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Towards a caring transdisciplinary research practice: navigating science, society and self

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ABSTRACT

Transdisciplinary research that bridges science and society is needed to address the complex social-ecological sustainability challenges we are facing. However, many transdisciplinary researchers grapple with balancing the competing demands of scientific rigour and excellence, societal impact and engagement, and self-care. This is especially evident in the growing literature by early-career researchers describing the challenges of pursuing a transdisciplinary research career in social-ecological sustainability research. To guide discussion and reflection towards a flourishing transdisciplinary research practice, we synthesized our own and other researchers' experiences of using a transdisciplinary approach and formulated the heuristic of the 'Triple-S': caring for Science, Society and Self. This heuristic adds the frequently overlooked personal aspects of transdisciplinary research. Current dominant academic structures, cultures and metrics of success are not supporting a balanced and flourishing transdisciplinary research practice, but rather creating and exacerbating the trade-offs between these three aspects. As an example of a solutions-oriented approach, we developed a theory of change to address the changes we see are necessary to enable a transdisciplinary research practice in line with the Triple-S. We hope that this will foster academic environments where transdisciplinary research practice can flourish and the next generation of researchers are not burnt-out, but empowered.

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1. Introduction

The urgency and complexity of global sustainability challenges, such as climate change, biodiversity loss, social injustice, and poverty, calls for new ways forward in sustainability science (Scoones et al. 2020). An increasing number of researchers are critically questioning their traditional role as solely knowledge provider and are becoming increasingly concerned about the practical use of the knowledge they produce, its outcomes and its impacts (Wiek et al. 2012; Wittmayer and Schöpke 2014; Frantzeskaki and Rok 2018; Schöpke et al. 2018; Pereira et al. 2020). During the last three decades, alternative forms of research have emerged to address the divide between science and practice, such as mode 2, post-normal, participatory, action, and transdisciplinary research (Fazey et al. 2018).

Transdisciplinary research seeks to integrate diverse knowledge from academic and non-academic actors to co-produce knowledge or solution options while reconciling values and preferences, and creating ownership for problems as well as solutions (Lang et al. 2012; Roux et al. 2017). Knowledge co-production is an essential element of transdisciplinary research and highlighted as key for science to have greater impact for sustainability

(Lemos et al. 2018; Norström et al. 2020; Scoones et al. 2020). Norström et al. (2020, p. 2) describe knowledge co-production as '*[i]terative and collaborative processes involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future*'. The practice of transdisciplinary research has been applied for decades (e.g. Thompson Klein 2004; Lang et al. 2012), such as in place-based sustainability research on social-ecological systems where it has recently gained more attention (Balvanera et al. 2017a; Cockburn et al. 2019; Pereira et al. 2020; Horcea-Milcu et al. 2020).

Place-based sustainability research on social-ecological systems generally addresses system dynamics and structures, interrelations between the ecological and social subsystems, direct and indirect drivers of change, and seeks potential solutions to support transformative change toward greater sustainability (Berkes et al. 2003; Balvanera et al. 2017b). Place-based research is context-specific, which makes it easier to engage actors in that place. One example of such research that applies a transdisciplinary approach is the study of how local non-governmental organizations with their sustainability initiatives can shift the social-ecological

system of Southern Transylvania in Romania towards a more sustainable state (Hanspach et al. 2014; Lam et al. 2020a).

Place-based sustainability research on social-ecological systems, which applies a transdisciplinary research approach, is at the centre of the Program on Ecosystem Change and Society (PECS) (Carpenter et al. 2012; Balvanera et al. 2017b). During the last ten years, research projects supported by PECS have collected a range of experiences and applications of conducting transdisciplinary research in social-ecological systems, especially from early-career researchers (Hanspach et al. 2014; Cockburn 2018; Sellberg 2018; Lam et al. 2020a; Fischer et al. *this issue*). These experiences provide insights on the benefits of collaborating with non-academic actors and engaging with their diverse knowledge systems (Tengö et al. 2017; Sellberg 2018; Lam et al. 2020b). However, they also shed light on the challenges that transdisciplinary research entails, especially in research conducted by early-career researchers, such as the difficulties of managing expectations of local actors and new researcher roles (Wittmayer et al. 2017; Cockburn and Cundill 2018; Haider et al. 2018; Lindvig 2018). This is part of a growing, but scattered, body of literature where (often early-career) researchers addressing different sustainability issues reflect on the challenges and recommendations of using a transdisciplinary approach (e.g. Patterson et al. 2013; Moore et al. 2018). There is a need to synthesize these experiences and insights in order to further advance transdisciplinary research and support development of the next generation of transdisciplinary researchers.

In this paper, we aim to contribute to such a synthesis across transdisciplinary research experiences and address gaps we have identified: the often-overlooked personal sphere, as well as the need for systemic changes. After describing the methods and approach we took in developing this paper (Section 2), we review the literature on the experiences of early-career researchers conducting transdisciplinary research, highlighting the key *challenges* and *recommendations* (Section 3). While the issues we raise are important for the wider community of transdisciplinary researchers addressing sustainability issues, early-career researchers are at the leading edge of this literature and bring key insights on these challenges. We then offer a new synthesis of this literature through presenting ‘The Triple-S: caring for Science, Society and Self’ (Section 4). The ‘Triple-S’ is a heuristic tool which we have developed to capture the notion that the challenges and opportunities of transdisciplinary research lie at the relational nexus of *Science*, *Society* and *Self*. By this we mean that transdisciplinary scholars are navigating the need to conduct scientifically rigorous research (*Science*), in

a way that engages actively and responsibly with society and is societally relevant (*Society*), whilst also seeing themselves (*Self*) in the research: acknowledging their positionality, taking care of themselves and managing the emotional demands of such engaged research. We believe that adding *Self* to the previously mentioned creative tension between *Science* and *Society* (Lang et al. 2012) better captures the real-world challenges experienced by transdisciplinary researchers and supports reflexivity, which ultimately improves transdisciplinary research (Popa et al. 2015; Temper et al. 2019). In the light of the COVID-19 pandemic and recent debate on well-being and ethics of care in academia, highlighting *Self* and care seems especially relevant (Leveque et al. 2017; Evans et al. 2018; Ives et al. 2019; Corbera et al. 2020). Transdisciplinary early-career researchers are pointing out that current dominant academic environments and institutions are not supporting a balanced and flourishing transdisciplinary research practice, but rather creating trade-offs between the three aspects of the ‘Triple-S’ (see e.g. Patterson et al. 2013; Ruppert-Winkel et al. 2015; Jaeger-Erben et al. 2018). Nevertheless, a systemic approach to address this is often missing. Therefore, we share the process and outcomes of a theory of change which we developed to guide ourselves and others in fostering academic environments where transdisciplinary research practice acknowledging the Triple-S dimensions can flourish (Section 5). In this way, we hope to contribute a solution-oriented and generative resource to support transdisciplinary scholars, and to support ourselves in on-going reflection in our community of practice.

2. Methods and approach

2.1 Who are we and why are we doing this? Reflection in a community of practice

We are four early-career researchers from three different countries who met as doctoral scholars in 2015–2016. We have developed a small community of practice (Wenger 1999; Cundill et al. 2015) through reflecting and sharing our experiences on the practice of transdisciplinary research. We call our group the ‘Transdisciplinary PhD Journeys Community of Practice’. Our story starts in 2015, when two of us (My and Jessica) first met at the inaugural PECS Conference in Stellenbosch, South Africa. Through interactions at various PECS-related conferences and workshops, David and Petra joined us. We all do engaged, place-based research in different social-ecological settings, including rural Transylvania in Romania (Lam et al. 2020a), the Stockholm city-region in Sweden (Sellberg et al. 2020), and South African landscapes (Cockburn

2018; Holden et al. 2019). We were drawn together by our shared commitment to experimenting with transdisciplinary approaches in our PhD research. We anchored this shared interest through a blog series, which we wrote together to exchange and share our reflections (available online here, and also attached as a full-text in [Appendix 1](#)). Since initiating this blog series,

- three of us have completed our PhD dissertations in which we included explicit focus on reflecting on the transdisciplinary experience (Cockburn 2018; Holden 2018; Sellberg 2018),
- we have facilitated workshops and conference sessions (see [Appendix 2](#)), and
- we have published peer-reviewed outputs about our experiences (Cockburn and Cundill 2018; Holden et al. 2019),

to share and expand our understanding and experiences of transdisciplinarity. Leaders in the PECS community have encouraged us by highlighting that our generation of researchers are working at ‘the frontier’ of developing transdisciplinary work in social-ecological systems research. This paper is the product of our process of drawing together our reflections and insights in order to share them with a wider audience.

The approach we have taken to develop this paper is a form of autoethnographic research called collective or collaborative autoethnography (Ellis et al. 2010; Santiago et al. 2017). We have combined this with an iterative process of sharing and reviewing literature on transdisciplinarity in the context of early-career researchers (see [Appendix 3](#) for our ‘literature bank’ on early-career researcher transdisciplinary experiences). Similar approaches have been adopted by other early-career researchers in writing about their reflections (see e.g. Patterson et al. 2013; Ruppert-Winkel et al. 2015; Jaeger-Erben et al. 2018). The value of a collective autoethnographic approach is that it can be ‘*a canvas for self-reflexivity, determination, and episodic recounting ... it offers a space for convergence of experiences that still maintains the agency and interconnectedness of the self*’ (Santiago et al. 2017, p. 51). This slow but deliberate collective autoethnographic process has enabled us to reflect individually and collectively, and to build a community of practice, which are important practices in transdisciplinary research (Popa et al. 2015; Cockburn and Cundill 2018). A strength of autoethnography is that it is a research approach which is about both process and product (Ellis et al. 2010): it has thus enabled us to reflect together and support one another, and to produce outputs such as conference sessions, blog posts, and this paper (see timeline of activities in [Appendix 2](#)).

2.2 Theory of change process

Developing a theory of change has become a common practice in monitoring and evaluation to pay explicit attention to understanding the central processes or drivers by which change comes about for individuals, groups or communities (Funnell and Rogers 2011). While the application of theory of change as a tool to map and track change in project and programme interventions is now quite common, it is as yet not widely practiced in academia, including in transdisciplinary research on sustainability issues (Oberlack et al. 2019; Schneider et al. 2019). Accordingly, Oberlack et al. (2019) argue that theories of change ‘*constitute tools that can and should be applied more extensively to strengthen the relevance, reflexivity, learning ability, and effectiveness of sustainability science*’ (Oberlack et al. 2019, p. 107). We consider their argument particularly relevant to the reflexivity-oriented work of transdisciplinary research.

As will become apparent from the literature review below, early-career researchers are experiencing a wide range of challenges to practicing transdisciplinarity in academia. It is therefore apparent that change is necessary for us to realise the ideals of transdisciplinarity, and thus we suggest that mapping out what that change process might look like could offer a solution-oriented and generative tool for addressing these deep-seated challenges. The purpose of our theory of change is to guide ourselves and others in fostering academic environments where transdisciplinary research practice acknowledging the Triple-S dimensions can flourish.

We designed a theory of change workshop for our community of practice according to the broad principles of programme theory (Funnell and Rogers 2011), and followed practical guidelines provided by Keystone Accountability (2009). We followed these five steps in developing our theory of change: 1) Articulate the vision, 2) Map the preconditions and pathways of change, 3) Map the role-players in the system, 4) Identify specific change dimensions, and 5) Identify indicators to monitor, evaluate and learn from change as it unfolds ([Appendix 4](#)). We employed a graphic facilitator to support us in this process to visualise the vision and the change process, and to help us think deeply and creatively about our theory of change (Winkel and Junge 2012).

3. Transdisciplinary experiences among early-career researchers

3.1 Challenges faced by early-career researchers

Early-career researchers are increasingly recognised as pivotal in advancing transdisciplinary research. This is due to: i) their inherent drive to engage in meaningful and respectful research that has direct

and positive societal impacts; and ii) the steady rise in calls (i.e. funding) for greater transdisciplinarity in research, on which early-career researchers are heavily reliant (Lindvig 2018; Hackenburg et al. 2019). At the same time, there is a growing body of evidence on the barriers and challenges experienced by transdisciplinary early-career researchers within academia (Felt et al. 2012; Ruppert-Winkel et al. 2015; Haider et al. 2018; Jaeger-Erben et al. 2018; Knaggård et al. 2018; Lindvig 2018; Moore et al. 2018; Kelly et al. 2019; Temper et al. 2019). These challenges are not exclusive to researchers early in their careers, but offer important points of discussion for the wider community of transdisciplinary researchers addressing sustainability issues. We briefly synthesise some of the key insights from this literature here.

Moore et al. (2018) highlight that despite vocal support and encouragement for transdisciplinary research, it is still not *'well understood, supported, or valued at the discipline or institutional level'*. Hackenburg et al. (2019) cautions that the field of ecosystem services risks losing early-career researchers due to burgeoning demands of transdisciplinary research coupled with inadequate institutional (political and social) support. Kelly et al. (2019) refer to increased research transaction costs which results in time and resource constraints for transdisciplinary early-career researchers. Other authors describe challenges by reflecting individually or collectively on their transdisciplinary research journeys (Graybill et al. 2006; Patterson et al. 2013; Ruppert-Winkel et al. 2015; Van Breda et al. 2016; Jaeger-Erben et al. 2018; Holden et al. 2019).

Across this growing literature, a central theme that emerges is that early-career researchers are continuously attempting to balance and live up to the various requirements of conducting scientifically rigorous and societally relevant transdisciplinary research while managing anxiety and stress related to risks of falling behind in their research career. Transdisciplinary early-career researchers are trading off pushing their own scientific career, which is easier to do within the scope of one discipline, as opposed to managing research that aims for: i) interdisciplinarity and the integration of disciplinary knowledge; ii) engagement between academia and society; iii) development of functional research-management interfaces; and iv) both societal and scientific impact. Thus, the main challenges can be described around issues of time and resources (social, personal and research-related) required to achieve 'good' transdisciplinary research (i.e. research that is both societally impactful and respectful, and scientifically rigorous), as well as issues of well-being related to the anxiety experienced in this quest. These issues are exacerbated by a lack of institutional support and appropriate metrics of success,

since standard academic metrics focus on measuring number and academic impact of publications (bibliometric impact factor) (Fischer et al. 2012; Dedeurwaerdere 2013; Wiek et al. 2014). Finding true transdisciplinary evaluators and reviewers is challenging due to issues around common minimum standards for data and analysis. Reviews and evaluations therefore take longer than usual (Palmer et al. 2018). Furthermore, transdisciplinary research is in many cases place-based which can make publishing in 'international' journals tricky due to the perceived 'lack of relevance to a global audience' (Brister 2016; Jaeger-Erben et al. 2018). Taylor et al. (2016) highlight how it takes longer time to get to a point of publishable results in transdisciplinary work. Altogether, this means transdisciplinary early-career researchers are falling further behind their disciplinary-focused counterparts (Nash 2008). Ironically, early-career researchers are striving to solve complex sustainability issues while conducting 'unsustainable science' (Paasche and Österblom 2019).

3.2 Proposed recommendations for transdisciplinary scholars

Many of the transdisciplinary experiences documented in this literature also offer recommendations, ranging from addressing the individual level, to projects, communities and the institutions in which they are embedded. At the individual level, recommendations targeting interdisciplinary research are also relevant for transdisciplinary sustainability researchers, including the ability to speak and move with agility across disciplines and epistemologies, while developing your core and becoming grounded in specific methods (Haider et al. 2018; Kelly et al. 2019). Additionally, transdisciplinary scholars emphasize social competencies and skills of facilitation and stakeholder engagement for individual researchers (Enengel et al. 2012; Holden et al. 2019). Reflexivity is seen as crucial to transdisciplinary research. Reflexive practices involve reflecting on the multiple roles and positionality held by the researcher (Van Poeck et al. 2017; Temper et al. 2019). Knaggård et al. (2018) show how reflexivity enables early-career researchers to form an academic identity beyond boundaries, and Taylor et al. (2016) highlight that on-going reflection on process is key to generate publishable results in transdisciplinary research. Although related to reflexivity, only a few of these early-career transdisciplinary scholars explicitly raise aspects of well-being and self-care. Recommendations for the well-being of the researcher relate both to the emotions and ethical considerations involved in relations with non-academic actors (Ward and Gahagan 2010), as well as to managing time and prioritizing across the competing demands of scientific and societal outputs

(Sellberg 2018). For example, consider the multiple roles that transdisciplinary researchers play – researcher, knowledge broker, mediator and friend – all while reconciling academic needs with practitioner expectations and managing interpersonal relationships. These aspects compounded by time and budget constraints result in constant anxiety on whether you have provided a warm and caring atmosphere, given the time for each person to explain what they need, listened in a non-judgemental manner, and upheld positive interactions while upholding ethical research criteria for working with ‘stakeholders’ and academic expectations (Ward and Gahagan 2010; Cockburn and Cundill 2018; Holden 2018).

Regarding research design, scholars emphasize a transparent, yet flexible process (Jaeger-Erben et al. 2018), with emphasis on the initial co-design phase (Moser 2016) and with room for iterations where values and objectives can be re-negotiated (Temper et al. 2019). Several scholars emphasize building relationships and communities of practice, both with other transdisciplinary scholars for mutual support and reflexive practices, and with change agents, practitioners and stakeholders in a specific place (Patterson et al. 2013; Van Breda et al. 2016; Cockburn 2018; Sellberg 2018). Scholars also raise the need for improved institutional support, training and incentives to enable transdisciplinary research, particularly early in the career stage (Rivera-Ferre et al. 2013; Cockburn 2018). Mitchell and Willetts (2009) present alternative quality criteria for inter- and transdisciplinary doctoral research, where, for example, ‘Substantial contribution to knowledge’ is modified to ‘Original and creative contribution to knowledge and/or practice’. Apart from the last ones, most of the recommendations proposed (e.g. setting up communities of practice, reflexivity and training) require additional time and resources compared to disciplinary research. Transdisciplinary early-career researchers are therefore likely to run into the same barriers and risks described previously, which are linked to the current dominant structures, culture and success metrics in academia (Fam et al. 2019). Echoing the need brought up by more senior researchers in the field of sustainability science (e.g. Fischer et al. 2012; Paasche and Österblom 2019), this calls for more systemic approaches to institutional change.

3.3 Towards a new synthesis and a solution-oriented tool

As we have engaged with the fast-growing body of literature on early-career researchers’ transdisciplinary experiences (Appendix 3, and Section 3.1 and 3.2), we have been struck by the somewhat disparate nature of this literature (i.e. it lacks connection and

synthesis), and the pattern of long lists of challenges and recommendations (see e.g. Patterson et al. 2013; Ruppert-Winkel et al. 2015; Jaeger-Erben et al. 2018). Two gaps have also started to crystalize: that few address the personal aspects of well-being and self-care, as well as more systemic institutional changes. We aim to offer a contribution that synthesizes and makes sense of this existing literature in a new way and offers a generative tool for scholars to navigate the complexities of practicing transdisciplinarity. We do this through a heuristic that we have called ‘The Triple-S: caring for Science, Society and Self’. With the Triple-S as our vision, we then develop a theory of change to outline how we might get there (Section 5). The theory of change is not a prescription. Rather, it provides illustrative examples for transdisciplinary scholars to adapt and use in the sense-making of their own contexts.

4. The Triple-S heuristic

The Triple-S heuristic includes three aspects: Science, Society and Self, which are explained further below and exemplified in our blog posts (Appendix 1). These three aspects are interconnected and navigating this relational space involves engaging in networks and relations with both human and non-human actors (Figure 1).

4.1 Science

Science represents the aspiration of scientific rigour and excellence in transdisciplinary research. While this objective is shared with mono- and interdisciplinary fields, its meaning is somewhat different for transdisciplinary research. As other scholars, transdisciplinary researchers strive for originality, novelty and rigorous use of scientific methods, but in addition need to engage with a wider range of actors and knowledge types in a sufficiently rigorous way (see Petra Holden’s blog post, Appendix 1). The variety of knowledge can pose challenges for how or whether to integrate them (Tengö et al. 2014), as well as normative challenges of whose perspective gets heard, generating calls for strengthening the political rigour and radical critical reflexivity in transformative, activist research (Temper et al. 2019; Lam et al. 2020b). In the close collaboration with a partner, for example, a transdisciplinary researcher needs to make sure that the co-creation process has sufficient space for learning, exploration and reflection, to limit the risk of the research process becoming more of a consultancy project (see My Sellberg’s blog post, Appendix 1). This means that other types of competencies and skills are emphasized to reach excellence in transdisciplinary research, such as systems thinking,



Figure 1. The Triple-S heuristic: caring for Science, Society and Self in transdisciplinary research practice. The Triple-S outlines a relational space where the three aspects are interconnected and navigating this space involves engaging in networks and relations with both human and non-human actors. Illustration by Liezl Kruger.

interpersonal skills and reflexivity (see Jessica Cockburn’s blog post, [Appendix 1](#)) (Holden et al. 2019).

4.2 Society

Society represents the aspiration for research to address societally relevant problems and engage societal actors in the process in a respectful way. Transdisciplinary research has been described as ‘science with society’ (Seidl et al. 2013) and transdisciplinary early-career researchers share a drive to make an impact outside of academia and contribute to sustainability transformations and to transformative space-making (Sellberg 2018; Pereira et al. 2020; Lam et al. 2020a) (see David Lam’s blog post, [Appendix 1](#)). Even though the extent to which a PhD, for example, can contribute to transformative change or address complex societal challenges is of course limited (see David Lam’s and My Sellberg’s blog posts, [Appendix 1](#)). Societal engagement requires time and trust-building to become meaningful and not extractive, as well as relational and translational competencies, and an ability to handle everyday ethical challenges (as highlighted by My Sellberg’s and Jessica Cockburn’s blog posts, [Appendix 1](#)) (Holden et al. 2019). Other enabling conditions are, for example, existing relationships, ongoing transdisciplinary case studies, and actors that are actively searching for science-society collaborations.

4.3 Self

Self represents the aspiration of health and well-being of the researcher, as well as the ability to recognize the connections between the researcher and the system in which they operate. This includes practicing self-care, but also reflexivity, where the researcher is learning about his or her identity, role, positionality and influence – in academia, in the research project, and in the wider context in which they are embedded.

There is a growing debate on mental health in academia and recent studies have started to shed light on the situation of PhD students (Levecque et al. 2017; Evans et al. 2018). Results show that PhD students have a significantly higher risk of depression and other mental health issues compared to other highly educated groups (Levecque et al. 2017). So far, this research has not focused on the specific conditions of transdisciplinary research. As a transdisciplinary PhD student engaging with sustainability issues, well-being relates to dealing with emotions of ‘despair and powerlessness in the face of the horrors of the Anthropocene’ (Megan Davies’s blog post, [Appendix 1](#)), as well as juggling and prioritizing among diverse demands related to the first two S’s – *Science* and *Society*, that will affect your future career opportunities (My Sellberg’s blog post, [Appendix 1](#)). This demands emotional and psychological competencies, such as self-awareness and time management, as well as a deeper level of reflexivity, which involves reflecting on the underlying assumptions, values and ethical considerations of your

research (Jessica Cockburn's blog post, [Appendix 1](#)). Examples of reflexive practices are journaling, connecting with others through communities of practice, and identifying allies and supporters (e.g. supervisors, or fellow postgrads) to collectively reflect with.

4.4 Navigating the Triple-S as a relational space

As shown by unpacking the three aspects of *Science*, *Society* and *Self*, they are interconnected. While it is well established that transdisciplinary researchers have to meet the demands of achieving both scientific rigour and societal relevance, the Triple-S acknowledges the often unspoken and under-rated demand of *Self* (i.e. self-care, well-being, reflexivity and positionality). We postulate that poor attention to *Self* impacts the quality of transdisciplinary research both in terms of scientific rigour and societal relevance. Mental health issues associated with the demands of research and associated loss of well-being is well known to impact the quality of research itself (Evans et al. 2018). Recognising *Self* in the transdisciplinary research process means that we acknowledge our influence on the systems under study, which is necessary to do rigorous transdisciplinary science (Audouin et al. 2013; Preiser 2019). Acknowledgement of *Self* in transdisciplinary research also impacts the quality of how society is engaged, and more reflexivity means more thoughtful engagement with external actors and partners, thereby improving relations. From our perspective, being able to care and prioritise aspects associated with *Self* results in more robust transdisciplinary research.

We propose that the Triple-S heuristic is a relational space within which transdisciplinary researchers engage with themselves, their research and practice communities as well as research institutions. Out of the Triple-S heuristic emerges the realization that conducting transdisciplinary research is a deeply relational process (Cundill et al. 2019; Wolff et al. 2019). Following the principle of relationality (Preiser 2019), transdisciplinary research can be understood as a process that emerges at the interface of *Science*, *Society* and *Self*: connecting the researcher, the society in which they are embedded, and the academic system in which they operate. The challenge is how to navigate this space in a caring and ethical manner. Since the three aspects of the Triple-S are in such a tight relation to one another, the challenge is less about keeping the three 'in balance' or 'managing trade offs' between them, but to navigate and embody the relational space between these three components. However, current dominant academic environments, institutional structures, cultures and metrics of success are creating trade-offs between these three aspects. This leads to mental health issues, but also decreases the ability to address the actual

complexity of the sustainability challenges we are facing (Paasche and Österblom 2019). So, we need a shift in the academic system for researchers to effectively achieve the Triple-S.

5. Theory of change for Triple-S research

The theory of change we developed identifies the changes we see as necessary in academia to enable a flourishing transdisciplinary research practice in line with the Triple-S ([Figure 2](#), [Appendix 4](#)). This process and its outcomes is an example of how researchers can come together and articulate forward-looking strategies and concrete next steps to further develop transdisciplinary research practices despite the constraints of the current academic system.

5.1 Vision of a flourishing transdisciplinary research practice

At the core of our vision is a flourishing transdisciplinary research practice in accordance with the Triple-S aspirations, where scientific rigour, societal impact and engagement, and care towards self and others, are equally valued ([Figure 2](#), towards the right-hand side). Transdisciplinary research is recognized as being situated in the nexus of *Science*, *Society* and *Self*, and those students and early-career researchers who want to engage societal actors are empowered to do so in a way that honours the Triple-S dimensions.

For Triple-S research to flourish we need a shift in the academic system towards a more caring academic system, that fosters cultures of care, collaboration and community within our institutions ([Figure 2](#), movement from left to right). Care, in this respect, is not only about caring for ourselves, but caring about our colleagues, especially colleagues in the early-career stage, and the different academic and non-academic communities we are involved in. An expression of a more caring academia produces research of similar or higher quality, but through a slower pace that enables relational rather than extractive research (Paasche and Österblom 2019). Similar changes have been promoted by different movements within academia, through ethics of care in academia (Ward and Gahagan 2010; Corbera et al. 2020), slow academia (Berg and Seeber 2016), feminist perspectives on the neo-liberal university (e.g. the Fractal network: <http://fractalcollective.org/>), the neglect of people's inner worlds (e.g. their emotions, thoughts, identities and beliefs) (Ives et al. 2019) and other reactions against the trends of increased productivity and acceleration in science (e.g. Fischer et al. 2012; Paasche and Österblom 2019). These many calls for a more caring academic system resonate with and can enable our vision for a flourishing transdisciplinary research

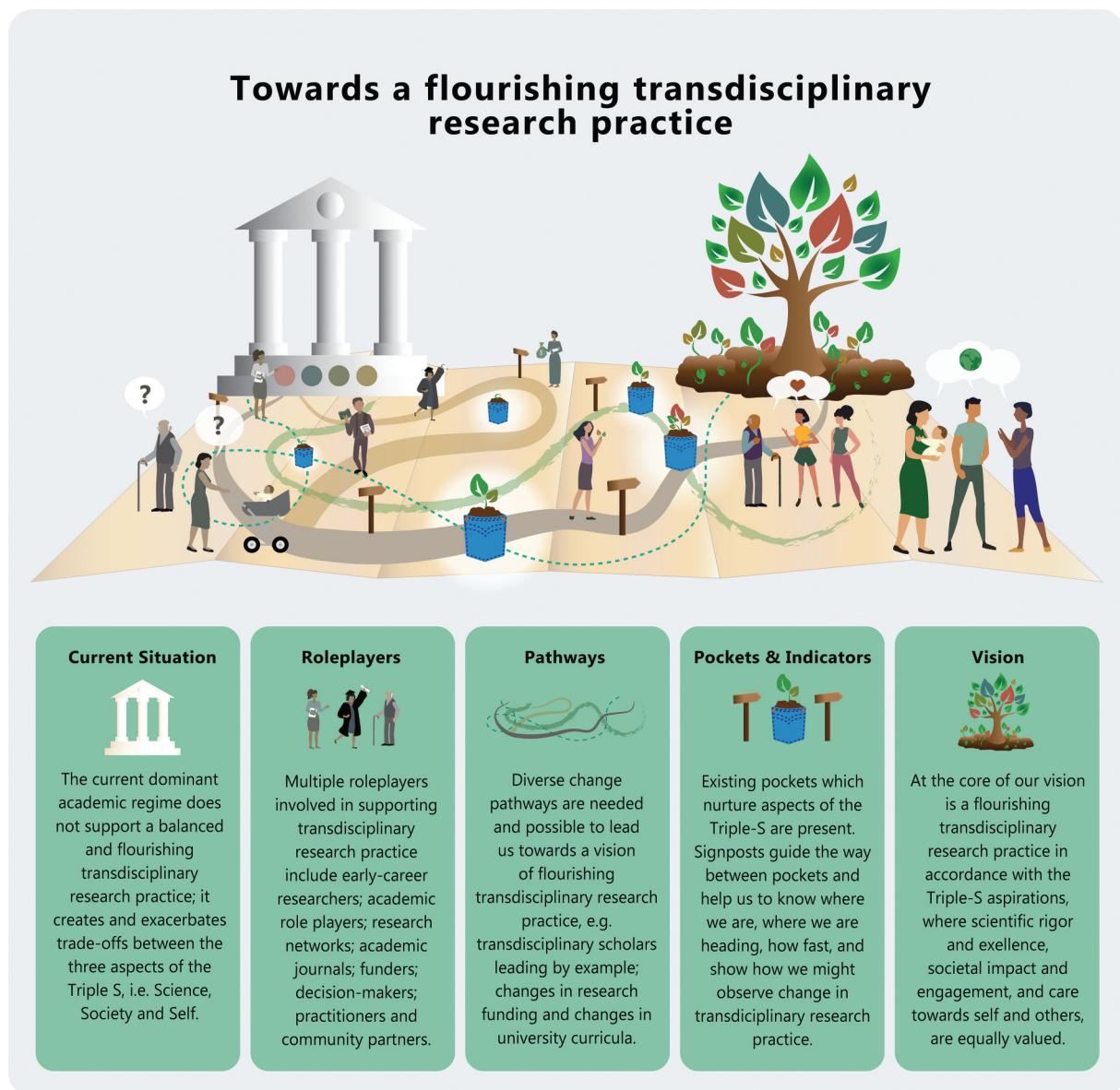


Figure 2. Theory of change towards research environments that foster flourishing transdisciplinary research practice in line with the Triple-S. This illustration shows how transdisciplinary scholars can work in pockets and networks to bring about change towards a future of academia where the Triple-S vision of caring for *Science*, *Society* and *Self* is integrated and realized. While the illustration shows a general movement from left (current situation) to right (vision), there are diverse, multi-directional change pathways, which involve a diversity of role-players in a dynamic and relational process of realising the vision. The signposts are indicators that help us know if we are moving in the direction of the vision (see examples of indicators in [Appendix 4: Step 5](#)). Illustration by Liezl Kruger.

practice. However, the multiple demands and ambitious relational nature of transdisciplinary research make a focus on care – of the self and of others – a particular priority for transdisciplinary research.

5.2 Pathways for systemic change

Realizing this vision requires systemic change within academia. The pathways and strategies we identified relate to two phases, where the first one prepares the system for change and mobilizes key actor networks (Note: the change process described below is illustrated in [Figure 2](#)) (Olsson et al. 2006; Moore et al. 2014).

Preparing for change, by nurturing pockets and planting seeds for a flourishing transdisciplinary research practice, is the phase that we are in now. An important first step towards the vision is to introduce care and self-care as an equally valued dimension within transdisciplinary research, in addition to the two dimensions that have been highlighted previously, that is *Science* and *Society*. According to theory on transformations, transformative agency is distributed in networks of key actors across the system, rather than in sole champions (Westley et al. 2013). Existing communities and networks of transdisciplinary researchers, with both established and early-career researchers, are key players here. They can lead by example by recognizing and practicing

the Triple-S heuristic, for example in mentorship roles and in the workplace. Prioritising self-care requires changes in our everyday practices and interactions, and this requires discipline (e.g. the practice of regular journaling, see Jessica Cockburn's blog post). One must make an intentional commitment to doing science differently in an academic system that currently does not enable this way of doing science. Existing networks and communities are a great support in making these changes. Our own 'Transdisciplinary PhD Journeys Community of Practice' is one example of such a network.

Within the current regime there are pockets that create enabling environments for the seeds of a flourishing practice of transdisciplinary research aligned with the vision of the Triple-S heuristic. We see these pockets as examples of niches for innovation from which broader change can emerge (Geels 2002; Bennett et al. 2016). Examples of such pockets are international research programs such as the PECS community, sustainability research centres located at universities, as well as different platforms and boundary organizations at the research-policy-practice interface (e.g. IPBES, Future Earth and other regional and local level platforms) (see more examples in Appendix 4: Step 3). Pockets create a space for new ways of doing research aligned with the Triple-S, but they do not guarantee it and all research within the pocket might not follow the Triple-S. For us, the PECS community provided a way for us to meet, a space to organize learning events, and helped to legitimize a transdisciplinary research approach. Senior PECS researchers encouraged us to develop our community of practice and recognized our expertise in this area of research. The leaders of such pockets are key role-players and through their actions the pockets will grow in size and numbers, form new coalitions and alliances and become more widespread (Pereira et al. 2018).

Early-career researchers also have an important role in using the agency we have and to lead by example. We can identify key role-players within our sphere of influence with whom we have, or could build, a relationship, and work with to create enabling conditions for research in line with the Triple-S. Examples are editors of journals promoting transdisciplinary publications, funders who are open to transdisciplinary research, and senior academics leading curriculum innovation. Relationality and reciprocal care among role-players will be key to navigate the change process.

In the second phase, these initial changes become embedded in institutions so that they are no longer dependent on individuals. Academic institutions need to adapt and change to enable research in line with the Triple-S and create conditions for long-lasting change. Although, the whole university does not need to change and not all research needs to be

transdisciplinary, there are four areas within the current academic system that require significant changes:

- Change in research funding to become more flexible, allowing for a wider range of outputs. Funding bodies could become key collaborators in enabling transdisciplinary projects through a genuine understanding of what it requires in terms of research, time, resources, and evaluation (e.g. resources to build the necessary skills for conducting high-quality transdisciplinary research, see Petra Holden's blog post). Key role-players are the funders and national and global research leaders.
- Change in university administration to an infrastructure that supports collaboration instead of disciplinary divisions, and values societal collaborations. New units and faculties need to be established with different norms and rules that create enabling conditions for transdisciplinarity (e.g. the enabling environment of an interdisciplinary research centre, see My Sellberg's blog post). This relates to the ideas of pockets within universities to nurture research in line with the Triple-S. Key role-players are the senior researchers in leadership positions, as well as the academic managers and decision-makers.
- Change in incentive structures and reward systems to promote criteria and incentives that enable a healthier work-life balance. Key role-players include grading committees, editors and reviewers, and people responsible for recruitments. New standardized measures of success and scientific rigour within transdisciplinary research are essential to realize this change, for example, in terms of what counts as novel and what type of impact is valued (e.g. early-career researchers are pushed to publish their research at the expense of building relationships and creating impact on the ground, see David Lam's blog post).
- Change in education and training, including change in curriculum at undergrad level, and changes in training and support along with skills needed for research that embodies the Triple-S (e.g. learning to navigate disciplinary differences, see Petra Holden's blog post). Key role-players are the supervisors, course leaders and academic decision-makers.

This second phase also involves changes in society and in the interfaces and relations between academic and other societal actors. An expression of these societal changes is that people know about transdisciplinary research and know who to contact at the university when they want to explore a certain issue. Here, other important actors are the partners, local communities, practitioners, and different bridging

organizations (Parker and Crona 2012; Roux et al. 2017).

5.3 Towards a caring practice of transdisciplinarity

Ethics of care is receiving increased attention in academia and higher education, especially in light of the COVID-19 pandemic (Ali et al. 2020; Corbera et al. 2020; Yellow Horse and Nakagawa 2020). The cross-cutting idea of care in transdisciplinary research, not just self-care, which came out of our theory of change process, aligns with this movement. In describing our vision of a flourishing transdisciplinary research practice above, it became clear that care is an essential value in transdisciplinary research practice and that a more caring academic environment is an important enabling factor of this vision. We see at least three reasons for this.

First, care is needed to build trust and establish collaborations with academic and non-academic actors in transdisciplinary research settings. Care can be a value that supports the building of trust and relations because it refers to the feelings of attachment and responsibility that can underpin transformative transdisciplinary research, similar to care in stewardship research (Enqvist et al. 2018).

Second, care in postgraduate supervision can help to better understand the challenges of early-career researchers to navigate between scientific rigour, societal relevance, and self-care in transdisciplinary research. Caring postgraduate supervision can support transdisciplinary early-career researchers to take care of themselves on their journeys in a disciplinary academic world, as well as concerning the emotional and time difficulties that emerge from relationships with academic actors from different disciplines and non-academic actors.

Third, care can help to focus on what is important, especially in times of the COVID-19 pandemic, and redefine excellence in teaching and research (Corbera et al. 2020). The personal and social challenges which have emerged out of the COVID-19 pandemic have highlighted some of the limitations within the academic system when it comes to ethics of care (Ali et al. 2020; Corbera et al. 2020; Yellow Horse and Nakagawa 2020). In response to these limitations, Corbera et al. (2020) highlight the need to '*refocus on what is most important, and redefine excellence in teaching and research*'. This is similar to what we have identified in working towards the flourishing transdisciplinary research practice we describe above.

Therefore, we propose drawing on the notion of ethics of care (Tronto 1998; Moriggi et al. 2020) to guide the development of a more caring practice of transdisciplinarity. Caring for people and nature can be a driving force to conduct transformative

transdisciplinary research that is societally relevant and fosters sustainability (Lam et al. 2020a). Care is fundamentally a relational notion (Moriggi et al. 2020), and drawing on care as a driving value for transdisciplinary research practice can enable a more relational form of research practice within an otherwise highly segmented academic environment. Our exploration of ethics of care as a guiding concept is necessarily brief here, and we invite others to contribute with their experiences to further develop the idea of a caring practice of transdisciplinary research.

6. Conclusion

In this paper, we addressed the challenge of transdisciplinary research trying to navigate and embody the relational space between scientific rigour and excellence, societal impact and engagement, and self-care. From reviewing the emerging body of literature on transdisciplinary experiences by early-career researchers, and sharing our own experiences in a community of practice, we contributed with a novel synthesis: 'the Triple-S heuristic: caring for *Science*, *Society* and *Self*'. This heuristic adds the often-overlooked personal aspects of transdisciplinary research. We believe that adding *Self* better captures the real-world challenges experienced by transdisciplinary researchers and supports reflexivity, which ultimately improves transdisciplinary research. To address the gap of systemic and solutions-oriented approaches for changing the current dominant academic environments and institutions that are not supporting a flourishing transdisciplinary research practice, we shared the process and outcomes of a theory of change that we developed. Our theory of change identifies pathways for the transformative change that is needed to enable a more holistic and flourishing transdisciplinary research practice in academia. It also identifies pockets of change, key change opportunities within academia, and the various role players who can and should be involved in this change process. Importantly, the theory of change highlights the situated agency of early-career transdisciplinary researchers to initiate and actively participate in the necessary change processes. Our theory of change process further revealed the importance of going beyond self-care, to building an ethics of care in academia that can create enabling conditions to support the work of transdisciplinary researchers.

As place-based, engaged researchers, the PECS community has both created conditions for our community of practice to take form, and has confirmed the importance of sharing our experiences with a wider audience. We are thankful for this support and see the important role communities such as PECS have as pockets where transdisciplinary

research practice in accordance with the Triple-S vision has a better chance to flourish.

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