

Sequencing Nature: A Hypothetical Neuropsychological Model of Landscape-Guided Regulation of Attention and Self-Referential Processing in Therapeutic Ornithology

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Abstract

Therapeutic ornithology is conceptualized as a structured nature-based intervention that utilizes focused visual and auditory engagement with wild birds to enhance mental health. This paper proposes a hypothesis-generating neuropsychological framework in which a deliberate sequence of natural environments guides participants through three phases of psychological processing: (1) redirection of attention away from internally focused, ruminative thought toward external stimuli, (2) stabilization of attention and sustained present-moment engagement, and (3) reflective, non-ruminative self-referential processing and integration.

We suggest that distinct landscape types may differentially support these processes, with open environments characterized by birds moving freely across space from multiple directions, forested settings supporting sustained external focus with birds that are difficult to detect visually and are primarily perceived through their vocalizations, and aesthetically valued semi-open landscapes enabling reflective processing, with birds that are present in a relatively stationary manner and are not easily disturbed or flushed. The proposed model is informed by observational data from therapeutic sessions and is situated within current literature on large-scale brain networks implicated in attention and self-referential processing, including the dorsal and ventral attention networks and the default mode network.

The framework advances the hypothesis that structured exposure to natural environments may contribute to reductions in maladaptive rumination and improvements in attentional and affective regulation, processes relevant to common mental disorders such as depression and anxiety. The model is intended to guide future empirical research and to inform the development of scalable, nature-based mental health interventions.

Attention; Self Concept; Rumination; Environment; Mental Health; Cognitive Therapy

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INTRODUCTION

Contact with natural environments has been associated with improvements in mental health, including reductions in perceived stress, attenuation of maladaptive rumination, and resto-

ration of directed attention. These effects have been described within the framework of Attention Restoration Theory (ART) [1,2] and are increasingly examined in relation to large-scale brain networks implicated in attention and self-related processing, including the default mode network (DMN) and attentional networks (dorsal and ventral attention networks; DAN, VAN) [3,4,5].

Emerging evidence suggests that different types of natural environments may differentially engage attentional and affective processes. Open landscapes (e.g., meadows or fields) may facilitate rapid, stimulus-driven attentional capture, potentially supporting disengagement from internally focused, ruminative thought [6,7]. In contrast, more densely structured environments, such as forests, provide sustained and multimodal sensory input (including auditory, olfactory, and visual stimuli), which may promote stable external attention and present-moment engagement [4,7]. Semi-open environments combining elements of prospect and refuge (e.g., water bodies bordered by vegetation) have been associated with reflective and contemplative states, which may support adaptive forms of self-referential processing and experiential integration [8,9]. These patterns are broadly consistent with findings suggesting that natural environments may influence the balance and interaction between attentional systems and the DMN, although the underlying mechanisms remain incompletely understood.

Importantly, the relationship between environmental complexity and psychological restoration does not appear to be linear. Environments characterised by very high levels of sensory input and biodiversity (e.g., highly dense ecosystems) may, under certain conditions, lead to sensory overload, increased bottom-up attentional demands, and difficulties in maintaining coherent attentional focus [8]. Such conditions may be associated with increased cognitive fatigue and reduced restorative benefit. This suggests that environments of moderate complexity—providing sufficient richness to elicit interest without overwhelming attentional capacity—may be optimal for attentional regulation and psychological restoration.

Biodiversity, and in particular avian diversity, appears to be an important contributor to

these effects. Observational and epidemiological studies indicate that higher bird species richness is associated with improved self-rated mental health, lower levels of anxiety and depression, and enhanced subjective restoration, with some effects persisting for several hours following exposure [10,11,12]. Birds may act through multiple pathways: as salient and dynamic sensory stimuli that attract attention, as a source of “soft fascination” consistent with ART, and as stimuli capable of eliciting positive affective and symbolic responses [13,14,15].

Importantly, human–bird interactions should not be regarded as a homogeneous form of contact. Browning et al. [16] propose the concept of interaction patterns (IPs) to distinguish generalizable forms of engagement with birds according to the specific human action and the nature of the relationship with the bird-related stimulus. Thus, watching wild birds, listening to bird-song, photographing birds, caring for a companion bird, participating in citizen science, or encountering birds incidentally represent distinct interaction patterns that may engage different psychological, cognitive, behavioral, and physiological processes. This distinction is particularly relevant when interpreting evidence for health and well-being benefits, because findings associated with one interaction pattern cannot necessarily be generalized to other forms of human–bird contact. For example, the effects of listening to recorded birdsong are conceptually and mechanistically different from those of active birdwatching, caring for a companion bird, or incidental exposure to birds in everyday environments. The authors suggest that that research on the health effects of human–bird interactions should consider specific interaction pattern–outcome pairings rather than treating contact with birds as a single, uniform exposure. It is therefore important to note that different interaction patterns may engage different sensory, cognitive, emotional, and behavioral processes, which in turn may involve partially distinct neural and physiological pathways and ultimately lead to different health and well-being outcomes.

Within this context, therapeutic ornithology may be conceptualised as a structured, professionally guided nature-based intervention based on attentive observation and listening to wild birds [17,18,19]. Although preliminary observa-

tions and related lines of research suggest potential benefits for attentional and affective processes, a coherent theoretical framework linking environmental structure, attentional dynamics, and mental health outcomes remains underdeveloped. The present paper addresses this gap by proposing a hypothesis-generating neuropsychological model of therapeutic ornithology, with particular relevance to mechanisms implicated in common mental disorders, including depression and anxiety.

The aim of the present paper is to propose and theoretically justify a conceptual neuropsychological model in which a deliberate sequencing of natural landscape types is hypothesised to guide the dynamics of mental processes during therapeutic ornithology sessions across three successive phases: (1) redirection of attention from internally focused, ruminative thought toward external stimuli, particularly in open environments featuring salient and dynamic bird activity; (2) stabilization of attention and sustained present-moment engagement, as may occur in more densely structured environments with high levels of multimodal sensory input; and (3) reflective integration and non-ruminative self-referential processing, potentially facilitated by aesthetically valued semi-open landscapes.

The model is informed by phenomenological observations derived from conducted sessions and is situated within current neuroscientific and ecopsychological literature. Within this framework, landscape is conceptualised as a potential modulator of attentional regulation, emotional arousal, and self-referential processing, processes that are implicated in common mental disorders. This perspective may contribute to understanding mechanisms underlying the beneficial effects of nature-based interventions, including therapeutic ornithology.

In the context of Browning et al. [16], this distinction is particularly important because the proposed relationships between specific interaction patterns, sensory experiences, attentional processes, and health and well-being outcomes should be regarded as hypothesis-generating rather than as established causal mechanisms. The framework provides a basis for distinguishing potentially different pathways through which bird-focused experiences may influence human functioning, but the available

evidence does not yet allow these pathways to be considered empirically established. Different interaction patterns may involve distinct combinations of sensory, cognitive, emotional, attentional, and behavioral processes and may therefore engage partially different physiological and neural mechanisms. Accordingly, the health and well-being effects associated with listening to birdsong, actively watching birds, caring for companion birds, or incidental exposure to birds should not necessarily be assumed to arise through the same mechanisms. Determining whether such mechanisms are actually involved, and whether they differ between interaction patterns, will require empirical studies incorporating validated psychological measures together with behavioral, physiological, and, where appropriate, neuroimaging methods.

Therapeutic Ornithology – A Case-Based Illustration

The conceptual reflections presented in this paper are informed by observations from therapeutic ornithology sessions conducted by the author during training as a certified forest therapy guide, organized by the Relational Ecotherapy Institute in May 2025 in Budy, located within the Białowieża Forest. The Białowieża Forest represents one of the most ecologically valuable and ornithologically rich regions in Europe, providing a particularly suitable context for bird-focused nature-based interventions and their potential effects on mental health [20]. The area attracts a substantial number of birdwatchers annually, reflecting both its biodiversity and its broader cultural, economic, and health-related significance.

Therapeutic ornithology should be distinguished from recreational birdwatching. It may be defined as an intentional, structured, and typically professionally guided intervention based on attentive engagement with wild birds—primarily through observation, listening, and experiential presence—with the aim of enhancing mental health, supporting emotional regulation, and facilitating adaptive psychological processes [18,21,22]. Within this approach, attention is not directed toward the natural environment in general, but rather toward specific focal stim-

uli—birds—which function simultaneously as perceptual, cognitive, emotional, aesthetic, and symbolic cues [11,17,21].

A central feature of this intervention is a shift in emphasis from taxonomic identification toward the subjective psychological experience of the participant. While species recognition may occur, it is not the primary objective. Instead, the intervention focuses on processes such as the regulation and direction of attention, modulation of emotional arousal (including both activation and calming), and the attribution of personal meaning to the encounter [14,15,21,22]. In contrast to informal birdwatching or hobby-based ornithological activity, therapeutic ornithology employs bird observation as a deliberate tool of psychological influence, with reported effects including emotional calming, mood enhancement, reductions in anxiety and loneliness, and improved coping with stress [17,18,23].

Previous publication has distinguished between two related constructs describing the psychological effects of engagement with birds [19]. The term bird therapy refers to spontaneous, self-directed engagement in bird observation associated with subjectively perceived improvements in well-being. In contrast, therapeutic ornithology denotes a structured, planned intervention conducted by a trained professional with the explicit aim of improving mental health outcomes.

Participants in therapeutic ornithology sessions have described the perceived mechanisms of action across multiple domains, including perceptual (shifting attention toward external stimuli), emotional (positive affect and calming), cognitive (curiosity and environmental orientation), social (shared experience), symbolic (associations with freedom, continuity, and hope), and existential dimensions [21]. These multi-level effects are consistent with broader conceptualisations of nature-based interventions as engaging interacting cognitive, affective, and meaning-related processes.

In the literature and practice, related approaches are described using a range of overlapping terms, including contemplative birding, mindful birding, slow birding, bird-observation therapy, bird-based interventions, bird-assisted wellbeing practice, bird-centered nature therapy, mindful bird observation therapy, therapeutic

contact with birds, and bird observation as a therapeutic intervention [13,16,20,24]. This terminological diversity reflects the emerging and interdisciplinary nature of the field, as well as the need for clearer conceptual frameworks such as the one proposed in the present paper.

Attentional Redirection

A central mechanism underlying therapeutic ornithology, supported by observational data and prior literature, is the rapid redirection of attention from internally focused, often ruminative mental content toward external environmental stimuli [11,21,25]. This process involves a shift in cognitive processing from self-related thoughts and affective states toward salient features of the environment, including the presence, movement, and vocalisations of birds. Such externally oriented attentional engagement appears to be associated with a reduction in the dominance of internally generated content and a corresponding increase in present-moment awareness.

Participants in therapeutic ornithology sessions have described this process as a subjective relief from persistent thoughts and worries, accompanied by emotional calming and improvements in mood [11,21,26]. In previous observational work conducted during the COVID-19 pandemic, participants reported a temporary disengagement from ongoing psychological burdens, including pandemic-related stressors [26]. These reports suggest that engagement in bird observation may facilitate a transient suspension of ruminative processing and support a shift toward externally anchored experience.

Similar observations have been described by Harkness [23], who emphasised that focused visual and auditory attention directed at specific, dynamic natural stimuli may narrow the attentional field and reduce the salience of intrusive thoughts. This process may be understood as a temporary reorganisation of cognitive-emotional processing, allowing for a reduction in perceived psychological load and facilitating subsequent re-engagement with everyday demands in a more regulated manner. In this context, bird observation can be conceptualised as a form of attentional and arousal regulation, associated with reductions in tension and anxie-

ty, and with restoration of engagement with the external environment [17,25,26].

Therapeutic ornithology differs from formal psychotherapeutic modalities such as group psychotherapy, although certain processual analogies may be noted. While group psychotherapy typically takes place in a controlled indoor setting, therapeutic ornithology sessions are conducted in natural environments and involve movement through space. Despite their relatively shorter duration (approximately 1.5–2 hours), these sessions demonstrate an observable internal dynamic at both the individual and group levels. Importantly, the natural setting allows for the integration of environmental features into the unfolding psychological process.

The central proposition of the present paper is that the deliberate selection and sequencing of environmental contexts within therapeutic ornithology sessions may correspond to successive

phases of participants’ psychological processes. Within this framework, therapeutic ornithology may be defined as a structured, nature-based supportive intervention in which engagement with birds in their natural habitat is utilised to promote mental health, reduce stress, and support attentional and emotional regulation. A distinguishing feature of this approach is the active role of the environment: landscape characteristics—including spatial openness, sensory density, acoustic properties, and aesthetic qualities—are conceptualised not merely as contextual factors, but as elements that may modulate psychological processes.

Observations from conducted sessions suggest a recurring pattern of three broad phases of psychological engagement, each associated with different environmental conditions. These phases, corresponding to distinct types of landscapes, form the basis of the conceptual model proposed in this paper (see Table 1).

Table 1. An experience-based three phases model of the psychological process in therapeutic ornithology and the corresponding landscape types

Phase	Psychological process	Environmental characteristics	Practical remarks / mechanism of action
1	The participant’s mind remains engaged with current matters, problems, and intrusive thoughts, and needs to disengage from this ongoing mental processing.	Open terrain with isolated trees and shrubs, requiring the participant to scan the surroundings in different directions and repeatedly shift attention to locate and follow moving birds against the background.	Attention is actively directed away from rumination toward external, dynamic stimuli, requiring repeated shifts of attention across different directions to detect and follow birds.
2	Focus on being present in the “here and now”; cutting off from everyday worries	Forested area; proximity of trees, high density of visual and auditory stimuli (song from many directions); birds less easy to notice	Sustained engagement of attention with multiple, dynamic natural stimuli, promoting immersion in the present moment and further disengagement from internally focused thought.
3	A shift toward inward attention and contemplation, allowing awareness of one’s own emotions, memories, and thoughts without returning to rumination on current problems.	Semi-open, aesthetically valuable landscape (e.g., reedbeds surrounded by forest, a bridge over a river with a view)	Transition from externally focused attention toward contemplative awareness, potentially facilitating awe, emotional processing, psychological integration, and a sense of connection with something larger than oneself.

At the outset of a session, participants typically remain cognitively preoccupied with ongoing concerns, including plans, tasks, and worries. Exposure to open landscapes featuring visible and dynamic bird activity distributed across

different parts of the visual field may facilitate a shift of attention away from internally focused, ruminative content toward external stimuli. Detecting and following birds appearing in different directions requires active scanning of the en-

vironment and repeated shifts of attention across the visual field. This initial phase may therefore support disengagement from habitual patterns of internally focused and ruminative thought.

In the intermediate phase, once attention has been redirected outward, more densely structured environments—characterised by rich and multimodal sensory input (e.g., auditory, olfactory, and visual stimuli)—may promote sustained attentional engagement and immersion in the present moment. The abundance and spatial distribution of these stimuli can occupy a substantial portion of the perceptual field, requiring continuous engagement with the surrounding environment and potentially reducing cognitive interference from everyday concerns. This phase may therefore be characterised by a state of sensory and attentional immersion, broadly consistent with present-moment awareness and mindfulness-like experience.

In the later phase, attention may gradually shift back toward inward-oriented processing; however, this shift is qualitatively different from the earlier ruminative mode. Rather than returning to ongoing worries and problem-focused thought, participants may engage in reflective and integrative processing of their emotions, memories, and thoughts. Semi-open environments that combine extended views with elements of enclosure (e.g., tree lines or reed-beds) may support this transition toward a more contemplative mode of awareness. Such settings may facilitate experiences of awe, a greater sense of connectedness with the natural environment, and increased awareness of one's inner experience.

Taken together, this sequence suggests that the deliberate selection and ordering of landscape types may function as a structured component of the intervention rather than as a contextual background. Environmental characteristics and the presence of birds may act synergistically to support successive phases of attentional regulation, emotional processing, and psychological integration.

Neurobiological Model

The psychological processes described above may be interpreted within a neuropsychologi-

cal framework; however, the present work does not include direct measurements of brain activity and should be understood as a theoretical model grounded in existing neuroscientific literature on responses to natural as compared with built environments. As key reference points, we draw on studies by Kühn et al. [7], who examined resting-state functional connectivity during exposure to natural versus urban scenes, and by Kim et al. [6], who investigated patterns of brain activation under comparable conditions.

These studies suggest that natural and built environments are associated with distinct patterns of neural activity. Exposure to natural environments has been linked to activation in regions implicated in emotional regulation and cognitive control, including the anterior cingulate cortex, prefrontal areas (superior and middle frontal gyri), parietal regions (including the precuneus), basal ganglia, and insular cortex, which has been interpreted as reflecting a state of regulated cognitive-emotional engagement [7]. In contrast, urban environments have been associated with increased activation in regions linked to emotional reactivity and threat processing, including the amygdala, hippocampus, parahippocampal gyrus, temporal pole, inferior frontal gyrus, and occipital visual areas [7].

Within the proposed model, these findings may provide an indirect framework for interpreting the observed phases of therapeutic ornithology. In the initial phase, participants may present with a pattern of heightened internal preoccupation and arousal, which can be conceptually aligned with increased limbic reactivity and stimulus-driven attentional capture. Subsequent exposure to natural environments may be associated with a shift toward patterns of activity related to attentional regulation, cognitive control, and positive affect, although this remains to be empirically verified.

Differences between the intermediate and later phases may be interpreted in relation to large-scale attentional systems, including the dorsal attention network (DAN), supporting goal-directed (top-down) attentional control, and the ventral attention network (VAN), associated with stimulus-driven (bottom-up) attentional reorientation [27,28]. Kühn et al. [7] reported that exposure to natural stimuli was associated with increased functional connectivity between

DAN and VAN, as well as between attentional networks and the default mode network (DMN), compared with built environments. Such findings suggest that natural environments may facilitate greater integration between externally directed attention, internally oriented processing, and sensorimotor systems.

More recent studies indicate that exposure to natural environments may strengthen functional connectivity between the DMN and attentional and executive networks, potentially supporting recovery following stress and reductions in rumination [4,5]. Within the present framework, this may correspond to a transition from externally oriented attentional engagement toward reflective, non-ruminative forms of self-referential processing.

Previous research on the neural correlates of human–bird interactions has addressed these phenomena at a different level of analysis from that proposed in the present conceptual framework. As highlighted by Browning et al. [16], only nine studies included in their review assessed brain activity or neural function, with these studies relying predominantly on electroencephalographic (EEG) recordings [29,30] and magnetoencephalography (MEG) [31]. These studies provide valuable evidence of changes in neural activity in response to bird-related sensory experiences, particularly birdsong, but they do not directly address the more complex relationships between specific interaction patterns and the functioning of large-scale brain networks proposed in the present framework. Thus, the existing neurophysiological literature should be regarded as an important foundation for understanding the neural basis of human–bird interactions, while more advanced neuroimaging approaches may be required to investigate the proposed mechanisms at the level of large-scale brain networks.

From a process-oriented perspective, the proposed sequence of environmental contexts may be understood as supporting successive shifts in modes of cognitive-emotional functioning. Open environments may facilitate initial attentional capture and disengagement from ruminative processing through salient external stimuli. More complex, multimodal environments may support sustained attentional engagement and regulation of arousal, potentially involving coor-

dinated activity of DAN and VAN. In later stages, semi-open and aesthetically structured environments may facilitate reflective processing, which may be conceptually linked to interactions between attentional systems and the DMN.

Importantly, the role of the environment in this model is not limited to a passive background. Rather, environmental characteristics may act as modulators of attentional allocation, emotional arousal, and self-referential processing. The sequential organisation of landscapes is therefore conceptualised as a structured component of the intervention, potentially guiding transitions between cognitive-emotional states.

These neurobiological considerations should be interpreted with caution. The present study did not include neuroimaging or other direct measures of neural activity, and therefore does not provide empirical evidence for the activation of specific brain regions or networks in the context of therapeutic ornithology. References to the limbic system, attentional networks (DAN, VAN), and the DMN are intended to provide a theoretically plausible explanatory framework consistent with existing literature [5,6,7], rather than to demonstrate causal mechanisms. Furthermore, the cited studies were conducted under controlled laboratory conditions, often involving brief exposure to visual stimuli, and may not fully capture the complexity of prolonged, multisensory, and socially embedded experiences in natural environments.

Finally, the effectiveness of therapeutic ornithology is likely to depend on a range of contextual and individual factors. Greater engagement in bird observation has been associated with stronger restorative effects, irrespective of formal expertise [32]. The development of intuitive and embodied recognition of birds (so-called “jizz”) may reduce cognitive load and facilitate attentional engagement [33]. Environmental conditions, including weather, do not appear to uniformly diminish therapeutic effects, with subjective experience and individual adaptation playing a significant role [34]. These observations are consistent with broader findings in ecotherapy and nature-based interventions, which emphasise the active role of environmental context—including landscape characteristics, biodiversity, and sensory qualities—in shaping psychological outcomes [9,14,16,35]

In the context of the growing burden of mental health disorders and ongoing environmental change, the deliberate design of nature-based interventions that account for the temporal sequencing of environmental exposures and individual differences in engagement may help optimize their therapeutic potential and facilitate their application across diverse populations. The present model represents a preliminary, hypothesis-generating framework intended to inform future empirical research, including experimental, neuroimaging, and longitudinal studies, and to support the potential integration of therapeutic ornithology into mental health care and prevention strategies.

Clinical Implications

The proposed model of therapeutic ornithology has several potential implications for clinical practice, particularly in the context of common mental disorders such as depression and anxiety, where maladaptive rumination, attentional dysregulation, and impaired emotional regulation play a central role [25,36]. By conceptualising structured engagement with natural environments as a process that may facilitate shifts in attentional focus and modes of self-referential processing, therapeutic ornithology may offer a complementary approach to existing psychological interventions.

One potential application lies in supporting the reduction of ruminative thinking. The initial phase of externally oriented attentional engagement may provide a practical method for interrupting repetitive negative thought patterns, which are characteristic of depressive and anxiety disorders. This mechanism may be particularly relevant for patients who experience difficulty engaging in traditional cognitive or mindfulness-based techniques that require sustained internal focus.

The intermediate phase, characterised by sustained engagement with multisensory environmental stimuli, may support the development of attentional stability and present-moment awareness. In this respect, therapeutic ornithology may share functional similarities with mindfulness-based interventions, while offering an externally anchored and potentially more acces-

sible form of attentional training. This may be beneficial for individuals who find conventional mindfulness practices challenging or insufficiently engaging.

The later phase, involving reflective and non-ruminative self-referential processing, may provide a context for adaptive introspection and emotional integration. Such processes are relevant to recovery-oriented approaches in psychiatry, where the capacity to reflect on one's experiences without being overwhelmed by them is considered an important therapeutic goal.

From a service delivery perspective, therapeutic ornithology may represent a low-cost, scalable, and ecologically valid intervention that can be implemented in community and outpatient settings. It may be particularly suited to preventive and early-intervention contexts, as well as to populations with limited access to formal mental health services. The intervention may also be integrated with existing treatment modalities, including psychotherapy and pharmacotherapy, as an adjunctive approach supporting broader therapeutic goals.

However, several considerations should be taken into account. The proposed model is conceptual and requires empirical validation. The effectiveness of the intervention is likely to depend on individual factors, including baseline symptom severity, attentional capacity, motivation, and familiarity with natural environments. Environmental variables, such as accessibility, biodiversity, and safety, as well as practical factors (e.g., weather conditions), may also influence outcomes.

Future research should aim to evaluate the clinical effectiveness of therapeutic ornithology using controlled study designs, including randomised controlled trials, and to investigate its mechanisms of action using behavioural and neurobiological measures. Particular attention should be paid to identifying patient groups most likely to benefit, as well as to optimising the structure and delivery of the intervention.

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