

# BIRD SOUNDS AND PERCEIVED RESTORATION

Bird sounds and their contributions to perceived attention restoration and stress recovery

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### Acknowledgments

This work was supported by the Economic and Social Research Council [grant number ES/J500148/1]; the National Trust; and the Surrey Wildlife Trust. We thank Peter Brash and Andrew Jamieson for their ornithological advice, and three anonymous reviewers for their helpful comments on an earlier version of this manuscript.

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### Highlights

- We explored reasons for restorative perceptions of bird sounds
- Thematic analysis of twenty interview transcripts revealed three main themes:
- Affective and cognitive appraisals, and relationships to nature
- Acoustic, aesthetic, and associative properties were also implicated
- Perceptions of restorative value vary between bird species

Natural environments, and particularly visual stimuli in nature, are usually perceived as restorative following stress and attention fatigue. Studies extending these findings to auditory natural stimuli have used soundscapes comprising multiple types of sound. Birdsong recurs as a type of sound used in such studies, but little is known about restorative perceptions of bird sounds on their own and how these may relate to existing theories of environmental restoration. Via semi-structured interviews with twenty adult participants, bird songs and calls were found to be the type of natural sound most commonly associated with perceived stress recovery and attention restoration. However, not all bird sounds were regarded as helpful for such processes. Three themes formed the basis of these perceived relationships: affective appraisals, cognitive appraisals, and relationships with nature. Sub-themes of the acoustic, aesthetic, and associative properties of bird sounds were also related to restorative perceptions. Future studies should quantitatively examine the potential of a variety of bird sounds to aid attention restoration and stress recovery, and how these might be predicted by acoustic, aesthetic, and associative properties, in order to better understand how and why sounds such as birdsong might provide restorative benefits.

## 1. Introduction

Birdsong is an almost universal part of our experience of the outdoors, with almost 600 species known to be native to the United Kingdom and many of these found in cities as well as in the countryside. Even though the visibility of avifauna may be limited, particularly in urban environments, their songs and calls make it easier to identify their presence. Bird sounds feature commonly in studies that explore attention restoration and stress recovery via natural sounds and soundscapes (e.g. Alvarsson, Wien, & Nilsson, 2010) and particularly perceived restorativeness (e.g. Kjellgren & Buhrkall, 2010; Payne, 2012), but to date we are unaware of any published studies that seek to understand reasons why bird sounds might be perceived as restorative. To this end, the present study aimed to qualitatively explore the restorative potential of bird sounds after imagined cognitive fatigue or stress. Given the lack of previous research on attention restoration or stress recovery and bird sounds in particular, a qualitative approach was chosen in order to

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explore and identify reasons for participants' restorative perceptions of bird sounds in their own words, and how these might relate to existing theories of attention restoration and stress recovery.

### 1.1. Theoretical perspectives

Both direct and indirect experience of nature has been shown to generate cognitive, affective, and psycho-physiological benefits following stress and attention fatigue (e.g. Berman, Jonides, & Kaplan, 2008; Hartig, Evans, Jamner, Davis, & Gärling, 2003; Ulrich et al., 1991). Theoretical explanations for these benefits are drawn from two main frameworks; attention restoration theory (ART; Kaplan & Kaplan, 1989; Kaplan, 1995), which posits an information-processing approach to restorative experiences, and stress recovery theory (SRT; Ulrich, 1983; Ulrich et al., 1991), which suggests that affective appraisals of one's environment are responsible for restorative outcomes.

Attention restoration theory (ART; Kaplan & Kaplan, 1989; Kaplan, 1995) suggests that cognitive and affective benefits of exposure to nature arise through replenishment of the cognitive resources required to direct or sustain attention over an extended period. Such replenishment is proposed to occur through use of effortless attention, enabling recovery of resources required for sustained or directed attention. Kaplan and Kaplan (1989) suggest that this effortless attention is engaged through stimuli that are fascinating, and particularly those that encourage what is termed soft fascination – in other words, they do not occupy all of an individual's attention but provide opportunity for reflection. Kaplan (1995) also notes that fascination may be necessary but not sufficient for complete restoration: these fascinating stimuli should be part of an environment that generates a sense of being away, or psychological escape from demands on directed attention; is compatible with one's aims and desires for a restorative experience; and offers sufficient extent to explore the environment. By qualitatively exploring reasons why birdsong might be regarded as restorative, we hoped to explore whether such phenomena might be explained by aspects of the ART framework.

Ulrich's (1983) stress recovery theory (SRT) also draws on evidence of the benefits of natural environments and how they can facilitate reductions in physiological arousal following stress. These

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benefits, and associated improvements in positive affect and attention, are argued to arise as a function of interest in and positive affective appraisals of natural environments that possess certain adaptive qualities. These qualities may be aesthetic, such as the levels of complexity, pattern, depth, surface texture, and mystery within an environment, or semantic, such as the absence of threat and presence of resources. Ulrich (1983) argues that positive appraisals of such environments and subsequent reductions in arousal and negative affect may lead to recovery from stress and associated attention depletion.

In his 1983 work Ulrich noted that previous studies on the affective benefits of exposure to natural environments, leading to the development of his psycho-evolutionary SRT framework, had focused largely on visual responses. However, Ulrich draws on the work of Berlyne (1960, 1971) in proposing relationships between interest, arousal, and aesthetic properties such as complexity and pattern. Berlyne's own work on these collative variables was not limited to visual stimuli but also included sounds, and as such it is reasonable to suppose that interest in, and affective appraisals of, natural sounds might also be explained in part by their aesthetic properties. Furthermore, given suggestions by Morton (1977) that acoustic properties of animal sounds such as smoothness, intensity, and pitch are related to the presence or absence of threat associated with these sounds, it is possible that such properties might influence affective appraisals of bird sounds and their subsequent ability to facilitate perceived recovery from stress in a similar way to visual structural properties.

Although ART and SRT were used as frameworks to guide thematic analysis where appropriate, this study did not compare the validity of the two theories; rather, they were used as tools in order to develop an understanding of perceptions of bird sounds within existing theoretical parameters and to relate reasons for restorative potential to existing theorised processes. However, aspects of participants' experiences that are not addressed by ART or SRT are highlighted and discussed.

### 1.2. Natural sounds and restoration

Despite the predominantly visual focus of existing literature on perceived and actual attention restoration and stress recovery in nature, recent research suggests that sound may influence such processes.

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Payne (2012) observed that a rural soundscape was perceived to be higher in restorative potential than soundscapes from a park or an urban setting. Kjellgren and Buhrkall (2010) noted that participants responded negatively to the lack of non-visual natural stimuli when experiencing nature through video-recordings as opposed to direct contact. One participant described themselves as “missing the smells and sounds” of nature, while another described it as being “too quiet” (Kjellgren & Buhrkall, 2010, p. 470). This suggests that natural sounds may contribute to the restorative experience, perhaps because they signify a living or vital natural environment. Such an interpretation would speak to an SRT perspective of an evolutionarily adaptive natural environment and ultimately to the concept of biophilia (Ulrich, 1983, Wilson, 1984); that is, the sounds of nature may be linked intrinsically to the environment in which humans evolved and to a state of being alive.

Jahncke, Hygge, Halin, Green, and Dimberg (2011) studied attention restoration following fatigue in office settings, and found that exposure to a natural soundscape (river and bird sounds) enhanced self-reported motivation to work to a greater extent than did listening to office sounds. In the context of SRT, Alvarsson et al. (2010) found that a similar natural soundscape (birdsong and running water) was rated as more pleasant than sounds from the built environment, and induced faster recovery from stress as measured by skin conductance level. Goel and Etwaroo (2006) found that listening to birdsong accompanied by classical music reduced self-reported negative affect. Together, these studies indicate that natural sounds and soundscapes may facilitate affective and physiological recovery from stress and negative mood, yet they do not explore why such sounds might be beneficial or whether specific sounds in nature may offer restorative potential on their own. Bird sounds are common to the soundscapes used or described in the studies listed above, and their prevalence suggests that they may merit further study.

### 1.3. Bird sounds, attention restoration, and stress recovery

Participants in previous studies on natural stimuli have commented specifically on their positive appraisals of birdsong; for example, in Kjellgren and Buhrkall’s (2010, p. 469) study a participant notes, “The singing of the birds makes me feel relaxed,” and a participant in Fredrickson and Anderson’s (1999, p.

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31) interviews on wilderness experiences reports, “It was so incredible being able to hear the birds...”.

However, little attention has been paid to reasons why birdsong might be perceived as beneficial for stress recovery or attention restoration, and indeed whether such perceptions may vary between different types of birds. In the studies cited above, birdsong or bird sound is used as a general descriptor for the sounds used, yet this is not a uniform stimulus and listeners may perceive different bird sounds in varying ways. For example, the sounds of songbirds are perceived as pleasant yet calls of gulls are not (Björk, 1985), and such differences could lead to variation in restorative perceptions, particularly in light of SRT’s focus on affective appraisals. Bird songs and calls can vary in complexity and pattern, just as visual natural stimuli do, and as such variation in restorative perceptions may in part be explained by aesthetic properties as proposed by Berlyne (1960, 1971) and by SRT (Ulrich, 1983; Ulrich et al., 1991). Equally, different birds produce characteristic calls and songs that vary in acoustic properties such as pitch, intensity, and roughness. Given Morton’s (1977) argument that such properties may serve as symbols of a bird’s size and aggressive intent, it may be that certain bird calls symbolise threat that, according to SRT, would increase arousal and reduce perceptions of stress recovery. However, research that explores such potential reasons for variation in restorative perceptions of different bird species is currently lacking.

Different bird species may also symbolise phenomena that are specific to an individual or a culture; for example, Mynott (2009) and Cocker (2013) note that owls may be associated with positive attributes (wisdom) as well as negative (death), and that British perceptions of robins as positive and cheerful signs in the depths of winter may be at odds with traditional European folklore which associates robins with death and sacrifice. Individuals may learn to associate the sounds of particular birds with their practical or instrumental meaning; for example, pigeons on city streets are often seen as negative or an annoyance, and it may be that their sounds take on these properties by association. Personal connection to nature may also influence how restorative birds and their sounds are perceived to be by different individuals. While existing theoretical approaches to restorative environments generally view connection to nature as a general human trait, recent work in the fields of connectedness to nature suggests that this may vary individually (e.g. Mayer & Frantz, 2004). To extrapolate, not all birds may be perceived as restorative, and not all listeners may find them restorative. As such, it seems sensible to explore how personal associations with different

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birds and their sounds, as well as one's overarching relationship with the natural world, might influence the extent to which they are considered beneficial for restoration.

### 1.4. Aims

An exploratory qualitative study was conducted in order to understand the extent to which bird sounds related to perceptions of attention restoration and stress recovery in natural environments. These sounds, and mechanisms through which they might produce such benefits, were identified through semi-structured interviews with a sample of adult residents of the United Kingdom. Transcripts were analysed using a version of thematic analysis (Braun & Clarke, 2006; Hsieh & Shannon, 2005) in order to identify themes that might underpin relationships between bird sounds and perceived restoration, and to relate them to existing theories. Relationships between natural sounds and creativity were also explored in the interviews, but these fall beyond the scope of this paper and are not discussed here.

## 2. Method

### 2.1. Participants and design

A volunteer sample of twenty adults (ten male and ten female) resident in South East England took part in individual semi-structured interviews. The interviews were advertised as part of a study on how people felt about their surroundings. Participants were recruited through a combination of advertising online (nine participants), locally distributed flyers (one participant), and snowball sampling amongst academic networks (ten participants). Ages ranged from 22 to 74 ( $M = 49.54$  years,  $SD = 18.12$ ), and participants were recruited according to age quotas comprising at least three males and three females in each of the following age brackets: 18 – 44; 45 – 64; and 65 years or older. These brackets were informed by age groups used in ONS (2011) population estimates. Fifteen participants were British, four were dual nationality (British/Irish, British/Indian, British/Turkish, and British/Portuguese), and one was Ukrainian. All had been

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resident in the UK for at least three years. Three lived in rural areas, ten in suburban areas, and three in urban areas. Participants were not compensated for their time.

### 2.2. Measures

*2.2.2. Semi-structured interview schedule.* Semi-structured interviews were guided by a schedule of open-ended questions (see Appendix A). The schedule opened with a warm-up section that prompted participants to discuss their favourite place and why they liked it. Participants were then asked to imagine two separate scenarios; one of directed attention fatigue, and one of stress and negative affect. In each scenario, participants were asked what kinds of places would facilitate their recovery. Prompts were used as necessary in order to encourage participants to consider whether a natural environment such as a park, garden, forest, or the beach, and which sensory aspects of it, might help, and conversely which aspects might hinder restoration and stress recovery. Nine participants were asked to respond to a stress recovery scenario and then an attention restoration scenario, and this order was reversed for eleven participants so as to control for exhaustion of responses early in the interview.

### 2.3. Procedure

After providing informed consent and demographic details, participants completed the semi-structured interview and were then thanked and debriefed. All participants were interviewed by the first author in a one-to-one setting where possible, such as the participant's own home, or else in quiet spaces such as a laboratory. Interviews lasted between 20 and 50 minutes, and were audio-recorded and transcribed. The names of participants, third parties (e.g. participants' friends and family), and locations were removed in order to protect confidentiality.

### 2.4. Analysis

Interview transcripts were analysed through thematic content analysis (Braun & Clarke, 2006; Hsieh & Shannon, 2005), enabling identification of key themes that were then related to attention restoration

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theory (ART; Kaplan & Kaplan, 1989; Kaplan, 1995) and stress recovery theory (SRT; Ulrich, 1983) where appropriate. This approach was chosen in order to ground findings of perceptions of bird sounds within the data, but also to use the existing frameworks as tools to facilitate understanding of participants' perceptions of bird sounds without constraining their interpretation. We acknowledge the active role of the researchers, and particularly the first author, in identifying themes within the transcripts as an integral part of the analysis (Braun & Clarke, 2006). Thematic content analysis was judged to be appropriate because of the exploratory nature of the study, and the relative lack of literature on the contribution of audio, and particularly bird sounds, to attention restoration or stress recovery in nature.

Individual transcripts were read thoroughly and repeatedly in order for the first author to become immersed in the data. Text was highlighted where it related to participants' responses regarding natural sounds and restoration, in order to generate codes regarding key concepts. These codes were supported by the researcher's comments and reflections made whilst reading the text. After all relevant codes had been extracted they were grouped into categories and broader themes. Categories and themes were related to existing theories (ART and SRT) where applicable. This process occurred for each transcript, and new themes that emerged from later transcripts were related back to previous transcripts. Finally, a list of themes and categories that commonly occurred across transcripts was generated in order to describe shared experiences amongst participants. Themes that did not occur commonly but still provided insight into experiences and perceptions of natural sounds are also presented below. The first author conducted the reading and initial coding. Coding and groupings into categories and themes were discussed and reviewed with the second and third authors to form a consensus in order to enhance reliability of the analysis. Texts relating to ART and SRT were analysed separately, but are presented together below due to overlap in themes and participants' tendencies to use terms relating to stress and attention fatigue interchangeably.

### **3. Results and discussion**

One hundred and eighty-six instances of natural sounds in relation to attention restoration and stress recovery were identified across the twenty transcripts. Content analysis revealed that bird songs and calls were the most commonly mentioned sounds, accounting for 35% of sounds mentioned, followed by water

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(24%), non-avian animals (18%), elements (12%), and other sounds such as interaction with nature and silence (11%). As such, birds seemed to be the most salient source of restorative sounds in natural environments discussed by participants, and thematic analysis was conducted on responses relating to bird sounds only. Three themes were identified as potential contributors to relationships between bird sounds and perceived restoration and stress recovery: affective appraisals, cognitive appraisals, and relationships with nature. These themes are discussed individually below.

### 3.1. Affective appraisals

Participants' affective appraisals of different bird sounds were related to how helpful or unhelpful they believed these sounds would be during restoration from attention fatigue and stress. In several cases participants used specific bird species as exemplars. Bird sounds that generated positively valenced or pleasant appraisals were judged to be helpful, whereas those that generated negatively valenced appraisals were not. Bird sounds associated with perceived attention restoration and stress recovery also tended to generate affective appraisals of low arousal, although this was not always the case. These appraisals may be formed on the basis of associations with the bird sound as well as its acoustic properties. Relationships between affective appraisals of bird sounds and their perceived restorative value may align with Ulrich's (1983) SRT approach, in that the positive or negative meanings of hearing certain bird sounds are related to how restorative they are perceived to be. These affective appraisals focus on feelings of safety and happiness versus feelings of threat and danger, with the former judged to be more restorative.

#### *3.1.1. Positive valence and low to moderate arousal*

##### *3.1.1.1. Associations*

Bird sounds that were associated with pleasant events or stimuli were felt to be helpful for attention restoration and stress recovery because they generated positive affective states and were associated with memories of positively valenced times and places. For several participants these associations related to the enjoyment of childhood and were focused on specific bird sounds, as Participant L notes:

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I think it's the wood pigeon. That kind of reminds me of summer and sort of long, hot summers and so when I hear that sometimes it takes you back and you feel, like, you know-, so your childhood-, nice, yeah...

Birdsong was also related to perceived stress recovery through associations with states of low activation or arousal. For Participant M, birdsong was equated with states of both positive valence and low arousal, and this aided his perceived relaxation from stress.

I love the sound of birdsong, by the way. That's beautiful for when you're trying to relax. ... I guess it's peace, isn't it? It's serenity, to hear birdsong.

### *3.1.1.2. Acoustics*

Appraisals of positive valence and low arousal were also related to the sound itself and its acoustic properties. Participant Q felt that the sounds made by chickens would generate a state of comfort, which would help her to relax following stress.

Chickens. I dig in the garden and they come and I throw them the slugs and they go *buk-buk-buk*.

And it's a very comfortable, chatty sort of sound.

Participant T reflected on the melodious acoustic properties of birdsong, and related these to the positive valence she achieved through listening to it, although not necessarily low arousal.

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Well, it's so tuneful. It starts to make you think about music and how music is put together. ... I don't know, I just like the sound of birds singing. I just like the sound of them. Makes me feel happy, I suppose.

### *3.1.2. Negative valence and high arousal*

#### *3.1.2.1. Associations*

Bird sounds that generated affective appraisals of negative valence and/or high arousal were considered to be unhelpful for attention restoration and stress recovery. For several participants this was tied to a particular species, the magpie, whose sound was associated with negatively valenced meaning; that is, aggressive behaviour towards other birds. For Participant U, these associations were perceived to generate stress and would detract from relaxation.

... when a magpie's very raucous it means it's probably being aggressive to something else, and therefore that's a stressful sound because it's against something. It's antagonising another bird, attacking another bird.

Participant I felt that certain bird sounds, such as owls hooting, would be unhelpful for stress recovery because they would generate negative affective states such as fear in relation to himself, rather than the welfare of other birds.

Well, any squawky birds. Ones that go, 'Rarr! Rarr!', you know? I don't know if there are any birds like that, there probably are. ... But these are all archetypal spooky sounds. Screeches, owls hooting, branches cracking. ... Because they're frightening.

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This participant described hooting owls as negative archetypes, suggesting that he considered his negative appraisal of this type of sound to be common to other individuals. However, Mynott (2009) notes that owls can have other, positive archetypal associations, including wisdom, and that the symbolism of bird species can vary depending on cultural context. As such, it may be more valuable to focus on meanings attached to bird sounds by individuals, rather than making generalisations.

It is also notable that certain bird sounds may be liked, but may not be considered helpful for restoration or stress recovery. Participant Q commented that the sounds made by red kites would not help her to relax. For her, these sounds were highly arousing and negatively valenced, in that they afforded negative symbolic meanings of aggression. Although she stated that she liked these sounds, and while sounds need not be positively valenced to be liked (see Hunter & Schellenberg, 2010, for a discussion on valence and liking in music), her response suggests that liking may not be sufficient for a sound to be restorative:

And often the red kites, again, will be wheeling overhead, so I hear them. ... I'm not sure it's relaxing, actually. I like it, but I don't think it's a relaxing sound because it's quite an aggressive sound... yeah, it's the symbol of them, the power of them.

### *3.1.2.2. Acoustics*

Certain birds, such as crows and magpies, were also perceived to generate affective appraisals comprising negative valence and moderate to high arousal as a function of their acoustic properties such as harshness and loudness. These appraisals were related to perceptions of the sounds being unhelpful for restoration or stress recovery. Participant U described these qualities as irritating and therefore generating appraisals of moderate to high arousal: “Irritating birds ... Maybe magpies, which can be very raucous...” However, Participant T viewed these qualities in terms of negative valence rather than arousal: “The noise

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that crows make is pretty horrible, actually. It's that sort of squawking noise. But I wouldn't think it would stress me, it's just unpleasant really.”

Taken together with Participant U's earlier observation that the raucous sound of a magpie is associated with its aggressive behaviour, it may be that the acoustic and associative properties of bird sounds are not wholly dissociable. Just as Ulrich (1983) suggests that certain structural properties of a natural landscape may be related to their adaptive benefits and resulting affective appraisals and restorative value, so too may acoustic properties of bird sounds represent their adaptive value or meaning to a listener; for example, that rough, loud sounds are associated with aggressive animals or animal behaviours (Morton, 1977), and as such may be viewed as unpleasant and potentially unhelpful for attention restoration or stress recovery.

### 3.2. Cognitive appraisals

In addition to affective value, perceptions of bird sounds as restorative or non-restorative were also influenced by participants' cognitive appraisals of the sounds. These appraisals centred on bird sounds as a source of alternative focus during stress and attention fatigue that could distract one from problems at hand, and as a novel stimulus away from everyday environments, as well as one that would be easy to process and attend to. These sub-themes align with concepts of attention restoration put forward in Kaplan & Kaplan's (1989) ART framework.

#### 3.2.1. *Distraction*

Participant I perceived the song of the blackbird as a welcome distraction when he was in a state of attention fatigue: “Yeah, well, the birds singing. Blackbirds singing. ... Well, it's distraction, you see.” Participant U expressed a similar response, noting that birdsong provided him with a source of alternative focus when he was stressed or fatigued:

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We sit and feed and look after the birds a lot, so certainly I would sit and listen to the birds, or the squirrels. ... Because you forget what it is that you're-, why you're there. If you're doing what you're suggesting, I'm there to relax or to get mental stress out of it, so anything that would make me concentrate on something other than that would help, I suppose.

These responses appear similar to the concept of fascination in ART (Kaplan & Kaplan, 1989; Kaplan, 1995), which suggests that natural stimuli can provide a source of alternative focus that is beneficial during attention fatigue. The connection between birdsong as a distraction and the concept of fascination was made explicit by Participant E, who described the sound of an owl as something that fascinated him. He also suggested that the sound afforded both positive and negative valence, in that he thought it was nice but that it also had frightening associations. This echoes the response made by Participant I, for whom owl sounds generated negative valence, but here Participant E suggests that this association may be a learned response as a result of media exposure rather than an innate response.

There are sounds that fascinate me, like we've got a resident owl which really-, I don't know whether I think it's creepy or what. I like it, you know. It makes you think of these horror movies you get and so on, but in a way it's a nice thing.

These contrasting positive and negative appraisals may mirror Kaplan and Kaplan's (1989) argument that fascination can be hard or soft; that is, wholly compelling, such as violence or gore, or gently engaging, such as non-threatening natural stimuli. In the context of bird sounds, Participant E's observation suggests that this fascination may also be hard or soft, although it is not clear to what extent this might influence restorative outcomes. It is notable that Kaplan (1995) discusses bird-watching as a process-based type of fascination, and Participant E appears to derive similar fascination from the act of bird-'listening'.

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The process of being distracted by listening to bird sounds also seemed to offer participants an opportunity to escape demands, and even to gain a different perspective on such concerns. As Participant U noted:

The sounds. If there are any birds about, perhaps helping you to relax. ... Because it helps you forget what you were there-, if you're stressed you've got something in your mind, you now, turning it over, and if you've got sounds outside yourself. ... If you hear neighbours, that's going to irritate you, so if you had something in your mind that is irritating and stressed you, then something like birds, you would concentrate on that sound and that would, you know, take your-, you'd concentrate on something else other than what it is you're trying to get away from.

### 3.2.2. *Effortless attention*

In addition to providing distraction or an alternative focus, participants' responses also suggest that bird sounds are perceived as easy to attend to. Participant D described bird sounds as “a part of being, it's not something that's imposed upon me, it's something I've chosen to do and they're there. I said that they help me relax, it's a part of the experience.” This view was supported by comments from Participant N, who noted that natural sounds, including birdsong, are “all relatively low-key, so the sound doesn't impose on one.” Participant S used a passive expression to describe the process of distraction achieved through listening to birdsong, supporting the notion that this process is effortless: “... again, takes your mind off that particular piece of work that you might have been doing or trying to concentrate.” Together, these responses suggest that bird sounds may be experienced in a bottom-up manner that is not effortful or likely to place further demands on attention or affect.

### 3.2.3. *Novelty*

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The relative novelty of birdsong also contributed to Participant S's perceptions of these sounds as restorative after attention fatigue. He noted that the dissimilarity between birdsong and other, everyday acoustic stimuli contributed to its role as a source of distraction or alternative focus. "Yeah, I mean obviously I might hear some birds. ... it's just because it's something different. It's a different sort of sound." This supports findings from the field of environmental aesthetics, such as the work of Berlyne (1960, 1971), in which novelty has been positively associated with both interest and arousal.

Participants also commented that the novelty of birdsong provided a sense of distance from everyday environments. Participant L indicated that bird sounds were not common in her usual, urban environment, and that this would help her relax: "Again I guess birds, that's probably quite relaxing, the birds singing. You don't get that too much in [location omitted]." Participant S also described a relationship between the novelty of birdsong and a feeling of being away from inside environments that would aid stress recovery. "Oh, something different. You don't normally hear it. Inside your flat or your house, you don't have that sound. I don't have a budgerigar. Other people might."

Participant S's comments suggest that, for him, bird sounds serve as a symbol of an environment that is away from his daily life indoors, and that the novelty of this sound is an important part of this symbolism. It seems reasonable that novel or exotic stimuli might generate a sense of being away, and indeed a relationship between environmental novelty and physical being away was reported by Laumann, Gärling, and Stormark (2001). Participant S also comments on the potential for individual differences in relation to novelty, in that bird sounds were novel and therefore perceived as restorative for him, but this may differ for other individuals who keep birds as pets, for example.

### 3.3. Relationships with nature

In addition to meanings and properties of the sounds themselves, the relationship between bird sounds and restorative perceptions was also influenced by participants' connections with nature. This

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appeared to be a two-way relationship, in that experience of bird sounds and birdsong helped some participants to interact with or feel more connected to nature, yet for other participants the benefits achieved through birdsong were limited by low existing affinity with nature or conflicting contextual needs. These findings may correspond with existing evidence suggesting that exposure to nature can increase one's feelings of connectedness to the natural world (e.g. Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2008), as well as the attention restoration theory construct of compatibility which implies that restorative stimuli or environments must be compatible with one's aims.

### *3.3.1. Interactivity and connection to nature*

For Participant G, listening to birdsong in her garden was part of a quasi-social experience in that she regarded the birds she interacted with as though they were friends. This experience generated positively valenced affective appraisals which she perceived as restorative. “Well, this robin. It's so lovely. It's like a friend when it comes within feet of you and just sits there, singing. And you get jays and finches. It's just nice.” It is interesting to note that existing restoration research suggests that experience of nature with human company can reduce its restorative potential (Staats & Hartig, 2004), yet Participant G's comment indicates that restorative potential may be found through non-human animal company. Participant G's response also suggests that restoration can occur through a transactional, rather than passive or bottom-up, experience of the natural world. This perspective was also expressed by Participant U, for whom listening to birds in the context of restoration was related to his habit of feeding and caring for the birds in his garden: “We sit and feed and look after the birds a lot, so certainly I would sit and listen to the birds...”

Comments from Participant J provide a complementary perspective. She noted that hearing birds helped her to feel more connected to nature, which in turn helped her to feel removed from sources of stress. “And I think it's a connection, I think you feel connected with nature and, you know, something that's a bit more-, well, what I consider to be more real than some of the stressful things that happen in life...” Here, this participant reflects on how hearing birdsong can enable her to connect not just with nature but also with something beyond her sources of stress. This may be related to the concept of escape discussed earlier, in

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that the connection to nature achieved through birdsong appears to remove or distance this participant from stress or demands.

### 3.3.2. *Contextual and individual differences*

Although many participants indicated that birdsong was often helpful for restoration, responses from two participants indicated that these perceptions might vary with personal and situational context.

Participant R had earlier described herself as “not really an outdoor kind of person” and went on to describe her perceptions of bird sounds when cognitively fatigued as follows: “... most nature noises like birds, you know, bees and wasps and things, they don't really-, they bother me, if I'm in that mood. I don't want to kind of hear animal noises and stuff.” For Participant R, the sounds of nature, including birds, were perceived to generate negative affect and would not be restorative, and this appeared to be connected to her self-identification as being disinterested in, and perhaps not highly connected to, nature. Within literature on restorative environments, recovery from stress or attention fatigue is often considered from an evolutionary psychology or biophilia perspective (cf. Kaplan & Kaplan, 1989; Kaplan, 1995; Ulrich, 1983; Ulrich et al., 1991) in which nature is generally considered to be positively regarded by humans, yet participant responses here suggest that individual differences in connectedness to nature may also be a relevant factor in the perceived restorative potential of birdsong, and that this may merit further study within restorative environments.

Participant J also noted that certain birds could act negatively on attention restoration if their sounds were in conflict with her current aims. “... the other night a cat climbed up one of the trees and was trying to get at the magpies, and they were flying down at it, dive-bombing the cat, and making the most horrific noise. So that kind of kept me awake, annoying.” For this participant, the sounds made by magpies were incompatible with her need for sleep, and as such generated negatively valenced appraisals and would not be considered restorative; indeed, they were considered to be unpleasant noise. It is possible to draw a parallel

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between these perceptions and the ART construct of compatibility, in that bird sounds that are incompatible with one's context-dependent needs for restoration seem unlikely to be restorative.

### 4. Conclusions

The present study aimed to explore the role of bird sounds in restorative perceptions of nature after imagined stress and attention fatigue. In so doing, transcripts from semi-structured interviews with twenty adult participants were analysed using thematic content analysis (Braun & Clarke, 2006; Hsieh & Shannon, 2005). One hundred and eighty-six instances of sounds were mentioned in relation to restoration from attention fatigue and stress, of which birds were the most commonly discussed sound source. Three themes were identified as potential contributors to the relationship between bird sounds and perceived attention restoration and stress recovery: affective appraisals, cognitive appraisals, and relationships with nature. Together, these suggest that certain bird sounds may aid perceived restoration from stress or fatigue by encouraging positive affect and reduced arousal, alternative and effortless attentional focus to novel stimuli, and connection to nature. Associations and acoustic and aesthetic properties were also perceived to influence restorative potential through these themes, often in relation to specific bird species. However, low levels of existing connection to nature may reduce the likelihood of restoration through bird sounds, as may incompatibility between the sound and a listener's current aims.

#### 4.1. Birdsong and restoration

The findings of the present study build on existing work on the role of sound, and particularly bird sounds, in restorative perceptions of nature (e.g. Payne, 2012; Kjellgren & Buhrkall, 2010). In line with SRT (Ulrich, 1983), bird sounds judged to be restorative also generated affective appraisals of positive valence and low arousal. Bird sounds that were associated with threat or aggression tended to generate appraisals of negative valence and high arousal, and were not considered to be restorative. Furthermore, some participants discussed personal associations with birds and bird sounds that influenced their affective appraisals and how restorative they were perceived to be.

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Restorative perceptions of bird sounds were also explained to some extent by potential correlates of ART factors (Kaplan & Kaplan, 1989). Bird sounds were perceived as welcome distractions that effortlessly removed participants from cognitive or affective demands, in a manner akin to the ART construct of fascination. The popularity of 'birding' in the United Kingdom and elsewhere suggests that there is something especially captivating about birds over and above other animals, perhaps due to their beauty, musical sounds, and their relative otherness, emphasised by their ability to fly (Cocker, 2013). We found that the relative novelty associated with bird sounds, particularly in comparison to urban or built environments, also contributed to their perceived ability to distract or remove participants from sources of stress or fatigue. Contextual differences such as present aims and needs may moderate restorative benefits, echoing the ART compatibility factor. Individual differences in affinity with nature were found to affect perceptions of bird sounds as restorative. Birdsong in general was considered helpful for restoration, which may speak to a biophilic perspective in which these sounds symbolise vitality of nature and a sense of all being well in the world, but this may be contingent on participants' existing connection to nature.

Perceived restorative benefits of bird sounds varied between bird species, as well as between participants. For example, although non-specific birdsong was generally discussed in a positive, restorative context, birds with unmelodic calls or aggressive behaviours were judged to be non-restorative, and this relationship was underpinned by affective appraisals. This may support Berlyne's (1971) findings on the effects of acoustic properties on affective appraisals of sounds, and supports Morton's (1977) argument and Ulrich's (1983) SRT framework in that threatening sounds may result in negative appraisals and reduce likelihood of restoration. Equally, the finding that novelty appeared to relate to perceived attention restoration aligns with Berlyne's (1960) suggestion that novelty and cognitive processes such as interest may be related. Symbolism, such as meanings or memories associated with bird sounds, acted on restoration through affective appraisals, and suggests a role for semantic, as well as acoustic and aesthetic, properties in perceptions of restoration through birdsong.

Given the finding that different bird sounds may provoke orthogonal responses in relation to restorative perceptions, restoration studies utilising birdsong as a stimulus should be mindful of the types of bird sounds or species that they include. In order to aid such choices, future research should seek to

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understand the extent to which acoustic and aesthetic qualities, and positive or negative associations, might predict ratings of valence, arousal, and restorative benefits amongst different types of bird sounds.

### 4.3. Limitations and opportunities for extension

The interviews utilised vignettes in which participants were asked to imagine their responses to situations of attention restoration or stress recovery in nature. Participants responded readily to the vignettes of imagined stress and directed attention fatigue, but may have been limited by the extent of their imagination or experience, or the lack of audible prompts for them to respond to in relation to natural sounds. Future qualitative studies may benefit from being conducted in outdoor settings or with auditory stimuli available for participants to experience and refer to in their responses. This may enable the collection of more detailed and representative data, as well as the direct comparison of auditory stimuli with other sensory experiences of natural environments.

The study was advertised as exploring relationships between people and their surroundings, with no explicit focus on relationships with the natural environment. However, we acknowledge that self-selection may limit the generalisability of our findings, in that participants willing to discuss their thoughts on ‘environments’ may also have an interest in nature. The snowball sampling technique used alongside online and local advertising may also have resulted in a high proportion of participants willing to discuss environmental views.

Participants sampled for this study were ordinarily resident in South East England. We sampled participants from rural, suburban, and urban areas, but the findings may not generalise well to residents elsewhere in the United Kingdom or elsewhere in the world. Affective appraisals of different bird sounds may vary depending on participants’ familiarity with the birds as a function of geographic location. Exotic bird sounds may generate different appraisals to those with which participants are familiar or have become habituated, and this may have effects on arousal and attention. Studies on this topic would extend understanding of how cognitive and affective appraisals interact with variables such as novelty.

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### 4.4. Summary

This exploratory study sought to identify the relative contribution of birdsong to perceptions of attention restoration and stress recovery in nature amongst a group of adult participants, and reasons why this might be. Birdsong was the sound most commonly associated with participants' restorative experiences in nature, although restorative perceptions varied between different bird species based on their acoustic, aesthetic, and associative properties. Three themes were found to contribute to the relationship between bird sound and restoration from stress and attention fatigue. The themes broadly correspond with theoretical explanations of cognitive and affective restoration from both attention restoration theory (ART; Kaplan & Kaplan, 1989) and stress recovery theory (SRT; Ulrich, 1983), although the perceived importance of personalised experiences with, and connectedness to, nature was also emphasised. These findings suggest that specific natural sounds may offer perceived restorative benefits, and provide opportunities for future studies to quantitatively measure relationships between bird sounds and restorative potential and outcomes. We hope that these findings might extend study of restorative audio environments and support the work of conservationists by showing the perceived importance of bird sounds in the psychological experience of nature.

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APPENDIX A

**Interview schedule**

Main questions or statements by the researcher are given in plain text; prompts that were asked only if required are given in *italics*.

**Introduction**

- a. First, thank you for very much for agreeing to be interviewed today. The interview will last around 30 - 45 minutes. Its purpose is to explore which kinds of environment you might like to visit if you feel a certain way or need to do a certain task.
- b. During the interview I'm going to ask you a number of questions about places you might like or not like to go to, but there are no right or wrong answers – I'm just interested in your thoughts and experiences. At times I might ask the same kinds of questions from different angles. If you would prefer not to answer a question, that's fine, just let me know. If you would like to take a break at any time, you can let me know and we can pause the interview.
- c. I would like to audio record the interview for the purposes of transcription, but your name will not be included in the transcription or the final report – only your gender, age, and participant number. I'll also make a few notes during the interview just to remind me of points we might want to return to. Are you happy for me to turn the audio recorder on now?

*[If no, researcher to suggest taking notes instead.]*

**Warm-up**

- I'd be interested to know what your favourite place is. *[By 'favourite place' I mean a place that is important to you, or well-liked by you, or valuable to you personally].* Can you tell me a bit about it?
  - *What is it like?*
  - *Why do you like to go there?*
  - *What kind of things do you do there?*

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### ART

- That's great, thank you. Now I have a few scenarios that I'd like you to imagine. In the first scenario, I'd like you to imagine that you're exhausted after working hard on a task, and you're finding it hard to concentrate. Where would you go in order to restore your ability to concentrate?
  - *Would you go to a natural environment? [e.g. a park, garden, forest, the beach...]*
    - *If yes, can you describe it for me?*
      - *What about that place do you find restorative? [Things you can see / hear / smell / touch]*
        - *Why do you think that is?*
    - *If no, why is that?*
- Are there any natural environments that would make it harder for you to concentrate?
  - *Can you describe them for me?*
  - *Why might they make it harder for you to concentrate?*
    - *Why do you think that is?*

### SRT

- In the next scenario I'd like you to imagine that you are stressed and in a negative mood, perhaps after having an argument. Where would you go in order to relax?
  - *Is there a natural environment that you might go to?*
    - *If yes, can you describe it for me?*
      - *What about that place do you find relaxing? [Things you can see / hear / smell / touch]*
        - *Why do you think that is?*

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- *If no, why is that?*
  
- Are there any natural environments that would increase your level of stress?
  - *Can you describe them for me?*
  - *What about them do you find stressful? [Things you can see / hear / smell / touch]*
    - *Why do you think that is?*

### **Closing**

We're coming up to the end of the interview now. Is there anything else about different places, and particularly natural environments, that you would like to talk about? OK, that's great – thank you very much for your time and participation. I'll turn off the recorder now.