Cover letter, response to reviewers.

We would like to thank all reviewers for your careful reading of our manuscript. We appreciate the insightful comments and suggestions and believe that they have contributed significantly in producing a stronger manuscript. Below are our responses to your comments. We are also submitting a revised manuscript which have all changes marked with the “track changes” feature in Microsoft Word.

Please keep in mind all references to lines relate to their line number with track changes visible.

Reviewer 1.

The manuscript addresses the topic of great interest: the psychological and physiological recovery exerted by natural environments.

*The introduction offers a fairly complete picture on the issue of research and directly related topics, but the literature analysis is not particularly up-to-date. In particular, using the keywords indicated by the authors, it is easy to identify more recent studies (as of 2016) that have not been covered.

**From the methodological viewpoint, the paper does not provide any indication of the method followed that can be guessed in the course of reading. It would be desirable for the authors to dedicate at least a few lines to describe what way to introduce the new theoretical approach to the issue. Is it a theoretical building?

***The remaining parts of the paper are very clear and the authors' positions well argued, although the conclusions are perhaps a little too concise with respect to the relevance that the proposed new theoretical approach might have.

**Finally, in order not to leave any doubt about the originality of this paper, it would be appropriate for the authors to clarify how their research compares to another manuscript that can be easily found on the web with a very similar purpose:

**Exploring the restorative effects of environments through conditioning - The conditioned restoration theory

https://brage.inn.no/innxmlui/bitstream/handle/11250/2426176/MPSY3010%20Masteroppgave%20Lars%20Even%20Egner%20september%202016.pdf?sequence=1

Since it is only a matter of perfecting the manuscript, I think I can attribute a minor revision before its publication.

Response:

Thank you for your review.

*We agree that more up-do-date research could be covered in the section where we review empirical research related to the CRT. To address this specifically, we added a new larger paragraph in this section to cover aspects related to virtual reality, as well as significantly expanded our section on whether previous/work experience with nature affect restoration.

**The issue of methodological viewpoint and the relationship to the similar manuscript are related. Both issues have its roots in that the authors initially thought the review was double blind, which we now realize it is not. The manuscript you located is the earliest formalization of the theory, which was submitted as a master’s thesis to
the Inland Norway University of Applied Sciences in 2016. The university lists all its master thesis’ online, which is why it is available. After being substantial reworked and developed, with the cooperation of authors with different backgrounds, we have transformed this initial idea into (what we believe is) a theory ready for publication. To address these issues, we include a compressed version of the history behind the theory, which includes the master's thesis, and the theory building up to its current state. This should clarify the manuscripts relation to the linked document, as well as how the theory was developed.

***We agree that the conclusion is too concise. As you point out, it does actually not contain any information regarding relevance of the theory. We expanded the section regarding this.

Changes:

*New paragraph in line 447-568. Significantly rewritten section 469-491. In total 17 new references added, most of them from 2016 and later.

**Line 177: Added “Originating from a discussion in a lecture on environmental psychology, which later was outlined in a master's thesis (Egner, 2016), the theory was substantial reworked and developed drawing on the different author’s backgrounds from health and environmental psychology. Implementing research from the former to explain phenomena in the latter.”

***Line 651: Added “We believe the theory will contribute to further insight into the mechanisms driving the psychological and physiological recovery exerted by natural environments, as well as other environments. This could improve design of areas where recovery is of great importance, such as the healthcare sector.”
Reviewer 2.

I don't understand the idea of the paper. Is it a literature review, or research paper? Furthermore, authors declared that it theoretically not unique to nature. So what is the novelty of this paper? If it is a literature review, authors should rewrite the paper and suggest the new idea for future researchers.

Response:

Thank you for your review. The idea of the paper is to propose a new theory that add to the understanding of the mechanisms underlying environmental restorativeness. Most specifically, the manuscript elaborate on how classical conditioning processes may contribute to restorative experiences—a concept that challenges previous theories, which argue that certain environments have *intrinsic* characteristics that elicit psychophysiological restoration (such theories, most often identify natural environments containing such intrinsic characteristics, thus being particularly favorable in eliciting psychophysiological restoration). The manuscript primarily falls under the category of research paper, although presentation of new theory often requires a more thorough review of the existing literature, often literature from several fields, than articles presenting original data.

By "not unique", we do not mean that the process itself has been explored outside of nature before. The whole process presented adds novel perspectives to the landscape of existing theories explaining environmental restorativeness, both in application to nature and other environments. By "not unique", we mean that although we present and explore the process in a nature-relaxation ‘pairing’, the process should be applicable to all environment-feeling settings. Please notice that (as mentioned above) most theories on environmental restorativeness assign to natural environments a particular effectiveness in eliciting stress reduction or restoration. At the same time, not only existing theories also recognize that other non-natural environments can elicit stress reduction and restoration, they also acknowledge that not always natural environments are associated with such benefits. In keeping with this, also the process proposed in our manuscript is in theory not unique to nature, but this paper mostly explores that aspect of the process as natural environments are most commonly associated with stress-reduction and restoration.

We agree that if the paper could have been presented as a literature review, where it first reviews the literature, and then presented the new theory. But we argue that because the theory require input from several different scientific fields, such as both healthcare, physiology, and environmental psychology, this would have been tiresome to the reader. We argue it is better to first present the theory first, making it read slightly more as a research paper. However, we agree that the distinction between the two becomes blurred in manuscripts like this.

We made changes to highlight the purpose of the paper, as well as clarify what we mean by "unique".

Changes:

Line 23: Change “theoretically” to “hypothetically”, to clarify that we are not referring to the theory, but to the statement that the theory can be applied elsewhere.

Line 175: Added “new” to “... the purpose of this paper is to present the Conditioned restoration theory (CRT) as a new theoretical framework that may contribute to explaining the mechanisms underlying the restorative effects of nature...” to clarify that the theory is new.
Reviewer 3.

The purpose of this paper is to present the Conditioned restoration theory (CRT) as a theoretical framework that may contribute to explaining the mechanisms underlying the restorative effects of nature, as well as other environments. This paper describe CRT, discuss its strengths and limitations, review research literature that supports it, and proposed how it can be integrated with established theories.

Minor revisions: It is a very interesting paper and for health x environment/culture. I would like to know if it is more papers that could be cited, more examples. The paper is well-done and I suggest the publication after minor revisions.

Response:

Thank you for your review. In line with reviewer 1, which also suggested that more literature should be covered, we have included a range of other papers in the revised manuscript. Most of the new papers cited are focused around the “empirical support” section, introducing a section on virtual reality and significantly expanded the “previous experience” section, as well as the new section 2.9. In total we have added 17 new papers, most of them from 2016 and later, listed below:


Calogiuri G, Litleeskare S, Fagerheim KA, Rydgren TL, Brambilla E, Thurston M. Experiencing nature through immersive Virtual Environments: Environmental perceptions, physical engagement, and affective responses during a simulated nature walk. Front Psychol. 2017;8: 2321.


Reviewer 4

I appreciate the opportunity to read this manuscript and commend the authors for their knowledge and clear explanation of the dominant theories associated with nature restoration and research as well as their efforts to contribute to this area of research. In general, the write up seems thorough and well-referenced, combining foundational literature and current literature.

The subject matter is timely as people learn more and debate the place of the natural environment for the wellbeing of humans. Additionally, mental health issues are a global concern. Please use my remarks to strengthen some of the arguments in your paper.

1* The authors did well bringing in critiques on two long-standing current theories on restoration. It is useful to question the psycho-evolutionary perspective of ART and SRT and thus far there is no way to prove these may have evolved as adaptive traits. However, one does not want to throw the baby out with the bathwater. It is as hard to prove these have not evolved as adaptive traits. Additionally, the authors pointed out that perhaps these theories are related, not mutually exclusive and may work together, indicating a potential problem in academia of trying to split hairs and argue for a certain theory at the risk of not seeing the forest for the trees.

1* Because ART does not, as the authors said, “explain some of the broader psycho-physiological effects of nature exposure, such as quicker hospital recovery time [10], reduced blood pressure, anger and aggressiveness, reduced arousal measured by cardiac interbeat interval [21], and lower sympathetic activation measured through skin conductance level” does not necessarily support a fallacy in ART, but perhaps there is more than ART going on in regards to human’s relationship with nature. Again perhaps ART and SRT work together.

1* A strong takeaway is that there is more to learn about these specific theories as well as human and nature relationships. Their critique of ART and SRT open the door that there could be alternative explanations for the effects seen on human psychology and physiology in regards to human and nature relationships.

1* In that same vein, proving the validity of CRT does not show that ART and SRT are inaccurate, just that CRT may work. Associating nature or other things with relaxation and therefore triggering relaxations makes sense for some people. //Not a line shift here, but I think it’s a different point, so I add it.

2* However, I do not agree that the vast majority of members of modern society interact with nature in relaxing leisure. People not taking the time to interact with nature (the vast majority of people) is often stated a is a cause for concern. Numerous people interact with nature when they have to during disasters such as fires, hurricanes, tornados, floods, and the like. Many people interact with nature in leisure activities but that is not likely the majority of the population.

3* Another weakness in the author’s argument for CRT is that I am not sure it is logical that if a person works in a natural environment they cannot or are not as likely to be restored by it. This does not seem to be true for outdoor guides, for example. More likely the activity the guide teaches may not be as restorative as it used to be, however, many people purposefully engage in work in the outdoors because they enjoy and feel better when working in the outdoors.

4* Other authors have agreed that repeated time in nature when a child often leads to those people spending time in nature as an adult—certainly that could be classical conditioning model—which may be a part of the phenomenon, though it may not be the primary cause or it could be primary. Sorting out the interrelationships are challenging.

5* Humans are wired for forming relationships and need to be in relationships for psychological and physiological health. When people are exposed to nature during outdoor recreation events some people argue that something deep in people’s consciousness is awakened—a time when humans lived in nature relating on a daily basis. It is hypothesized that humans return to outdoor recreation because of that consciousness that is kindled or rekindled. Additionally, many Indigenous people practice relationships with the natural world as Robin Kimmerer has written about. It is about developing a healthy relationship, which, again does not discount that ART, SRT, and CRT may also exist, though Kimmerer and others suggest that looking at a slice when there is a system of relationships at work, may not be fruitful.
6* From the authors: “people tend to assign greater restorative qualities to places with which they have stronger emotional connections than to places with which they have weaker emotional ties [57–59].” This may be about the strength of a relationship, rather than conditioning—though it would be hard to tease these apart.

7* In this manuscript, the grammar is generally sound; there are some typos. There are some writing problems such as a possible spelling error: artefactual. Line 472-3: ART (i.e., being away, compatibility, fascination, and extent): there needs to be a period after the e. Names of theories are not capitalized. Line 148 has an extra period, the page number goes after the quote, and literature is reported in the past tense.

7* As the authors make transitions they often use the word WILL. Such as line 237: But as the article will illustrate, conditioning… Line 240: We will also cover likely … Because the paper is written in the present tense should be used. Please change throughout the paper.

Thank you, again for the opportunity to review this manuscript. It should help inspire discussion about human and nature relationships.

Response:

Thank you for your review.

1* We agree that the paper do not present the possibility of coexisting theories accurately, as well as presents the problem of evolutionary theories somewhat excessively. As you point out, it is indeed not an argument against the theory, it’s just not an argument for the theory, and the theory should rely on something else for validation, as the point about evolution is difficult to prove. Additionally, it is not a strong argument against a theory that it does not explain a broader set of processes leading to an outcome, multiple individual processes resulting in the same outcome can exist. CRT can coexist with other theory, multiple processes and theories most likely apply simultaneously, and we make some changes to highlight this. We think you put this nicely, and hope you do not mind the use of your formulation in the manuscript.

2* Firstly, we realize that the statement regarding the share of people interacting with nature lacks scientific documentation. Secondly, we believe there is probably vast cultural differences, and our belief that the vast majority of people interact with nature in a leisure setting is probably influenced by our own cultural background. To address this, we back the statement up with literature concerning interaction with nature, as well as address disasters and culture. We also add parks to our examples in the same section, to highlight that “artificial” nature such as parks and beaches is also included.

3* We agree with the critique regarding individuals working in nature are less likely to experience restoration in nature. We always meant that the restoration would be potentially lower, not completely removed or less likely to exists; that restoration is not a dichotomy, but a scale. It should also be completely dependent on the persons experience of work. In that work is only a co-variate of less relaxing experiences, not the cause itself. We would hypothesize that outdoor guides have a more relaxed relation to their work, and more positive experiences, than for examples loggers, fire-fighters combating forests fires or soldiers having experienced combat in nature. Unfortunately, we cannot find any literature comparing the restorative levels of different professions. We made some additions to the manuscript to highlight this.

4* We completely agree regarding the difficulty researching the interrelationships regarding childhood experiences and restoration. Although we touch on this in line x 459-461, we expand on this to clarify that we are not actually criticizing the studies for not sorting out the interrelationships, but that this is a methodologically difficult.

5* Thanks for this interesting comment, which has inspired us to include a new section that explore the potential role of CRT in a broader context of human-nature interactions. Please note that, in order to be consistent with our critique on evolutionary approaches (see introduction, line 106 and onwards) we have chosen not to focus on philosophical perspectives that sees people as having a deep/innate connection with nature. We have instead focused on the issue, raised by different authors (including Kimmeree) of broadening the focus including interdisciplinary and complex frameworks to protect biodiversity and promote sustainable
human-nature relationships. In this respect, we acknowledge the limits of CRT as a theoretical framework that mainly focuses on the restorative processes associated with nature exposure (which, to quote you, is just a “slice” of the system of relationships). However, we argue that CRT has the potential to serve as a more flexible framework. On one side, in fact, CRT does not imply that only natural environments with certain (people-friendly) characteristics can elicit psychological benefits, something that would imply the need of ‘taming’ nature to make it more ‘appreciable’ for people. On the other side, CRT may be used to inform programs that aim to promote more sustainable human-nature interactions – in the new section, we provide some evidence that may support such assumption.

6* Good point. We agree with the critique and add this alternative explanation and the difficulty of separating them in the section.

7* Thank you for pointing out these typos. We have made correction regarding all of them. Regarding artifact/artefact, the two terms seems to be used interchangeably, but artefact is mostly used in British English (https://www.oed.com/view/Entry/11133). Regarding the capitalization of theories, we see that we do capitalize some theories, which is wrong. We read through the manuscript to correct most of the cited literature to past tense, we did however not change sentence when the litterature was not directly addressed, such as "The person does not need to be aware of the connection, as contingency awareness is not necessary for evaluative conditioning [45]" or the only change would have been to write inn "have been shown to", making the sentence somewhat unnecessarily longer.
Finally, we changed all uses regarding what the paper “will” do to present tense.

Changes:

1*Line 171: Added “A strong takeaway is that there is more to learn about these specific theories as well as human and nature relationships. The shortcomings of ART and SRT open the door that there could be alternative explanations for the effects seen on human psychology and physiology regarding human and nature relationships.”

1*Line 121: After arguing against the evolutionary grounding, we add “It’s important to note that the reliance on evolutionary innate arguments does not weaken the theory itself, but rather does not strengthen it and should not be used as an argument regarding its validity.”

1*Line 547: Added “It’s important to note that we do not suggest the theories as exclusive. It is fully possible for a mechanism to apply to nature, but not apply to other environments. Different processes can result in the same outcome. Just as ART is not “competing” with SRT [23], CRT offers primarily to explore a previously unexplained mechanism behind restoration, not discredit all other explanations.”

2*Line 216: “While the frequency of interaction with nature is declining, a “extinction of experience” the current level of visitations to nature could still be said to be high [38,39], although we suspect strong cultural variations exist.”

2*Line 220: Added “victims of natural disasters,”

2*Line 227: Added “The share of people exposed to natural disasters is increasing [40], but being exposed to floods could only reduce restoration of water, not mountains.”

2*Line 215: Added “parks, beaches,”

3*Line 225: Added “It important to note that a broad range of “work relations” exist. An outdoor guide’s work relation to forests is most likely more relaxed than that of a logger, which is again more relaxed than that of a seasoned forest fire-fighter.”

3*Line 469-495: Section regarding working relation to nature and restorativeness has been rewritten and expanded on.

4*Line 511: Added “Designing studies that provide evidence for these interrelationships are challenging.”
5*Line 572-610: We added a subheading entitled “CRT within the broader context of a two-sided and sustainable human-nature relationship”

6*Line 342: Added “It should be noted that other explanations than CRT can explain this relationship. It could be because of a stronger relationship with the environment, although teasing apart the two is difficult.”

7*Line 128: Changed “artifact” for “artefact”

7*Line 533: Corrected “i.e,” to “i.e.”

7*Line 40: Changed capitalization of theory.

7*Line 150: Removed extra period and moved page indicator to the end of the quote.

7*Line 97; 147; 237; 250; 340; 341; 348; 376; 387; 393; 394; 426; 473; 474; 504; 566: Rewritten reported research to past tense.

7*Line 183; 211; 235; 257; 260; 366: Slightly reworded to remove “will” and rewrite to present tense.