.0000000000001533

Deutsch, J. A., & Deutsch, D. (1963). Attention: Some theoretical considerations. *Psychological Review*, *70*(1), 80–90. https://doi.org/10.1037/h0039515

Ebner, N. C., Riediger, M., & Lindenberger, U. (2010). FACES—A database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior Research Methods*, *42*(1), 351–362. https://doi.org/10.3758/BRM.42.1.351

Enock, P. M., Hofmann, S. G., & McNally, R. J. (2014). Attention Bias Modification Training Via Smartphone to Reduce Social Anxiety: A Randomized, Controlled Multi-Session Experiment. *Cognitive Therapy and Research*, *38*(2), 200–216. https://doi.org/10.1007/s10608-014-9606-z

Eriksen, C. W., & Yeh, Y.-Y. (1985). Allocation of attention in the visual field. *Journal of Experimental Psychology: Human Perception and Performance*, *11*(5), 583–597. https://doi.org/10.1037/0096-1523.11.5.583

Evans, T. C., Walukevich, K. A., Seager, I., & Britton, J. C. (2018). A psychometric comparison of anxiety-relevant attention measures. *Anxiety, Stress & Coping*, *31*(5), 539–554.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Finlay, A. y., & Khan, G. k. (1994). Dermatology Life Quality Index (DLQI)—A simple practical measure for routine clinical use. *Clinical and Experimental Dermatology*, *19*(3), 210–216. https://doi.org/10.1111/j.1365-2230.1994.tb01167.x

Fortune, D. G., Main, C. J., O'Sullivan, T. M., & Griffiths, C. E. M. (1997). Assessing illness-related stress in psoriasis: The psychometric properties of the Psoriasis Life Stress Inventory. *Journal of Psychosomatic Research*, *42*(5), 467–475. https://doi.org/10.1016/S0022-3999(97)00036-6

Fortune, D. G., Richards, H. L., Corrin, A., Taylor, R. J., Griffiths, C. E. M., & Main, C. J. (2003). Attentional Bias for Psoriasis-Specific and Psychosocial Threat in Patients with Psoriasis. *Journal of Behavioral Medicine*, *26*(3), 211–224. https://doi.org/10.1023/A:1023408503807

Fox, E., Russo, R., Bowles, R., & Dutton, K. (2001). Do Threatening Stimuli Draw or Hold Visual Attention in Subclinical Anxiety? *Journal of Experimental Psychology. General*, *130*(4), 681–700.

Fredriksson, T., & Pettersson, U. (1978). Severe psoriasis–oral therapy with a new retinoid. *Dermatology*, *157*(4), 238–244.

Hawro, T., Lehmann, S., Deuring, E., Weller, K., Altrichter, S., Church, M. k., Maurer, M., & Metz, M. (2019). Comparison of pruritus and sensory qualities induced by capsaicin, histamine and cowhage. *Journal of the European Academy of Dermatology and Venereology*, *33*(9), 1755–1761. https://doi.org/10.1111/jdv.15743

Hettiaratchy, S., & Papini, R. (2004). Initial management of a major burn: II—assessment and resuscitation. *BMJ*, *329*(7457), 101–103. https://doi.org/10.1136/bmj.329.7457.101

Holle, H., Warne, K., Seth, A. K., Critchley, H. D., & Ward, J. (2012). Neural basis of contagious itch and why some people are more prone to it. *Proceedings of the National Academy of Sciences*, *109*(48), 19816–19821. https://doi.org/10.1073/pnas.1216160109

Hongbo, Y., Thomas, C. L., Harrison, M. A., Sam Salek, M., & Finlay, A. Y. (2005). Translating the Science of Quality of Life into Practice: What Do Dermatology Life Quality Index Scores Mean? *Journal of Investigative Dermatology*, *125*(4), 659–664. https://doi.org/10.1111/j.0022-202X.2005.23621.x

James, W. (1890). *The principles of psychology*. Macmillan. https://go.exlibris.link/y71DHGvd

Jones, O., Schindler, I., & Holle, H. (2017). Assessing Acute Itch Intensity: General Labelled Magnitude Scale is More Reliable than Classic Visual Analogue Scale.

Acta Dermato Venereologica, *97*(3), 375–376. https://doi.org/10.2340/00015555-2584

Kleyn, C. E., McKie, S., Ross, A. R., Montaldi, D., Gregory, L. J., Elliott, R., Isaacs, C. L., Anderson, I. M., Richards, H. L., Deakin, J. W., & others. (2009). Diminished neural and cognitive responses to facial expressions of disgust in patients with psoriasis: A functional magnetic resonance imaging study. *Journal of Investigative Dermatology*, *129*(11), 2613–2619.

Kosteletzky, F., Namer, B., Forster, C., & Handwerker, H. (2009). Impact of Scratching on Itch and Sympathetic Reflexes Induced by Cowhage (Mucuna pruriens) and Histamine. *Acta Dermato Venereologica*, *89*(3), 271–277. https://doi.org/10.2340/00015555-0624

Koster, E. H. W., Crombez, G., Verschuere, B., Van Damme, S., & Wiersema, J. R. (2006). Components of attentional bias to threat in high trait anxiety: Facilitated engagement, impaired disengagement, and attentional avoidance. *Behaviour Research and Therapy*, *44*(12), 1757–1771. https://doi.org/10.1016/j.brat.2005.12.011

Koster, E. H. W., Verschuere, B., Crombez, G., & Van Damme, S. (2005). Time-course of attention for threatening pictures in high and low trait anxiety. *Behaviour Research and Therapy*, *43*(8), 1087–1098. https://doi.org/10.1016/j.brat.2004.08.004

Lakshmy, S., Balasundaram, S., Sarkar, S., Audhya, M., & Subramaniam, E. (2015). A Cross-sectional Study of Prevalence and Implications of Depression and Anxiety in Psoriasis. *Indian Journal of Psychological Medicine*, *37*(4), 434–440. https://doi.org/10.4103/0253-7176.168587

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. University of Florida, Gainesville. *In.: Tech Rep A-8*.

Langley, R. G., & Ellis, C. N. (2004). Evaluating psoriasis with Psoriasis Area and Severity Index, Psoriasis Global Assessment, and Lattice System Physician's Global Assessment. *Journal of the American Academy of Dermatology*, *51*(4), 563–569. https://doi.org/10.1016/j.jaad.2004.04.012

Lee, I.-S., Lee, A.-R., Lee, H., Park, H.-J., Chung, S.-Y., Wallraven, C., Bülthoff, I., & Chae, Y. (2014). Psychological distress and attentional bias toward acne lesions in patients with acne. *Psychology, Health & Medicine*, *19*(6), 680–686.

Lee, L. O., & Knight, B. G. (2009). Attentional Bias for Threat in Older Adults: Moderation of the Positivity Bias by Trait Anxiety and Stimulus Modality. *Psychology and Aging*, *24*(3), 741–747. https://doi.org/10.1037/a0016409

Leibovici, V., Magora, F., Cohen, S., & Ingber, A. (2009). Effects of Virtual Reality Immersion and Audiovisual Distraction Techniques for Patients with Pruritus. *Pain Research and Management*, *14*(4), 283–286. https://doi.org/10.1155/2009/178751

Lloyd, D. m., Hall, E., Hall, S., & McGlone, F. p. (2013). Can itch-related visual stimuli alone provoke a scratch response in healthy individuals? *British Journal of Dermatology*, *168*(1), 106–111. https://doi.org/10.1111/bjd.12132

Lundh, L.-G., & Czyzykow-Czarnocka, S. (2001). Priming of the Emotional Stroop Effect by a Schema Questionnaire. An Experimental Study of Test Order. *Cognitive Therapy and Research*, *25*(3), 281–289. https://doi.org/10.1023/A:1010784412175

MacLeod, C., & Clarke, P. J. F. (2015). The Attentional Bias Modification Approach to Anxiety Intervention. *Clinical Psychological Science*, *3*(1), 58–78. https://doi.org/10.1177/2167702614560749

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional Bias in Emotional Disorders. *Journal of Abnormal Psychology*, *95*, 15–20. https://doi.org/10.1037/0021-843X.95.1.15

McGlade, A. L., Craske, M. G., & Niles, A. N. (2020). Temporal trends in attention disengagement from social threat as a function of social anxiety. *Journal of Behavior Therapy and Experimental Psychiatry*, *68*, 101529. https://doi.org/10.1016/j.jbtep.2019.101529

McNally, R. J. (1995). Automaticity and the anxiety disorders. *Behaviour Research and Therapy*, *33*(7), 747–754. https://doi.org/10.1016/0005-7967(95)00015-P

Menter, A., & Griffiths, C. E. M. (2007). *Psoriasis 2 Current and future management of psoriasis*. *370*, 13.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the penn state worry questionnaire. *Behaviour Research and Therapy*, *28*(6), 487–495. https://doi.org/10.1016/0005-7967(90)90135-6

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy*, *36*(9), 809–848. https://doi.org/10.1016/S0005-7967(98)00063-1

Mogg, K., McNamara, J., Powys, M., Rawlinson, H., Seiffer, A., & Bradley, B. P. (2000). Selective attention to threat: A test of two cognitive models of anxiety. *Cognition & Emotion*, *14*(3), 375–399. https://doi.org/10.1080/026999300378888

Mounsey, S., J., & Kulakov, E. (2018). Psoriasis. *British Journal of Hospital Medicine*, *79*(8), C114–C117. https://doi.org/10.12968/hmed.2018.79.8.C114

Narayanan, S., Guyatt, V., Franceschetti, A., & Hautamaki, E. L. (2014). Disease burden and patient reported outcomes among patients with moderate to severe psoriasis: An ethnography study. *Psoriasis (Auckland, N.Z.)*, *5*, 1–7. https://doi.org/10.2147/PTT.S74906

NHS. (2017, October 20). *Psoriasis*. Nhs.Uk. https://www.nhs.uk/conditions/psoriasis/

NHS. (2018, May 11). *Psoriasis—Causes*. Nhs.Uk. https://www.nhs.uk/conditions/psoriasis/causes/

NHS. (2020, March 13). *Social anxiety (social phobia)*. Nhs.Uk. https://www.nhs.uk/mental-health/conditions/social-anxiety/

NICE. (2004, December 6). *Depression: Management of depression in primary and secondary care | Guidance | NICE*. NICE. https://www.nice.org.uk/guidance/cg23

NICE. (2012a, October 24). *Overview | Psoriasis: Assessment and management | Guidance | NICE*. NICE. https://www.nice.org.uk/guidance/cg153/

NICE. (2012b, October 24). *Recommendations | Psoriasis: Assessment and management | Guidance | NICE*. NICE. https://www.nice.org.uk/guidance/cg153/chapter/1-Recommendations

Oaten, M., Stevenson, R. J., & Case, T. I. (2011). Disease avoidance as a functional basis for stigmatization. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1583), 3433–3452. https://doi.org/10.1098/rstb.2011.0095

Ogdie, A., Langan, S., Love, T., Haynes, K., Shin, D., Seminara, N., Mehta, N. N., Troxel, A., Choi, H., & Gelfand, J. M. (2013). Prevalence and treatment patterns of psoriatic arthritis in the UK. *Rheumatology*, *52*(3), 568–575. https://doi.org/10.1093/rheumatology/kes324

Onnis, R., Dadds, M. R., & Bryant, R. A. (2011). Is there a mutual relationship between opposite attentional biases underlying anxiety? *Emotion*, *11*(3), 582–594. https://doi.org/10.1037/a0022019

Padma, K., Nanaware, S. S., Yadiyal, A., & Mathai, P. J. (2020). Cognitive impairment in patients with psoriasis: A clinical study in teaching hospital. *Journal of Family Medicine and Primary Care*, *9*(8), 4001–4004. https://doi.org/10.4103/jfmpc.jfmpc_104_20

Paivio, A. (1971). *Imagery and Verbal Processes*. Holt, Rinehart and Winston. https://books.google.co.uk/books?id=xmB9AAAAMAAJ

Parisi, R., Symmons, D. P. M., Griffiths, C. E. M., & Ashcroft, D. M. (2013). Global Epidemiology of Psoriasis: A Systematic Review of Incidence and Prevalence. *Journal of Investigative Dermatology*, *133*(2), 377–385. https://doi.org/10.1038/jid.2012.339

Pavlovia. (n.d.). Retrieved February 28, 2022, from https://pavlovia.org/

Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, *51*(1), 195–203. https://doi.org/10.3758/s13428-018-01193-y

Peschard, V., & Philippot, P. (2017). Overestimation of threat from neutral faces and voices in social anxiety. *Journal of Behavior Therapy and Experimental Psychiatry*, *57*, 206–211. https://doi.org/10.1016/j.jbtep.2017.06.003

Pishyar, R., Harris, L. M., & Menzies, R. G. (2004). Attentional bias for words and faces in social anxiety. *Anxiety, Stress & Coping*, *17*(1), 23–36. https://doi.org/10.1080/10615800310001601458

Posner, M. I. (1980). Orienting of Attention. *Quarterly Journal of Experimental Psychology*, *32*(1), 3–25. https://doi.org/10.1080/00335558008248231

Posner, M. I., & Petersen, S. E. (1990). The Attention System of the Human Brain. *Annual Review of Neuroscience*, *13*(1), 25–42. https://doi.org/10.1146/annurev.ne.13.030190.000325

Puzenat, E., Bronsard, V., Prey, S., Gourraud, P.-A., Aractingi, S., Bagot, M., Cribier, B., Joly, P., Jullien, D., Le Maitre, M., Paul, C., Richard-Lallemand, M.-A., Ortonne, J.-P., & Aubin, F. (2010). What are the best outcome measures for assessing plaque psoriasis severity? A systematic review of the literature. *Journal of the European Academy of Dermatology and Venereology*, *24*(s2), 10–16. https://doi.org/10.1111/j.1468-3083.2009.03562.x

Rapp, S. R., Feldman, S. R., Exum, M. L., Fleischer Jr, A. B., & Reboussin, D. M. (1999). Psoriasis causes as much disability as other major medical diseases. *Journal of the American Academy of Dermatology*, *41*(3), 401–407.

Rencz, F., Gulácsi, L., Péntek, M., Poór, A. k., Sárdy, M., Holló, P., Szegedi, A., Remenyik, É., & Brodszky, V. (2018). Proposal of a new scoring formula for the Dermatology Life Quality Index in psoriasis. *British Journal of Dermatology*, *179*(5), 1102–1108. https://doi.org/10.1111/bjd.16927

Rendon, A., & Schäkel, K. (2019). Psoriasis Pathogenesis and Treatment. *International Journal of Molecular Sciences*, *20*(6), 1475. https://doi.org/10.3390/ijms20061475

Rennefeld, C., Wiech, K., Schoell, E. D., Lorenz, J., & Bingel, U. (2010). Habituation to pain: Further support for a central component. *Pain*, *148*(3), 503–508. https://doi.org/10.1016/j.pain.2009.12.014

Rued, H. A., Hilmert, C. J., Strahm, A. M., & Thomas, L. E. (2019). The influence of stress on attentional bias to threat: An angry face and a noisy crowd. *Psychonomic Bulletin & Review*, *26*(3), 943–950. https://doi.org/10.3758/s13423-018-1538-2

Schoth, D. E., Nunes, V. D., & Liossi, C. (2012). Attentional bias towards pain-related information in chronic pain; a meta-analysis of visual-probe investigations. *Clinical Psychology Review*, *32*(1), 13–25. https://doi.org/10.1016/j.cpr.2011.09.004

Snaith, R. P., Baugh, S. J., Clayden, A. D., Husain, A., & Sipple, M. A. (1982). The Clinical Anxiety Scale: An Instrument Derived from the Hamilton Anxiety Scale. *British Journal of Psychiatry*, *141*(5), 518–523. Cambridge Core. https://doi.org/10.1192/bjp.141.5.518

Stormark, K. M., Nordby, H., & Hugdahl, K. (1995). Attentional shifts to emotionally charged cues: Behavioural and ERP data. *Cognition & Emotion*, *9*(5), 507–523.

Stroop, J. R. (1935). Studies of Interface in Serial Verbal Reactions. *Journal of Experimental Psychology.*, *18*(6), 643.

Treisman, A. (1964). Monitoring and storage of irrelevant messages in selective attention. *Journal of Verbal Learning and Verbal Behavior*, *3*(6), 449–459. https://doi.org/10.1016/S0022-5371(64)80015-3

Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology*, *12*(1), 97–136.

Vago, D. R., & Nakamura, Y. (2011). Selective Attentional Bias Towards Pain-Related Threat in Fibromyalgia: Preliminary Evidence for Effects of Mindfulness Meditation Training. *Cognitive Therapy and Research*, *35*(6), 581–594. https://doi.org/10.1007/s10608-011-9391-x

van Beugen, S., Maas, J., van Laarhoven, A. I. M., Galesloot, T. E., Rinck, M., Becker, E. S., van de Kerkhof, P. C. M., van Middendorp, H., & Evers, A. W. M. (2016). Implicit stigmatization-related biases in individuals with skin conditions and their significant others. *Health Psychology*, *35*(8), 861–865. https://doi.org/10.1037/hea0000404

Van Bockstaele, B., Verschuere, B., Tibboel, H., De Houwer, J., Crombez, G., & Koster, E. H. W. (2014). A review of current evidence for the causal impact of attentional bias on fear and anxiety. *Psychological Bulletin*, *140*(3), 682–721. https://doi.org/10.1037/a0034834

van Heuven, W. J. B., Mandera, P., Keuleers, E., & Brysbaert, M. (2014). Subtlex-UK: A New and Improved Word Frequency Database for British English. *Quarterly Journal of Experimental Psychology*, *67*(6), 1176–1190. https://doi.org/10.1080/17470218.2013.850521

van Laarhoven, A. I. M., van Damme, S., Lavrijsen, A. P. M., van Ryckeghem, D. M., Crombez, G., & Evers, A. W. M. (2018). Attentional processing of itch. *Psychological Research*, *82*(5), 876–888. https://doi.org/10.1007/s00426-017-0878-2

van Laarhoven, A. I. M., van Damme, S., Lavrijsen, A. (Sjan) P. M., van Ryckeghem, D. M., Crombez, G., & Evers, A. W. M. (2017). Do Tonic Itch and Pain Stimuli Draw Attention towards Their Location? *BioMed Research International*, *2017*, 1–11. https://doi.org/10.1155/2017/2031627

Waechter, S., & Stolz, J. (2015). Trait Anxiety, State Anxiety, and Attentional Bias to Threat: Assessing the Psychometric Properties of Response Time Measures. *Cognitive Therapy & Research*, *39*(4), 441–458. https://doi.org/10.1007/s10608-015-9670-z

Wahl, A., Loge, J. H., Wiklund, I., & Hanestad, B. R. (2000). The burden of psoriasis: A study concerning health-related quality of life among Norwegian adult patients with psoriasis compared with general population norms. *Journal of the American Academy of Dermatology*, *43*(5), 803–808. https://doi.org/10.1067/mjd.2000.107501

Warriner, A. B., Kuperman, V., & Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior Research Methods*, *45*(4), 1191–1207. https://doi.org/10.3758/s13428-012-0314-x

Wells, A., & Matthews, G. (1994). *Attention and emotion: A clinical perspective*. Psychology Press.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin*, *120*(1), 3–24. https://doi.org/10.1037/0033-2909.120.1.3

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders.* (pp. ix, 226). John Wiley & Sons.

Wilson, E., & MacLeod, C. (2003). Contrasting two accounts of anxiety-linked attentional bias: Selective attention to varying levels of stimulus threat intensity. *Journal of Abnormal Psychology*, *112*(2), 212–218. https://doi.org/10.1037/0021-843X.112.2.212

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *Q J Exp Psychol A*.

Yoon, K. L., & Zinbarg, R. E. (2008). Interpreting neutral faces as threatening is a default mode for socially anxious individuals. *Journal of Abnormal Psychology*, *117*(3), 680–685. https://doi.org/10.1037/0021-843X.117.3.680

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Appendix A: Experiment 1 Information Sheet

Information Sheet

Title: Auditory Modulation of (Histamine Induced) Itch

Researcher name: Henning Holle

Purpose of Study

The purpose of this study is to understand the impact of listening to scratching on itch perception. It aims to improve our understanding of how individuals interpret itch. This could lead to developments in the understanding of chronic itch conditions and contribute towards improving treatment strategies.

Procedures

This study consists of two parts. In the first part, the experimenter will place a drop of watery solution on your forearm. The skin is then pricked through the drop using the tip of a lancet. The prick may feel sharp, but not painful. Following the skin prick, you will notice that the skin area around the skin prick site will start to itch. After a few minutes, the affected area will appear slightly raised and reddened, similar to a mosquito bite. You will be required to continuously rate the intensity of the itch on a computerized scale for 10 minutes. The scale starts from 0 (no itch) to 100 (most intense itch imaginable). Itch and reddening of the skin have usually completed subsided 30 to 60 minutes after the skin prick. In the second part, the experimenter will repeat the process performed in the first part. This time, the watery solution applied may or may not itch. In addition to rating the itch, you will now listen to the sound of people scratching through a pair of headphones. It is essential therefore that you have no hearing problems. In the second session, the process will be repeated twice – once on each arm.

How much of your time will participation involve?

Taking part in this experiment will take about 60 minutes of your time.

Will your participation in the project remain confidential?

If you agree to take part, your name will not be recorded on the data sheets and the information will not be disclosed to other parties. Your responses to the questions will be used for the purpose of this project only. You can be assured that if you take part in the project you will remain anonymous.

Payment

Participation will be remunerated with a single payment of £8 on completion of the experiment. Alternatively, you can receive 60 minutes of RPS credit for taking part.

Potential Risks and Ethical Consideration

Taking part in the study will involve the experience of itch. The itch experienced after a histamine prick is similar to mosquito bite, although less intense. Itch and associated reddening of the skin have usually completely subsided 30 to 60 minutes after the application. The histamine prick test usually does not lead to bleeding. At most, there may be a droplet of blood. The experimenter has been trained in the correct application of the prick test.

When larger doses of histamine are infused directly into the blood stream, a number of unwanted side effects can occur. This side effects include headache, developing an itchy rash (urticaria), drop in blood pressure, constriction of the airways (bronchospasm) and cramp-like abdominal pains. In the present experiment, only

a very small amount of histamine solution will be deposited in the upper layers of the test site (up to 2 µl, which is equivalent to 0.002 ml). Most of this small amount of histamine solution will remain at the site of skin prick, and very little (if any) will enter your blood stream. It is therefore extremely unlikely that you will experience any of the above-mentioned side effects. Nonetheless, we have to make you aware that these side effects exist.

In order to make sure that it is safe for you to take part, you have to answer a number of questions about your medical history and any medication you are currently receiving (please see the consent form for details).

In short, the test area, which is located in the middle of your forearm should be free from

- skin infections

- acute or chronic eczema

- signs of increased skin reactivity. Examples of very sensitive skin include skin that allows ‘skin writing’, or abnormally thick, dry or scaly skin

You also shouldn’t be hypersensitive to any of the ingredients of the histamine solution, which are (apart from water and salt)

Histamine

Phenol

Glycerol

Sodium Hydroxide

You also shouldn't

currently suffer from acute allergic symptoms

suffer from a serious general disorder

currently have a fever

receive treatment with β-Blockers

suffer from any disease of the heart or blood vessels (cardiovascular disease)

have a history of low blood pressure

have a history of fainting during medical procedures (e.g., during a flu shot, or immunization shot)

suffer from asthma

be pregnant or breastfeeding

have taken antihistamines in the last 48 hours

Some people suffer from a condition called histamine intolerance. When eating histamine-rich foods (e.g., spinach, sauerkraut, certain types of sausage and fish), histamine-intolerant people tend to develop 'allergy-like' symptoms such as headaches, rashes, itching, diarrhea, and vomiting or abdominal pain. If you suffer from histamine intolerance, you should not take part in this experiment (as a precautionary measure). If a

histamine-intolerant person undergoes a histamine prick test, it may take longer than 30 – 60 minutes until the reddening of the skin has completely subsided.

No other risks of the histamine prick test are known to the investigator at this time.

Benefits

There are no immediate benefits to you in taking part however you will be helping research involved in understanding chronic itch conditions which in the long term could potentially help develop treatment strategies.

What happens now?

If you are interested in taking part in the study you are asked to complete and sign the consent form. Then you will be given more specific instructions. Do not sign if you do not wish to take part. If you do decide to take part however, you have the right to withdraw from the experiment at any time without giving a reason. Please feel free to ask any questions that you may have.

Contact for Further Information

If you have any further questions about this study, feel free to contact Dr Henning Holle (H.holle@hull.ac.uk) If you have any concerns about the way in which the study has been conducted, you should contact the Chair of the Department of psychology Ethics Committee on ethics@psynet.hull.ac.uk

Appendix B: Experiment 1 and 2 Consent form

CONSENT FORM FOR PARTICIPANT

Auditory Modulation of (Histamine Induced) Itch

Supervisor: Dr. Henning Holle, Department of Psychology, University of Hull

You should complete the whole of this sheet by yourself. If you have any questions, please ask the Experimenter.

Age: _____ years

Please circle as necessary:

Gender:

Male/female

Do you have any problems hearing? YES/NO

If female, are you currently pregnant or breastfeeding? YES/NO

Do you have any of the following in the test area: left or right wrist area

Wounds, rashes, swelling or reddening YES/NO

Tattoos YES/NO

Scars YES/NO

Creams which you have applied in the past 24 hours (e.g. moisturizer) YES/NO

Very sensitive skin (e.g., skin that allows skin writing, dry, thick or scaly skin) YES/NO

Have you taken any of the medication/drugs **in the past 48 hours**:

Antihistamines (e.g., as a treatment for hayfever) YES/NO

Beta blockers (e.g., for treatment of heart condition) YES/NO

Are you currently taking **any** medication regularly, other than oral contraceptive,

i.e., 'the pill' YES/NO

If yes, please list all medication(s) you are currently taking on a regular basis

Do you currently suffer from or have a history of any of the following:

Fainting during medical procedures (e.g., flu shots or immunization shots) YES/NO

An allergy? YES/NO

An acute or chronic skin condition (e.g. eczema, psoriasis)? YES/NO

Any disease of the heart or blood vessels (cardiovascular disease)? YES/NO

Low blood pressure? YES/NO

Fever? YES/NO

Asthma? YES/NO

Histamine Intolerance YES/NO

Are you hypersensitive to any of the following substances?

Histamine (spinach, sauerkraut, certain types of sausage and cheese are rich in histamine) YES/NO

Phenol (many types of berries and fruit are rich in phenol) YES/NO

Glycerol (milk, clotted cream, puddings and yogurt are rich in glycerol) YES/NO

Sodium Hydroxide (a.k.a. lye or caustic soda, used for preparation of pretzels, chinese noodles, also used in production of soft drinks) YES/NO

Please circle as necessary:

Have you read and understood the participant information sheet YES/NO

Have you had the opportunity to ask questions and discuss the study YES/NO

Have all the questions been answered satisfactorily YES/NO

Have you received enough information about the study YES/NO

Do you understand that you are free to withdraw from the study at any time without having to give a reason YES/NO

Do you agree to take part in the study YES/NO

"This study has been explained to me to my satisfaction, and I agree to take part. I understand that I am free to withdraw at any time."

Signature of the Participant. . . . . .

Date. . . . . .

Name (in block capitals) . . . . . .

I have explained the study to the above participant and he/she has agreed to take part.

Signature of researcher . . . . . .

Date. . . . . .

Appendix C: Experiment 2 Information Sheet

Information Sheet

Title: Auditory Modulation of (Histamine Induced) Itch and Its Effects on Attention
Researcher name: Sarah Etty & Henning Holle

Purpose of Study
The purpose of this study is to understand the impact of listening to scratching on itch perception. It aims to improve our understanding of how individuals interpret itch. This could lead to developments in the understanding of chronic itch conditions and contribute towards improving treatment strategies.

Procedures
This study consists of three parts. In the first part, the experimenter will place a drop of watery solution on your forearm. The skin is then pricked through the drop using the tip of a lancet. The prick may feel sharp, but not painful. Following the skin prick, you will notice that the skin area around the skin prick site will start to itch. After a few minutes, the affected area will appear slightly raised and reddened, similar to a mosquito bite. You will be required to continuously rate the intensity of the itch on a computerized scale for 10 minutes. The scale starts from 0 (no itch) to 100 (most intense itch imaginable). During this task you will also listen to the sound of people scratching through a pair of headphones. It is essential therefore that you have no hearing problems. Itch and reddening of the skin have usually completed subsided 30 to 60 minutes after the skin prick. The second part consists of completing attentional bias tasks. You will be asked to watch a computer screen and indicate on which side of the screen a dot appears. The dot will follow an image on either the same or the opposite side of the screen. You will have the opportunity to practise this task beforehand. The images in this task will include some that induce itch and display insects including mosquitoes, ants and butterflies. In the third part, the experimenter will repeat the process performed in the first part. This time, the watery solution applied may or may not itch.

How much of your time will participation involve?
Taking part in this experiment will take about 60 minutes of your time.

Will your participation in the project remain confidential?
If you agree to take part, your name will not be recorded on the data sheets and the information will not be disclosed to other parties. Your responses to the questions will be used for the purpose of this project only. You can be assured that if you take part in the project you will remain anonymous.

Payment
Participation will be remunerated with a single payment of £8 on completion of the experiment. Alternatively, you can receive 60 minutes of RPS credit for taking part.

Potential Risks and Ethical Consideration
Taking part in the study will involve the experience of itch. The itch experienced after a

histamine prick is similar to mosquito bite, although less intense. Itch and associated reddening of the skin have usually completely subsided 30 to 60 minutes after the application. The histamine prick test usually does not lead to bleeding. At most, there may be a droplet of blood. The experimenter has been trained in the correct application of the prick test.

When larger doses of histamine are infused directly into the blood stream, a number of unwanted side effects can occur. The side effects include headache, developing an itchy rash (urticaria), drop in blood pressure, constriction of the airways (bronchospasm) and cramp-like abdominal pains. In the present experiment, only a very small amount of histamine solution will be deposited in the upper layers of the test site (up to 2 µl, which is equivalent to 0.002 ml). Most of this small amount of histamine solution will remain at the site of skin prick, and very little (if any) will enter your blood stream. It is therefore extremely unlikely that you will experience any of the above-mentioned side effects. Nonetheless, we have to make you aware that these side effects exist.

In order to make sure that it is safe for you to take part, you have to answer a number of questions about your medical history and any medication you are currently receiving (please see the consent form for details).

In short, the test area, which is located in the middle of your forearm should be free from

- skin infections
- acute or chronic eczema
- signs of increased skin reactivity. Examples of very sensitive skin include skin that allows ‘skin writing’, or abnormally thick, dry or scaly skin

You also shouldn’t be hypersensitive to any of the ingredients of the histamine solution, which are (apart from water and salt)
Histamine
Phenol
Glycerol
Sodium Hydroxide

You also shouldn’t

currently suffer from acute allergic symptoms
suffer from a serious general disorder
currently have a fever
receive treatment with β-Blockers
suffer from any disease of the heart or blood vessels (cardiovascular disease)
have a history of low blood pressure
have a history of fainting during medical procedures (e.g., during a flu shot, or immunization shot)
suffer from asthma
be pregnant or breastfeeding
have taken antihistamines in the last 48 hours

Some people suffer from a condition called histamine intolerance. When eating histamine-rich

foods (e.g., spinach, sauerkraut, certain types of sausage and fish), histamine-intolerant people tend to develop 'allergy-like' symptoms such as headaches, rashes, itching, diarrhea, and vomiting or abdominal pain. If you suffer from histamine intolerance, you should not take part in this experiment (as a precautionary measure). If a histamine-intolerant person undergoes a histamine prick test, it may take longer than 30 – 60 minutes until the reddening of the skin has completely subsided.

No other risks of the histamine prick test are known to the investigator at this time.

Benefits
There are no immediate benefits to you in taking part however you will be helping research involved in understanding chronic itch conditions which in the long term could potentially help develop treatment strategies.

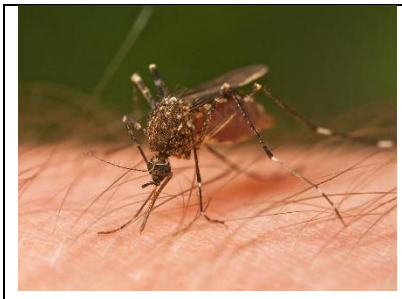
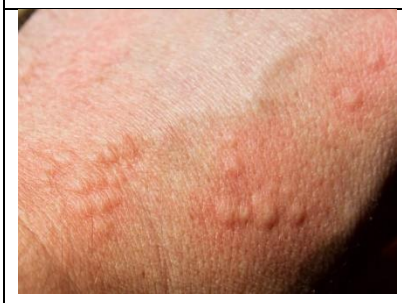
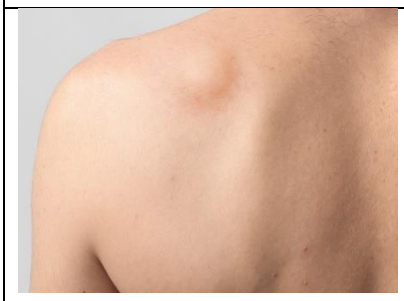
What happens now?
If you are interested in taking part in the study you are asked to complete and sign the consent form. Then you will be given more specific instructions. Do not sign if you do not wish to take part. If you do decide to take part however, you have the right to withdraw from the experiment at any time without giving a reason. Please feel free to ask any questions that you may have.

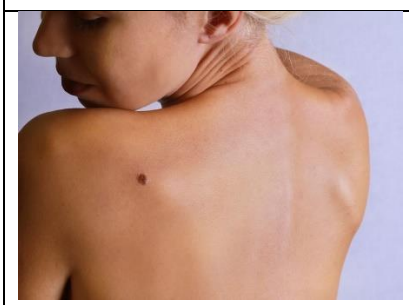
Contact for Further Information
If you have any further questions about this study, feel free to contact Dr Henning Holle (H.holle@hull.ac.uk) or Sarah Etty (s.etty-2018@hull.ac.uk). If you have any concerns about the way in which the study has been conducted, you should contact the Chair of the ethics committee of the Faculty of Health Sciences at l.walker@hull.ac.uk.

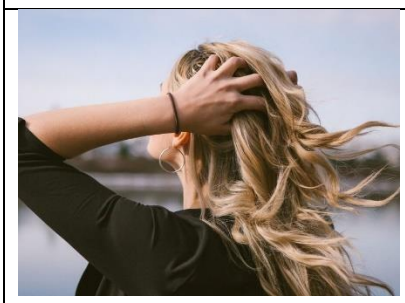
Appendix D: Experiment 2 images used as cues and their ratings.

Image	**Image Type**	**Pair**	**Itch Rating (1: not at all itchy – 5: extremely itchy)**
	Neutral	1	1.44
	Threat	1	4.02
	Neutral	2	1.05
	Threat	2	3.76

	Neutral	3	1.22
	Threat	3	2.37
	Neutral	4	1.64
	Threat	4	2.31
	Neutral	5	2.22

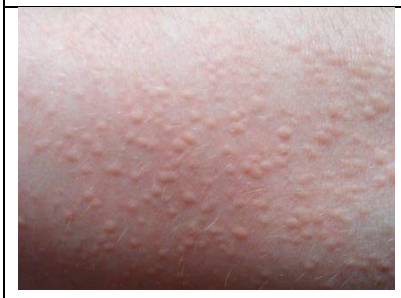
	Threat	5	3.24
	Neutral	6	1.03
	Threat	6	3.39
	Neutral	7	1.47
	Threat	7	2.92

	Neutral	8	1.36
	Threat	8	3.03
	Neutral	9	1.63
	Threat	9	3.07
	Neutral	10	1.68

	Threat	10	3.17
	Neutral	11	1.81
	Threat	11	2.73
	Neutral	12	1.15
	Threat	12	2.27

	Neutral	13	1.15
	Threat	13	2.85
	Neutral	14	1.19
	Threat	14	2.83
	Neutral	15	1.27

	Threat	15	2.63
	Neutral	16	1.25
	Threat	16	2.49
	Neutral	17	1.07
	Threat	17	2.24

	Neutral	18	1.12
	Threat	18	3.22

Prolific Screening (Psoriasis)

Page 1: Welcome page

*An Attentional Bias Approach Towards Understanding And Reducing The*Psychosocial Burden Of Psoriasis: Screening Survey

I would like to invite you to participate in a research project which forms part of my PhD research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others ifyou wish. Ask me if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

The purpose of the study is to investigate attentional bias among those with psoriasis compared with healthy control participants.

Why have I been invited to take part?

You are being invited to participate in this study because you may meet the eligibility forthe next stage of our research.

What will happen if I take part?

If you choose to take part in this study you will be asked to complete a questionnaire regarding your emotional wellbeing and physical health. If eligible you will then be invited to participate in the next stage of the research, which will include a reaction timetask.

Taking part in this questionnaire should take no more than 5 minutes of your time.You will not be asked to provide any personal or identifying information.

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in any way. Once you have read theinformation, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to indicate your consent before beginning the study.

What are the possible risks of taking part?

There are no known risks to taking part in this study.

What are the possible benefits of taking part?

The possible benefits of taking part include compensation for your time and the opportunity to participate in research that aims to reduce the psychosocial burdenassociated with psoriasis.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

No personal or identifiable data will be collected from you and you will therefore remain anonymous. Data will also be kept confidential and only myself and my supervisor will have access to this.

Data will be destroyed after 10 years.

The results of the current research will contribute towards upcoming research as it willhelp to decide on the design and procedure of future experiments.

What if I change my mind about taking part?

You are free to withdraw at any point during the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until you have been compensated for your submission, after which withdrawal of your data will no longer be possible. If you choose to withdraw from the study before submitting your answers the data you have provided will not be saved.

How is the project being funded?

This study is being funded by the Psoriasis Association.

What will happen to the results of the study?

The results of the study will be used to identify eligible participants who will then be approached about future research.

Who has reviewed this study?

Research studies are reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and been given a favourable opinion by Faculty of Health Sciences Ethics Committee, University ofHull.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

s.etty-2018@hull.ac.uk

University of Hull, Department of Psychology, Hull, HU6 7RX, UK

What if I have further questions, or if something goes wrong?

If you wish to make a complaint about the conduct of the study, you can contact the University of Hull using the details below for further advice and information:

Supervisor Name: Henning Holleh.holle@hull.ac.uk
University of Hull, Department of Psychology, Hull, HU6 7RX, UK01482 466152

Alternatively please contact registrar@hull.ac.uk

Thank you for reading this information and for considering taking part in thisresearch.

If you would like to participate, please continue to the next page.

CONSENT FORM

Title of study: An Attentional Bias Approach Towards Understanding And Reducing The Psychosocial Burden Of Psoriasis

Researcher: Sarah Etty Supervisor: Dr Henning Holle
Department of Psychology, University of Hull

1. I confirm that I have read the information for the above study. I have had the opportunity to consider the information, ask questions and have had any questionsanswered satisfactorily. *Required*

- Yes

2. I understand that my participation is voluntary and that I am free to withdraw at anytime without giving any reason. I understand that once I have completed and submittedmy questionnaires and these have been approved I cannot withdraw my anonymised data. *Required*

- Yes

3. I understand that the research data, which will be anonymised (not linked to me), will be retained by the researchers and may be shared with others and publicly disseminated to support other research in the future. *Required*

- Yes

4. I am aged 18 years or above. *Required*

- Yes

5. I understand that I will not be providing any personal data. *Required*

- Yes

6. I give permission for the collection and use of my data to answer the researchquestion in this study. *Required*

- Yes

7. I agree to take part in the above study. *Required*

- Yes

If yes in all questions:

Thank you!

Please continue onto the next page to begin the main study.

If no in one or more questions:

Thank you for your interest in our research!Please **do not** continue to the next page.
For any questions please contact Sarah Etty (s.etty-2018@hull.ac.uk).

Page 3: Screening part 1

Gender: *Required*

9.

- FemaleMale
- Non-binary
- Other
-

If 9.a. selected Other, please specify:

Pl e state your age. *Required*

10.

D 11. u have a diagnosis of plaque psoriasis? *Required*

- Yes
- No

Is 11.a. psoriasis currently active (with visible lesions)?

- Yes
- No

D 11.b. have any other health conditions that have a larger self-perceived impact

on your daily life than your psoriasis? If yes, please list these below. If no, please enter "none".

12. Do you have any other major health conditions? *Required*

- Yes
- No

12.a. Please list any major health conditions below.

13. Please answer yes. *Required*

- Yes
- No
- Not sure

14. Do you have any skin conditions other than psoriasis? *Required*

- Yes
- No

14.a. Please give details of skin conditions below.

Are you currently receiving any psychological interventions/treatment?

15.

Required

- Yes
- No

What type of psychological difficulty is the treatment/intervention for (e.g.depression, anxiety, post-traumatic stress disorder etc)?

15.a.

What type of intervention is it? E.g. medication (please state), counselling, CBT etc.

15.b.

Page 4: Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the pastweek. Don't take too long over your replies: your immediate is best.

16. I f[illegible] tense or 'wound up': *Required*

- Most of the timeA
- lot of the time
- From time to time, occasionally
- Not at all

17. I s[illegible] enjoy the things I used to enjoy: *Required*

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

18. I g[illegible] a sort of frightened feeling as if something awful is about to happen: *Required*

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

19. I can laugh and see the funny side of things:

- As much as I always could
- Not quite so much now
- Definitely not so much now
- Not at all

20. Worrying thoughts go through my mind: *Required*

- A great deal of the timeA
- lot of the time
- From time to time, but not too oftenOnly
- occasionally

21. I feel cheerful: *Required*

- Not at all
- Not often
- Sometimes
- Most of the time

22. I can sit at ease and feel relaxed: *Required*

- Definitely
- Usually
- Not often
- Not at all

23. P[illegible]e select the answer Sometimes. *Required*

- Not at all
- Not often
- Sometimes
- Most of the time

24. I f[illegible] as if I am slowed down: *Required*

- Nearly all the time
- Very often
- Sometimes
- Not at all

25. I [illegible] a sort of frightened feeling like 'butterflies' in the stomach: *Required*

- Not at all
- Occasionally
- Quite often
- Very often

26. I h[illegible] lost interest in my appearance: *Required*

- Definitely
-
I don't take as much care as I should

- I may not take quite as much careI
- take just as much care as ever

27. I feel restless as if I have to be on the move: *Required*

- Very much indeedQuite a
- lot
- Not very muchNot
- at all

28. I look forward with enjoyment to things: *Required*

- As much as I ever did Rather
- less than I used to Definitely
- less than I used toHardly at all
-

29. I get sudden feelings of panic: *Required*

- Very often indeed
- Quite often
- Not very often
- Not at all

30. I can enjoy a good book or radio or TV program: *Required*

- Often
- Sometimes
- Not often
- Very seldom

Page 5: Final page

Thank you for participating in this research. If you have any questions, please contact the researcher via email at s.etty-2018@hull.ac.uk.

Visit this Completion URL to complete your submission on Prolific:

https://app.prolific.co/submissions/complete?cc=379120F1

Once you have completed your submission you may close this window.

Appendix F: Control Screening Survey

Prolific Screening (Control)

Page 1: Welcome page

An Attentional Bias Approach Towards Understanding And Reducing The Psychosocial Burden Of Psoriasis: Screening Survey

I would like to invite you to participate in a research project which forms part of my PhD research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others ifyou wish. Ask me if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

The purpose of the study is to investigate attentional bias among those with psoriasis compared with healthy control participants.

Why have I been invited to take part?

You are being invited to participate in this study because you may meet the eligibility forthe next stage of our research.

What will happen if I take part?

If you choose to take part in this study you will be asked to complete a questionnaire regarding your emotional wellbeing and physical health. If eligible you will then be invited to participate in the next stage of the research, which will include a reaction timetask.

Taking part in this questionnaire should take no more than 6 minutes of your time.You will not be asked to provide any personal or identifying information.

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in any way. Once you have read theinformation, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to indicate your consent before beginning the study.

What are the possible risks of taking part?

There are no known risks to taking part in this study.

What are the possible benefits of taking part?

The possible benefits of taking part include compensation for your time and the opportunity to participate in research that aims to reduce the psychosocial burdenassociated with psoriasis.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

No personal or identifiable data will be collected from you and you will therefore remain anonymous. Data will also be kept confidential and only myself and my supervisor will have access to this.

Data will be destroyed after 10 years.

The results of the current research will contribute towards upcoming research as it willhelp to decide on the design and procedure of future experiments.

What if I change my mind about taking part?

You are free to withdraw at any point during the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until you have been compensated for your submission, after which withdrawal of your data will no longer be possible. If you choose to withdraw from the study before submitting your answers the data you have provided will not be saved.

How is the project being funded?

This study is being funded by the Psoriasis Association.

What will happen to the results of the study?

The results of the study will be used to identify eligible participants who will then be approached about future research.

Who has reviewed this study?

Research studies are reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and been given a favourable opinion by Faculty of Health Sciences Ethics Committee, University ofHull.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

s.etty-2018@hull.ac.uk

University of Hull, Department of Psychology, Hull, HU6 7RX, UK

What if I have further questions, or if something goes wrong?

If you wish to make a complaint about the conduct of the study, you can contact the University of Hull using the details below for further advice and information:

Supervisor Name: Henning Holleh.holle@hull.ac.uk
University of Hull, Department of Psychology, Hull, HU6 7RX, UK01482 466152

Alternatively please contact registrar@hull.ac.uk

Thank you for reading this information and for considering taking part in thisresearch.

If you would like to participate, please continue to the next page.

CONSENT FORM

Title of study: An Attentional Bias Approach Towards Understanding And Reducing The Psychosocial Burden Of Psoriasis

Researcher: Sarah Etty Supervisor: Dr Henning Holle
Department of Psychology, University of Hull

1. I confirm that I have read the information for the above study. I have had the opportunity to consider the information, ask questions and have had any questionsanswered satisfactorily. *Required*

- Yes

2. I understand that my participation is voluntary and that I am free to withdraw at anytime without giving any reason. I understand that once I have completed and submittedmy questionnaires and these have been approved I cannot withdraw my anonymised data. *Required*

- Yes

3. I understand that the research data, which will be anonymised (not linked to me), will be retained by the researchers and may be shared with others and publicly disseminated to support other research in the future. *Required*

- Yes

4. I am aged 18 years or above. *Required*

- Yes

5. I understand that I will not be providing any personal data. *Required*

- Yes

6. I give permission for the collection and use of my data to answer the researchquestion in this study. *Required*

- Yes

7. I agree to take part in the above study. *Required*

- Yes

If yes in all questions:

Thank you!

Please continue onto the next page to begin the main study.

If no in one or more questions:

Thank you for your interest in our research!Please **do not** continue to the next page.
For any questions please contact Sarah Etty (s.etty-2018@hull.ac.uk).

Page 3: Screening part 1

Gender: *Required*

9.

- FemaleMale
- Non-binary
- Other
-

If 9.a. selected Other, please specify:

P' e state your age. *Required*

10.

D ou have any major health conditions? *Required*

11.

- Yes
- No

P' 11.a. list any major health conditions below.

12. Please answer Yes. *Required*

- Yes
- No
- Not sure

D 13. u have any skin conditions? *Required*

- Yes
- No

P' 13.a. give details of skin conditions below.

A 14. ou currently receiving any psychological interventions/treatment? *Required*

- Yes
- No

W 14.a. What type of psychological difficulty is the treatment/intervention for (e.g.depression, anxiety, post-traumatic stress disorder etc)?

W 14.b. pe of intervention is it? E.g. medication (please state), counselling, CBT etc.

15. Are you fluent in the English language? *Required*

- Yes
- No

Page 4: Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the pastweek. Don’t take too long over your replies: your immediate is best.

16. I f[illegible] tense or 'wound up': *Required*

- Most of the timeA
- lot of the time
- From time to time, occasionally
- Not at all

17. I s[illegible] enjoy the things I used to enjoy: *Required*

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

18. I g[illegible] a sort of frightened feeling as if something awful is about to happen: *Required*

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

19. I laugh and see the funny side of things:

- As much as I always could
- Not quite so much now
- Definitely not so much now
- Not at all

20. W ving thoughts go through my mind: *Required*

- A great deal of the timeA
- lot of the time
- From time to time, but not too oftenOnly
- occasionally

21. I f l cheerful: *Required*

- Not at all
- Not often
- Sometimes
- Most of the time

22. I s sit at ease and feel relaxed: *Required*

- Definitely
- Usually
- Not often
- Not at all

23. P[illegible]e select the answer Sometimes. *Required*

- Not at all
- Not often
- Sometimes
- Most of the time

24. I f[illegible] as if I am slowed down: *Required*

- Nearly all the time
- Very often
- Sometimes
- Not at all

25. I [illegible] a sort of frightened feeling like 'butterflies' in the stomach: *Required*

- Not at all
- Occasionally
- Quite often
- Very often

26. I h[illegible]e lost interest in my appearance: *Required*

- Definitely
- I don't take as much care as I should

- I may not take quite as much careI
- take just as much care as ever

I f… restless as if I have to be on the move: *Required*

27.

- Very much indeedQuite a
- lot
- Not very muchNot
- at all

I l… forward with enjoyment to things: *Required*

28.

- As much as I ever did Rather
- less than I used to Definitely
- less than I used toHardly at all
-

I … sudden feelings of panic: *Required*

29.

- Very often indeed
- Quite often
- Not very often
- Not at all

I … enjoy a good book or radio or TV program: *Required*

30.

- Often
- Sometimes
- Not often
- Very seldom

Page 5: Final page

Thank you for participating in this research. If you have any questions, please contact the researcher via email at s.etty-2018@hull.ac.uk.

The survey is now complete.

Please click on the completion URL below to complete your submission on prolific:
https://app.prolific.co/submissions/complete?cc=6F1EC403
Once you have completed your submission you may close this window.

Appendix G: Psoriasis Evaluation Survey (with DLQI and PASI)

Psoriasis Evaluation

Page 1: Information

Please enter your Prolific ID: *Required*

An Attentional Bias Approach Towards Understanding And Reducing The Psychosocial Burden Of Psoriasis

I would like to invite you to participate in a research project which forms part of my PhD research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

The purpose of the study is to gain more information on the severity of your psoriasis before collecting reaction time data to measure your attentional bias.

Why have I been invited to take part?

You are being invited to participate in this study because the research needs information from those with psoriasis, such as yourself.

What will happen if I take part?

If you choose to take part in the study you will be asked answer some questions regarding your psoriasis and quality of life. You will then be asked to complete a reaction time task. You will be shown some words/images on the screen and then asked to press a button when a dot appears.

Taking part in this experiment should take no more than 20 minutes of your time. You will not be asked to provide any personal or identifying information.

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in any way. Once you have read the information, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to indicate your consent before beginning the survey.

What are the possible risks of taking part?

The only known risks known to the researchers are the potential for emotional distress caused by seeing words/images that represent social threat.

What are the possible benefits of taking part?

The possible benefits of taking part include compensation for your time, and the opportunity to participate in research that aims to reduce the psychosocial burden associated with psoriasis.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

No personal or identifiable data will be collected from you and you will therefore remain anonymous. Data will also be kept confidential and only myself and my supervisor will have access to this.

Data will be destroyed after 10 years.

The results of the current research will contribute towards upcoming research as it will help to decide on the design and procedure of future experiments.

What if I change my mind about taking part?

You are free to withdraw at any point during the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until you have been compensated for your submission, after which withdrawal of your data will no longer be possible. If you choose to withdraw from the study before submitting your answers the data you have provided will not be saved.

How is the project being funded?

This study is being funded by the Psoriasis Association.

What will happen to the results of the study?

The results of the study will be used to identify eligible participants who will then be approached about future research.

Who has reviewed this study?

Research studies are reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and been given a favourable opinion by Faculty of Health Sciences Ethics Committee, University of Hull.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

s.etty-2018@hull.ac.uk

University of Hull, Department of Psychology, Hull, HU6 7RX, UK

What if I have further questions, or if something goes wrong?

If you wish to make a complaint about the conduct of the study, you can contact the University of Hull using the details below for further advice and information:

Supervisor Name: Henning Holle h.holle@hull.ac.uk
University of Hull, Department of Psychology, Hull, HU6 7RX, UK

01482 466152

Alternatively please contact registrar@hull.ac.uk

Thank you for reading this information and for considering taking part in this research.

Page 2: Consent form

CONSENT FORM

Title of study: An Attentional Bias Approach Towards Understanding And Reducing The Psychosocial Burden Of Psoriasis

Researcher: Sarah Etty Supervisor: Dr Henning Holle
Department of Psychology, University of Hull

I confirm that I have read the information for the above study. I have had the opportunity to consider the information, ask questions and have had any questions answered satisfactorily. *Required*

- Yes

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. I understand that once I have completed and submitted my questionnaires I cannot withdraw my anonymised data. *Required*

- Yes

I understand that the research data, which will be anonymised (not linked to me), will be retained by the researchers and may be shared with others and publicly disseminated to support other research in the future. *Required*

- Yes

I am aged 18 years or above. *Required*

- Yes

I understand that I will not be providing any personal data. *Required*

- Yes

I give permission for the collection and use of my data to answer the research question in this study. *Required*

- Yes

I agree to take part in the above study. *Required*

- Yes

Page 3: Dermatology Life Quality Index (DLQI)

Please select your gender: *Required*

If you selected Other, please specify:

Please state your age: *Required*

The aim of this questionnaire is to measure how much your psoriasis has affected your life OVER THE LAST WEEK. Please select one answer for each question.

Over the last week, how itchy, sore, painful or stinging has your skin been? *Required*

- Very much
- A lot
- A little
- Not at all

Over the last week, how embarrassed or self conscious have you been because of your skin? *Required*

- Very much

- A lot
- A little
- Not at all

Over the last week, how much has your skin interfered with you going shopping or looking after your home or garden? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Over the last week, how much has your skin influenced the clothes you wear? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Over the last week, how much has your skin affected any social or leisure activities? *Required*

- Very much
- A lot
- A little

- Not at all Not
- relevant

Over the last week, how much has your skin made it difficult for you to do any sport? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Over the last week, has your skin prevented you from working or studying? *Required*

- Yes
- No
- Not relevant

If "No", over the last week how much has your skin been a problem at work or studying?

- A lot
- A little
- Not at all

Over the last week, how much has your skin created problems with your partner or any of your close friends or relatives? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Over the last week, how much has your skin caused any sexual difficulties? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Over the last week, how much of a problem has the treatment for your skin been, for example by making your home messy, or by taking up time? *Required*

- Very much
- A lot
- A little
- Not at all
- Not relevant

Page 4: Modified Online PASI (Psoriasis Area and Severity Index) Calculator
For each of the body areas below, please provide information about the amount of skin affected by psoriasis

We will also ask you about the level of redness, thickness and scaling for a typical lesion in each area.

Head

Using your palm (surface area of the hand not including thumb or fingers) as a measurement, how much skin are your lesions covering on your **head** at the moment?
E.g. 3 palm's worth of skin.

What colour is a typical spot of psoriasis on your head? *Required*

- No redness
- Slight pink
- Pink
- Red Dark
- red

How thick is a typical spot of your psoriasis on your head? *Required*

- No thickness
- Feels firm
- Raised Thick
- Very thick

How scaly is a typical spot of psoriasis on your head? *Required*

- No scale
- Slight scale
- Scaly Flaky
- Very flaky

Page 5: Modified Online PASI (Psoriasis Area and Severity Index) Calculator

For each of the body areas below, can you provide information on the following: the amount of skin affected by psoriasis, and the level of redness, thickness and scaling for a typical lesion in each area.

Arms 

Using your palm (surface area of the hand not including thumb or fingers) as a measurement, how much skin are your lesions covering on your arms at the moment?
E.g. 3 palm's worth of skin.

What colour is a typical spot of psoriasis on your arms? *Required*

- No redness
- Slight pink
- Pink
- Red Dark
- red

How thick is a typical spot of your psoriasis on your arms? *Required*

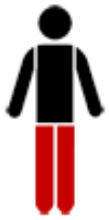
- No thickness
- Feels firm
- Raised Thick
- Very thick

How scaly is a typical spot of psoriasis on your arms? *Required*

- No scale
- Slight scale
- Scaly Flaky
- Very flaky

Page 6: Modified Online PASI (Psoriasis Area and Severity Index) Calculator

For each of the body areas below, can you provide information on the following: the amount of skin affected by psoriasis, and the level of redness, thickness and scaling for a typical lesion in each area.



Legs

Using your palm (surface area of the hand not including thumb or fingers) as a measurement, how much skin are your lesions covering on your legs at the moment?
E.g. 3 palm's worth of skin.

What colour is a typical spot of psoriasis on your legs? *Required*

- No redness
- Slight pink
- Pink
- Red Dark
- red

How thick is a typical spot of your psoriasis on your legs? *Required*

- No thickness
- Feels firm
- Raised Thick
- Very thick

How scaly is a typical spot of psoriasis on your legs? *Required*

- No scale
- Slight scale
- Scaly Flaky
- Very flaky

Page 7: Modified Online PASI (Psoriasis Area and Severity Index) Calculator

For each of the body areas below, can you provide information on the following: the amount of skin affected by psoriasis, and the level of redness, thickness and scaling for a typical lesion in each area.

Trunk 

Using your palm (surface area of the hand not including thumb or fingers) as a measurement, how much skin are your lesions covering on your trunk at the moment?
E.g. 3 palm's worth of skin.

What colour is a typical spot of psoriasis on your trunk? *Required*

- No redness
- Slight pink
- Pink
- Red Dark
- red

How thick is a typical spot of your psoriasis on your trunk? *Required*

- No thickness
- Feels firm
- Raised Thick
- Very thick

How scaly is a typical spot of psoriasis on your trunk? *Required*

- No scale
- Slight scale
- Scaly Flaky
- Very flaky

Page 8: Part 2

Thank you for completing the first part of the study.

The second part is a reaction time task, and for this you will be redirected to another site. You will be provided with instructions before completing this.

Please continue to the next page to be redirected to the second part of the study.

Page 9: Final page

Please click the following link to be redirected to the second part of the study.

Key for selection options

9 - Please select your gender:
Female Male
Non-binary Other Other

Appendix H: Psoriasis Word Rating Survey

A Visual Study of Psoriasis (Words)

Page 1: A Visual Study of Psoriasis

UNIVERSITY OF HULL

A Visual Study of Itch and Psoriasis

I would like to invite you to participate in a research project which forms part of my PhD research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. If there is anything that is not clear or if you would like more information, please send me an email to the following address: s.etty-2018@hull.ac.uk

You will be able to come back to the survey once you have had any queries answered.

What is the purpose of the study?

The purpose of the study is to investigate the perception of acute itch and psoriasis.

Why have I been invited to take part?

You are being invited to participate in this study because the research needs the opinions of those with psoriasis, such as yourself.

What will happen if I take part?

If you choose to take part in the study you will be asked to rate a series of words (99 words in total) in terms of how itchy they make you feel.

You will not be asked to provide any personal or identifying information.

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing

not to take part will not disadvantage you in any way. Once you have read the information, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to indicate your consent before beginning the survey.

What are the possible risks of taking part?

The only risks known to the researchers are the potential for emotional distress caused by seeing images that can induce itch or feelings of discomfort.

What are the possible benefits of taking part?

There are no immediate benefits to you in taking part however you will be helping research involved in understanding chronic itch conditions which in the long term could potentially help develop treatment strategies.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

No personal or identifiable data will be collected from you and you will therefore remain anonymous. Data will also be kept confidential and only myself and my supervisor will have access to this.

Data will be destroyed after 10 years.

The results of the current research will contribute towards upcoming research as it will help to decide on the design and procedure of future experiments.

What if I change my mind about taking part?

You are free to withdraw at any point during the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until you have submitted all of your answers, after which withdrawal of your data will no longer be possible due to all answers being given anonymously and no personal or identifiable information being collected. If you choose to withdraw from the study before submitting all your answers and completing the survey, the data you have provided will not be saved.

How is the project being funded?

This study is being funded by the Psoriasis Association.

What will happen to the results of the study?

The results of the study will be used to help provide stimuli for experiments for future research, and will not be published.

Who has reviewed this study?

Research studies are reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and been given a favourable opinion by Faculty of Health Sciences Ethics Committee, University of Hull.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

s.etty-2018@hull.ac.uk

University of Hull, Department of Psychology, Hull, HU6 7RX, UK

What if I have further questions, or if something goes wrong?

If you wish to make a complaint about the conduct of the study, you can contact the University of Hull using the details below for further advice and information:

Supervisor Name: Henning Holle h.holle@hull.ac.uk
University of Hull, Department of Psychology, Hull, HU6 7RX, UK 01482 466152

Alternatively please contact registrar@hull.ac.uk

Thank you for reading this information and for considering taking part in this research.

If you are happy to continue, please proceed to the next page.

UNIVERSITY OF HULL

CONSENT FORM

Title of study: A Visual Study of Itch and Psoriasis Researcher: Sarah Etty
Supervisor: Dr Henning Holle

Department of Psychology, University of Hull

I confirm that I have read the information for the above study. I have had the opportunity to consider the information, ask questions and have had any questions answered satisfactorily. *Required*

- Agree

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. I understand that once I have completed and submitted my questionnaires I cannot withdraw my anonymised data.
Required

- Agree

I understand that the research data, which will be anonymised (not linked to me), will be retained by the researchers and may be shared with others and publicly disseminated to support other research in the future. *Required*

- Agree

I am aged 18 years or above *Required*

- Agree

I understand that I will not be providing any personal data. *Required*

- Agree

I give permission for the collection and use of my data to answer the research question in this

study. *Required*

Agree

I agree to take part in the above study. *Required*

Agree

If yes in all questions:

Thank you!

Please click the following link to be redirected to the main study (next page).

If no in one or more questions:

Thank you for your interest in our research! We will NOT redirect you to the main study.
For any questions please contact Sarah Etty (s.etty-2018@hull.ac.uk).

Page 3: Word Ratings

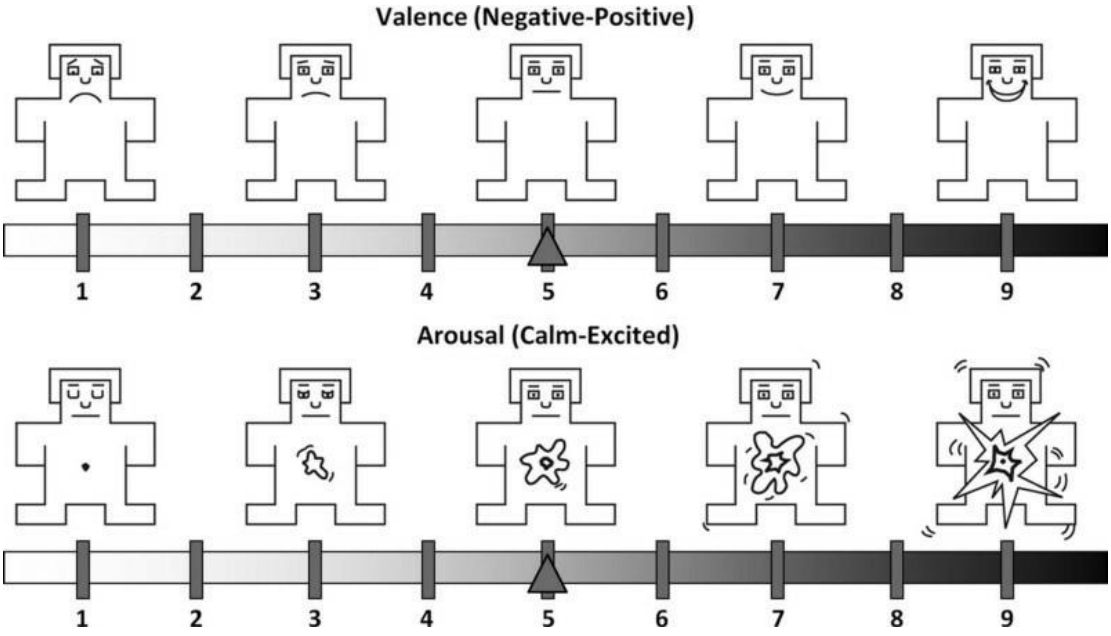
Please rate the words below for the following:

Relatedness (how related to your experience of psoriasis the word is)

Arousal (the level of emotional reaction the word provokes)

Valence (How negative or positive the word is in terms of meaning)

When rating Arousal and Valence, it may be useful to refer to the image below:



Please rate the following word: **RED** *Required*

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **RAW**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **INFLAMED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SHINY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **TREE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SCALY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **RASH**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SCALING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SWOLLEN**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **OPEN**

Please don't select more than 1 answer(s) per row.

Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	excited
unhappy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis

Please rate the following word: **PLAQUE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FLAKING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BLISTERS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BUMPS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	

calm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	excited
unhappy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis

Please rate the following word: **SPEAK**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BLEEDING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SKIN**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **CRUSTY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unhappy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis

Please rate the following word: WELCOME

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SILVERY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PATCHES**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **CRACKED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **COLOURFUL**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SCALP**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **LESION**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SPOTS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **LAMP**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FLARE-UP**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PEELING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SCABBY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **PREVIOUS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **IRRITATED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **TINGLY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BURNING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **TWICE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PAIN**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **ITCHING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **MESSY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **FORMAL**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **ROUGH**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PRICKLING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **OINTMENT**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **MAYOR**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SHEDDING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **STINGING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **DISCOMFORT**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **FIELD**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **CREAM**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SORE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **UNCOMFORTABLE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **GUITAR**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **EMBARRASSED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **STUPID**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FOOLISH**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **SWIMMING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **NOMINATE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **AWKWARD**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **UGLY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **OUTCAST**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **JEER**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PAUSE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **RIDICULOUS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **ALONE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FREAK**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SNEER**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **WRITE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **HIDE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **INSECURE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **LONELY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **JUDGED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **RETIRE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SHAME**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **INFERIOR**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BULLYING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **WATCHED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **PLAIN**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **BEACH**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **UNHAPPY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **SECLUDED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **MISUNDERSTOOD**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **KNITTED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **COVER-UP**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **VULNERABLE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **RIDICULE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **DISGUST**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **ROCKET**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **REPELLED**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **IGNORE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **GRIMACE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **SHOCK**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat...	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **ROSY**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **WHISPER**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FROWNING**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **STARE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelat . .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	relate d to

Please rate the following word: **REPULSIVE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **FURNISH**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **UNATTRACTIVE**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following word: **GROSS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

unrelated	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to

Please rate the following word: **SELF-CONSCIOUS**

Please don't select more than 1 answer(s) per row. Please select at least 3 answer(s).

	0	1	2	3	4	5	6	7	8	9	10	
calm												excited
unhappy												happy
unrelated to my psoriasis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	related to my psoriasis
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

UNIVERSITY OF HULL

Name of Researcher: Sarah Etty
Name of Supervisor: Dr Henning Holle

Thank you very much for participating in this research. You have made an important contribution to a developing body of knowledge in psychology, and we would like to thank you for this contribution.

Now that your participation is complete, we can tell you more about the study you have just participated in:

Attentional bias is a cognitive process whereby an individual unconsciously allocates their attention towards certain types of information more so than to others. Van Laarhoven et al. (2018) found that individuals showed an attentional bias towards itch related images when experiencing itch symptoms, whereas data previously collected by my supervisor has suggested the opposite for itch related words, in that it produces attentional bias *away* from the words i.e. an avoidance. Similar processes have been found among those with psoriasis, and this study intends to build on this research by measuring attentional bias among those with psoriasis using a different method. This requires different stimuli, and this survey will determine which stimuli is the most appropriate for use in this research.

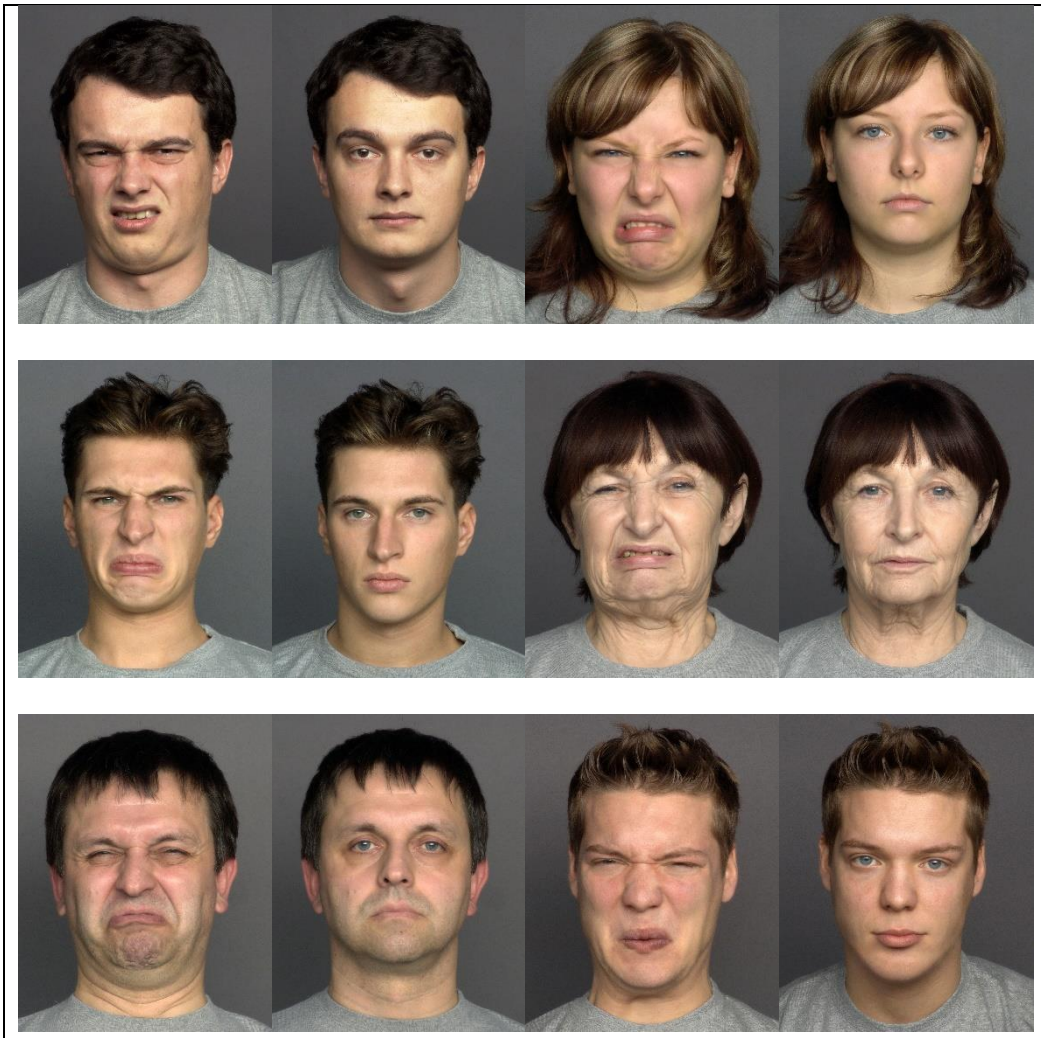
Please feel free to contact Sarah Etty (Email: s.etty-2018@hull.ac.uk) if you have any further questions or concerns, or if you would like to find out the results of this study. If you have any questions about your rights as a research participant, please feel free to contact the Ethics Committee of the Faculty of Health Science, University of Hull (FHS-ethicssubmissions@hull.ac.uk). Thank you for your time and participation; it is greatly appreciated!

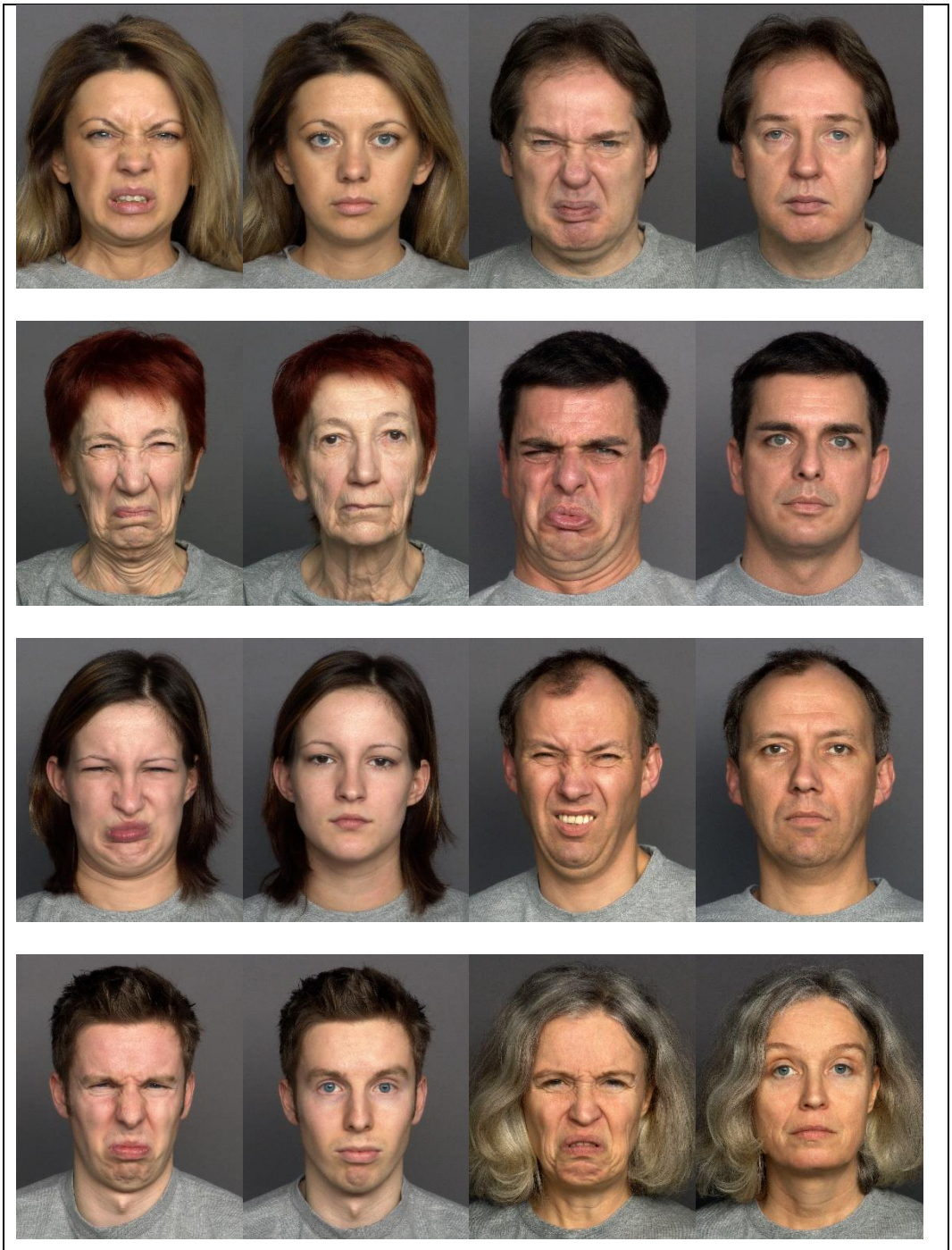
Sincerely, Sarah Etty

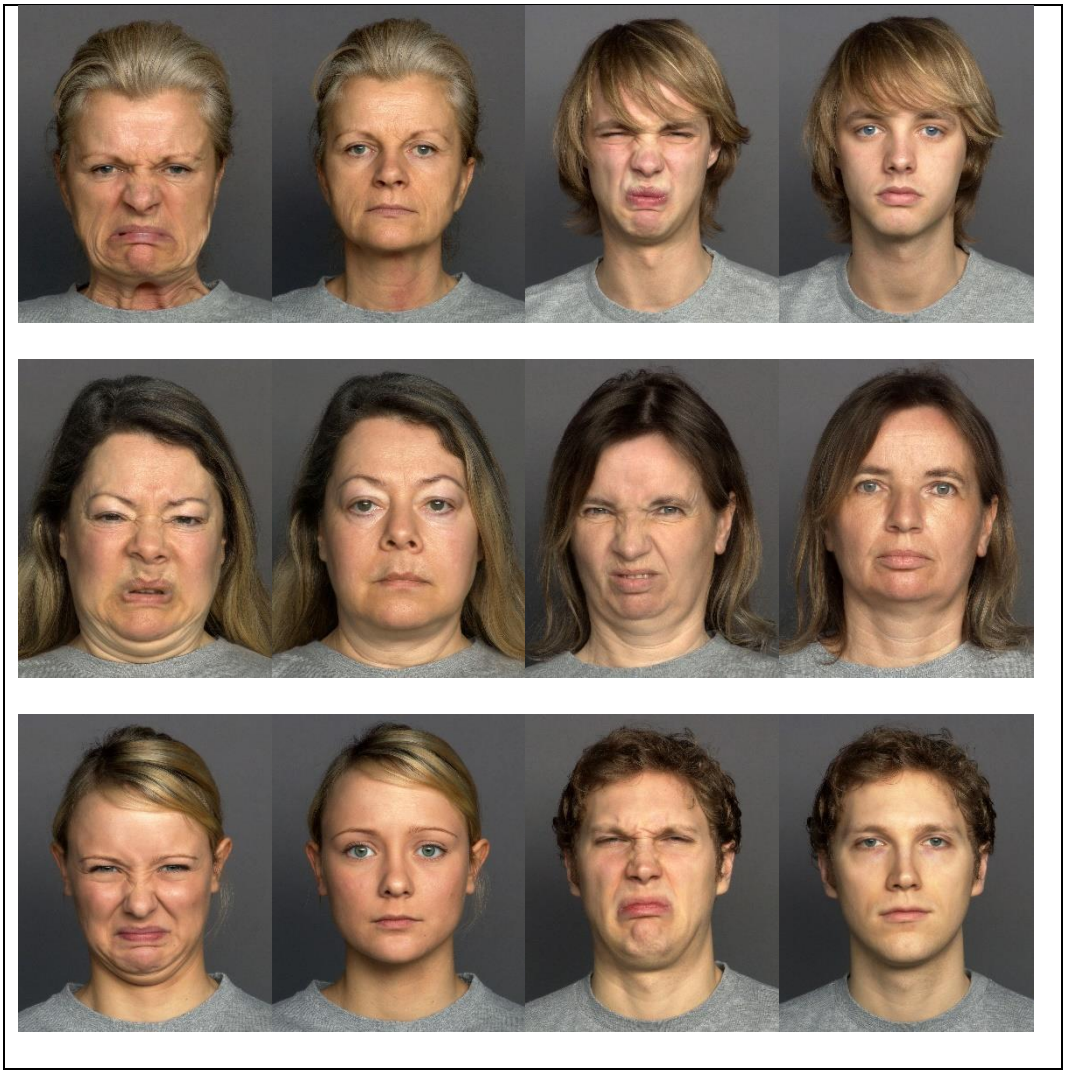
Survey now complete.

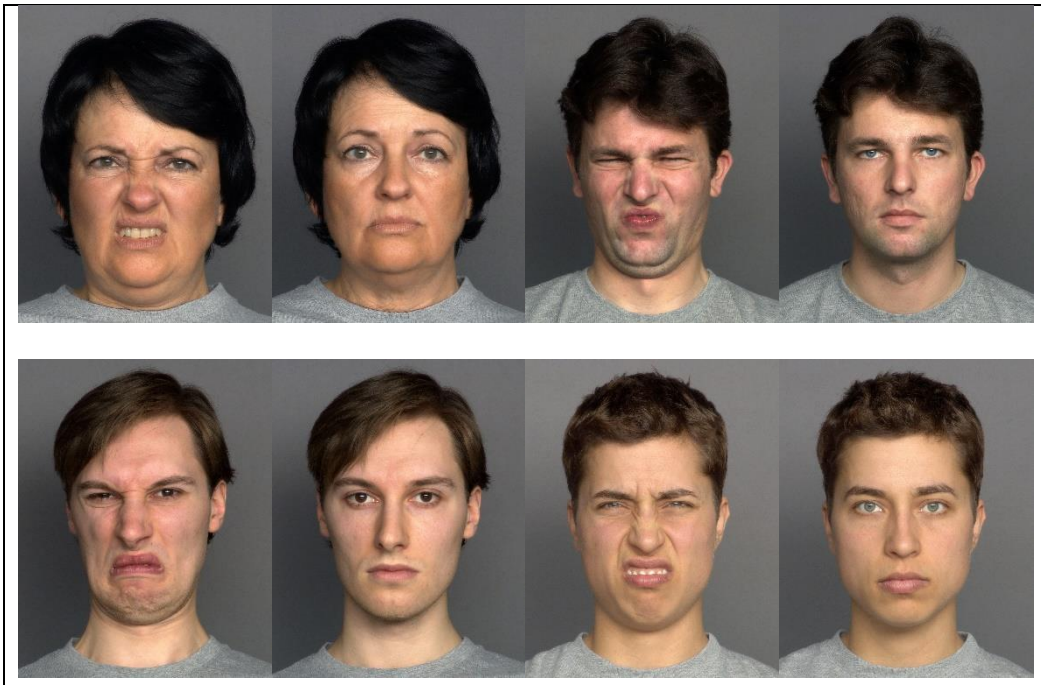
Thanks again for your participation.

Appendix I: FACES Stimuli used in experiments 5 and 6.









[i] The results of experiment 1 have now been published: Etty, S., George, D. N., Van Laarhoven, A. I., & Holle, H. (2022). Acute Itch Induces Attentional Avoidance of Itch-related Information. *Acta dermato-venereologica.*