1. The promise of scaffolding: a metaphor and living practice for transdisciplinary inquiry

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INTRODUCTION

The metaphor of scaffolding has traditionally implied the structuring and developmental effects that more advanced peers or adults have on younger learners’ activities. The metaphor first surfaced in the 1970s when Jerome Bruner, a cognitive psychologist, started to use the term (Bruner, 1973; Wood et al., 1976). Scaffolding connects to the Vygotskian (1978) concept zone of proximal development (Cazden, 1979), which indicates the zone that a learner at a certain level of development can cover only with the assistance of interactional support, the zone beyond which the learner cannot reach even with aid.

Scaffolding has been used to describe a variety of supportive interactions, including peers working with peers, that is the structuring effects on both individual and group actions (Renninger & Granott, 2005). In the context of group collaborations, the metaphor has come to include different methods, tools, and facilitation that support learning and decision-making, as well as pre-empt conflicts in multi-stakeholder processes (Jordan, 2016). Overarching the different contexts where it has been adopted, scaffolding offers perspectives on how new abilities come into being (Granott, 2005).

In this chapter, we explore scaffolding in the context of transdisciplinary (TD) projects and research (TDR) in order to uncover what gives a group the leverage and ability to climb higher than otherwise possible. We first discuss the role of metaphors and their importance for research processes, before focussing on the metaphor of scaffolding. We then make our case for the usefulness of scaffolding in TDR by pointing out challenges and scaffolding needs. Thereafter, we propose scaffolding for TDR as an integrated learning system made up of different interacting elements. We conclude by discussing the promise, legacy, and pitfalls of scaffolding. Our purpose is to deepen the inquiry into what scaffolding means, what it enables, and what it may constrain. In doing so we hope to reveal some insights and useful principles for scaffolding in TDR.

POINTS OF DEPARTURE AND THEIR RELEVANCE FOR TD DEFINITION

Our shared interest in TDR is directed towards learning, as both a research outcome and a dialogue process, and as key to societal transformation towards sustainability. TD is here defined from the awareness of complexity of both societal problems and the approach to address them, recognising the importance of varying perspectives and the integration of different knowledge cultures and their epistemics in a ‘multi-dimensional interactive process’ (Pohl et al., 2021). It is further understood as a transformative process of knowledge and ways of knowing, aiming

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to achieve problem solving with effects for societal transformation towards sustainability (Hirsch Hadorn et al., 2010; Pohl, 2011; Lang et al., 2012; Polk, 2014). Central for our interest is how to co-produce the knowledge needed to jointly adopt complex thinking while working on complex issues. With this framing as a starting point and a common interest in how languages and understanding affect group processes, we will first turn our attention to the role of metaphors – as they often function as a common language in TDR – before turning to the metaphor of scaffolding itself.

THE RELEVANCE OF METAPHORS IN TDR

Metaphors make up a large part of our everyday language and entail familiar or intriguing images that bridge the known with the unknown (Lakoff & Johnson, 1980; McGregor, 2004). In recent decades, metaphors have been acknowledged in science as irreplaceable tools of communication and as part of scientific findings (Judge, 1991; Sage et al., 2022). Thinking through metaphors allows us to access abstract matters, to refer to them and to act in accordance with them (Granott, 2005). These affordances can be especially helpful in group processes. The use of metaphors in TDR supports a deeper commitment regarding the integration of different knowledge cultures, organisational differences, and conflicting values (Judge, 1991; McGregor, 2004; Sage et al., 2022). Metaphors are also useful in translating different knowledge (Sage et al., 2022), to give group processes a common language (McGregor, 2004), but also to influence our social reality and perception of the world. Sage et al. (2022, p. 2) argue that transformation to sustainability will not take place within the language we are used to, since language also constructs the world in which we live and act. Therefore, a new language – facilitated by the constructions of metaphors – is needed to support the transition to unknown futures (Palmer, 2021). Applying a metaphoric thinking in TDR is therefore not just supportive but also necessary to imagine a societal transformation that acknowledges the consequences of global differences.

However, metaphors can be deployed too generically, not the least in group processes. There is a potential for metaphors to become resonant within the group by offering an image that is neither too familiar nor too distant from meaningful interpretation to contribute to a solution (McDonnell et al., 2017). But such possibility is lost in interactions where an all too familiar metaphor does not evoke such resonance. Instead, the metaphor appears empty or becomes used for what only seem to be agreed upon situations, visions, or goals. In line with earlier contributions (e.g. Scott, 1998; Tabak, 2004) we argue that this is also the case of the metaphor of scaffolding, such that the dynamic and context-bound aspects of the term tend to disappear, leaving scaffolding as a placeholder for any kind of support. Different writers have made attempts to categorise metaphors according to qualities and purpose of usage (Jensen, 2006; Judge, 1991). For example, an active metaphor carries saliency between the content of the metaphor and the ‘vehicle term’ used (Jensen, 2006, p. 45). Knowledge integration in TD is often described by the vehicle of the bridge, creating a connection between different knowledge cultures, disciplines, and ways of knowing (e.g. Pohl et al., 2021). In a similar way, a scaffolding becomes a vehicle term for several different actions supporting group processes. Judge (1991) distinguishes between the roles of metaphors in terms of categorisation; acting as a political inquiry; as means for survival; or in terms of posing a visual quality describing conceptual complexity. Illustrating these roles with the example of ‘bridge’, we
can first discern how the visual image of a bridge is helpful when discussing the need to both overcome obstacles created by differences and to bind these differences together. Second, the bridge represents a new category, something that needs to be built in the in-between space of different knowledges as a new hybrid knowledge. Third, the bridge represents the TD process itself as a political inquiry, building a walkway towards yet unvisited futures. Lastly, the metaphor of the bridge communicates the enabling support for the participants to reach beyond their individual spheres of knowing. Acknowledging that metaphors are important outcomes of research (Sage et al., 2022), we could imagine bridging as a verb describing, for example, integration in a new and different way (Palmer, 2021). Together these different roles of the metaphor help to deepen the notion of scaffolding beyond the immediate translation into sets of skills, methods, tools, or guidelines. In the next section we will analyse them by entering the scaffolding found at the construction site.

**THE ROLES OF SCAFFOLDING AS A METAPHOR – LEARNING FROM THE CONSTRUCTION SITE**

Granott (2005) suggests that the power of scaffolding as metaphor lies in the simple image it provides and in the intuitive understanding of what it entails. A visual quality describing the support of something in construction is the underlying translation of scaffolding as a metaphor, but taking a walk on a construction site might reveal other readings as well. The concept of scaffolding is reminiscent of the image of a building being constructed and surrounded by a light metal structure (or by a bamboo structure in some Asian countries!). If a building did not require height, the scaffolding would not be needed. On the contrary, the taller and more complex a building structure is, the more robust scaffolding it will require. In this manner, the scaffolding frames the construction process and sometimes also serves as temporary support for a structure that is not yet ready to stand by itself. A classic example is the brick vault that does not support itself until the last brick is put in place, but needs a vaulted scaffolding to carry the loads of the bricks until the vault is completed. In other situations, the scaffolding allows conflicting physical forces within the construction to coexist and be kept in tension, before finding a state of equilibrium in the final building element. While the scaffolding supports and protects the construction process, it gives the construction workers access to otherwise inaccessible places. Thanks to stairs and footbridges, workers can reach critical places in the building that are not yet possible to access on their own. The scaffolding, with its railings and sheltering tarpaulin, also protects the construction workers themselves, hindering them from falling or in other ways getting hurt at the site.

From this brief exploration, we can understand three dimensions of scaffolding that are important for TD processes, namely, its supportive and protective role for the building (the outcome of a process); its supporting and protecting role for the building process, by providing access to otherwise inaccessible parts of the building; and its supporting and protecting role for the construction workers. Finally, the scaffolding must be possible to remove when the building process is completed and the building erected, without jeopardising the result. However, an echo of the scaffolding is still possible to detect in the final building, even when the scaffolding is gone. Looking towards the completed building, the height of the building recalls a removed tall support, and the vaulted interior space reflects the vaulted support that once was there.
The observations of the structural features of the scaffolding describe not only the visual but also the categorisation capacity of the metaphor scaffolding. The latter defines what Judge (1991) refers to as a ‘container’, with distinct boundaries of an inside and an outside, which becomes meaningful to the participants once they can experience it physically. When participants in a group process become aware of the categorisation capacity of the scaffolding, they can use the scaffolding for supporting and protecting the process. They can further reflect upon the scope of the scaffolding, whether it supports, includes, and protects the right elements or not, thus performing what Midgley (2000) defines as boundary judgements. The metaphor of scaffolding acting as a political inquiry could be understood as the support of a group process in the adaptive sense-making processes of not knowing. As means of survival, scaffolding supports and protects simultaneously the structure, the process, and its builders. Trust, mutual respect, and care are emotional dimensions (Boix Mansilla et al., 2016) of well-discussed so-called ‘safe spaces’ needed for TDR (Palmer et al., 2020). In this way, metaphors are empowering concepts that enable modifications and adjustments of patterns that surround us (Judge, 1991).

Further properties of scaffolding concern the relationships between the construction workers. First, the workers must be recruited (Tabak, 2004) to the site in relation to their interest, knowledge, skills, and expertise, and devotion to the process. Second, scaffolding entails reciprocity, in which the construction workers change their actions in relationship to the structuring activity. This is important because scaffolding references a material structure, while it simultaneously spells adaptivity at the learning site – those involved are changing their behaviours as responses to emergent learning. This might not speak to the contemporary construction site, where specialised knowledge is preferred. However, if referring to a construction site as a site of learning (as in the original use of the term ‘workshop’), builders need to interchange knowledge to perform certain tasks; also, they build directly from each other’s work. Meaning making is thus scaffolded through the interactions of the construction workers. However, the interchangeability is limited. Sometimes the scaffolding needs to reduce the degrees of freedom to make it possible for the workers to develop the knowledge they are tasked with to thereby reach a higher-level construction (Tabak, 2004).

Furthermore, scaffolding is contextually bound, essentially behaving like a site-specific construction system; if not suitable enough for enabling its actors, it needs to be reconstructed. This implies that a scaffolding must be in constant transformation – a living practice – for the construction workers to find the support (insights) and protection they need at any time in the process. Consequently, we argue that to understand scaffolding, we do best to adopt a systemic view including both protection and support of outcome, process, and participants, in which multiple and interactional elements are progressively brought to bear on the structural activity. Scaffolding can then be understood as an integrated, yet dynamic, concept.

Being in a constant transformation, however, may bring about unintentional results of the scaffolding. If a scaffolding ‘hides’ the construction process and the building for too long with its tarpaulin, or if it is too ‘weak’ as a temporary support, the process can take negative turns. A lack of transparency in what purpose the scaffolding fills may serve hidden agendas. The form and character of the scaffolding can also lead to certain forms and characteristics of the building, which uncritically are accepted as an outcome of the means used (Andersson et al., 2018).
EXPLORING SCAFFOLDING NEEDS IN THE CONTEXT OF TD

How, then, can scaffolding be of relevance in TDR processes? Three collaborative phenomena of TDR are often highlighted as in need of attention (Hirsch Hadorn et al., 2010). The first is directed towards the challenges of multi-actors’ participation and towards the TD process itself (e.g. McGregor, 2017; Lang et al., 2012). The second embraces the challenges that come with integration of knowledge (e.g. Klein, 1990; Hoffman et al., 2017; Pohl et al., 2021), while the third has a focus on transformative outcomes, such as learning and decision-making (e.g. Schauppenlehner-Kloyber & Penker, 2014), and how these relate to the implementation of results and to societal transformation (e.g. Polk, 2015). These three phenomena also relate to our observations from the construction site, where we learnt that scaffolding protects and supports the participants, the process, and sometimes even the building itself. Our framing suggests the need for scaffolding in TDR to co-produce the knowledge needed to jointly adopt complex thinking while working on complex issues. This focus seems to place greater emphasis on the first two phenomena, since the implementation of results, at first glance, resides outside this scope. However, in TD, learning may also be regarded as a process outcome. In the following sections, we will discuss types of challenges that participants face when they adopt complex thinking, and what promises scaffolding can fulfil in this situation; then, we elaborate on what collaborative thinking may entail for scaffolding TDR processes.

Challenges in ‘Co-Production of Knowledge Needs’

The co-production of the knowledge needed to jointly address complex societal – including global – issues summons a variety of actor perspectives. However, actors carry with them not only knowledge diversity for addressing societal complexity, but also other diversities which the group may be less prepared to handle. In addition to knowledge diversity, a TDR process inevitably contains actors with diverse values, organisational positions, and habits of protocols, as well as routines for producing knowledge and making decisions. A higher-order thinking not only includes problem solving, critical and creative thinking, and decision-making (Lewis & Smith, 1993); we argue it also needs to include conflict resolution and moral and ethical reasoning. One challenge to support complex thinking, beyond knowledge integration, is how inherent values, norms, and institutional ideals influence perspectives, and how they are exposed and brought together.

Much is written about the necessity of integration of knowledge in TD (e.g. Pohl et al., 2021). Engaging actors with experience in different subject areas implies specialised knowledge that involves established boundaries that need to be translated when the knowledge is shared (Carlile, 2004). When group participants have some overlapping knowledge, they are better prepared for building comprehensive knowledge of an issue complex, or to combine their knowledge so that some issues are understood fully (Shaw et al., 2003). If the translation of knowledge boundaries or overlapping of knowledge does not occur, a meeting with actors from different contexts may instead result in knowledge gaps and other kinds of ‘dissonance’ that make the joint process less productive than what an individual or other group might have been able to create (Hatano & Inagaki, 1991).

The need for expressing differences in opinion and values while also maintaining a good working relationship is another important dynamic in contexts with actors from different areas of expertise (Rouwette et al., 2016). If there is normative pressure in the group it may be
difficult to explore the whole range of perspectives, and different group members may opt to stay in the safe zone of the knowledge they already share (Witte, 2007). The task of managing different values to create more complex understanding and learning together is therefore one of the central promises of scaffolding.

Beyond the difference in stakeholders’ organisational practices, diverging timeframes, financial arrangements, and access to resources may influence the joint knowledge production. Institutional preconditions could emerge as an imbalance of power between ‘elite actors’ and other groups hindering or guiding the knowledge production in certain directions. Hence, scaffolding in TD needs to support and protect the enabling quality of diversity, which includes accommodating controversy and conflicts (Turnhout et al., 2020).

Complex Thinking – Principles to Safeguard the Building and Building Process

Looking at what complex thinking means in terms of collaborative process, integration of knowledge, and collaborative learning, there are different scientific discourses that theorise and offer principles and, in some cases, processual scaffolding. Some of these are also explicitly investigating knowledge integration as the means towards complex thinking. Notably, knowledge integration occurs, not at a certain point in a process, but as the process itself (Repko, 2008). Understanding knowledge integration as equal to a dynamic process that unfolds creatively gives a prominent role for scaffolding in relation to both knowledge integration and complex thinking. In this section, we draw on some exemplars that provide a basis for unpacking how scaffolding increases task complexity awareness while groups are working on complex issues.

Complex thinking has been associated with philosopher Edgar Morin. It refers to the ways in which thought processes are organised according to similar principles that sustain real-world complexities (Teixeira de Melo et al., 2019). Complex thinking, according to Morin, means integrating uncertainty and incompleteness, self-reflection, and cross-learning from other cultures and disciplines in thought processes (Montuori, 2013). Morin designed a set of generalisable principles for complex thinking. The first three of these may be specifically useful: (1) the dialogical principle, (2) the principle of organisational recursion or recursivity, and (3) the hologrammatic principle. Entailed in the dialogical principle is the proposition of keeping diversity within unity and integrating what might seem like contradicting pieces of reality. The second principle stresses an iterative progression of the thought process that is both productive and a product. The third principle concerns the relationship of whole and parts and the way this relationship is represented (Teixeira de Melo et al., 2019). This principle relates to systems thinking in how ‘the parts are represented and contained in the whole and the whole is represented and contained in the parts’ (Morin, 2005, in Teixeira de Melo et al., 2019, p. 155). This is exemplified by Brown (2010), who frames this principle in terms of a combined synoptic and synergistic thinking (see Chapter 33). While synoptic thinking entails understanding the whole from its parts, synergistic thinking focusses on the relationships of parts to establish a new idea about the whole. The first thinking mode is about observations and reflections, while the latter is about creative thinking and testing. By putting them together, Brown (2010) proposes a recursive process of learning by characterising the second principle as a ‘collective learning spiral’, where modes of understanding parts and wholeness respectively are applied in an oscillating manner.
Klein (2012) has extracted four general principles that together address the complexity involved in knowledge integration when working with complex problems, namely: variance, platforming, iteration, and communicative rationality. While the principle of variance addresses the contextuality of integration – meaning there is no universal model and that variations are necessary – the platforming principle speaks to the need for certain actions to establish the fundamentals for integration. These could be, for example, an agreed upon structure, bridging concepts, or a common focus. The principle of iteration reminds us of Morin’s principle of organisational recursion in acknowledging that knowledge integration as a development process is never linear. Finally, the principle of communicative rationality emphasises the importance of finding a common language (this highlights the visualisation role of metaphors) to enable integration and social learning, but also to express intersubjectivity in terms of both new and hybrid knowledge.

Turning to the systems thinking field, we find several models that have been developed to strengthen different capacities in group interactions when working on complex issues, which complement Morin’s principles. Midgley (2014) puts four systems thinking skills forward as relevant for matching the complex challenges in TDR practices. These are boundaries for what is included and excluded from the analysis; relationships between different elements, such as complex causality and feedback loops; the idea of systems with emergent properties; and how multiple perspectives influence decision-making and implementation. Within systems thinking we find several practically based and facilitated models that scaffold these different thinking skills. With the multitude of models, an important discussion of pluralistic approaches and supportive frameworks for mixing methodologies has emerged, serving to contextualise, assess and evaluate their uses and best practices (Mingers & Brocklesby, 1997).

We have already noted that scaffolding targets the yet out of reach, higher-level tasks. In adult development theory, we find the theoretical basis for how tasks fundamentally comprise different levels of hierarchical complexity (e.g. Commons, 2008). In Ross’s (2008) scaffolded approach, learning is embedded and complexity awareness of issues develops using “the progressive, dialectically-nonlinear dynamics of development itself” (p.218). Ross calls this a ‘meta-intelligent reasoning’ which is supported by different dynamics integrated within the process. The practical process entails dynamics, like identifications of discrete issues and sub-issues; iterations – as tasks consist of several subtasks that need unpacking in iterations on different levels of integral attention and selections; and as a developmental design, meaning that the task complexity increases gradually as each task consists of the building block the next tasks depend upon. The developmental design includes coordination at a meta level; this implies that when the task complexity increases to a meta level, multiple systems may be coordinated in order to develop a complex action system. Ross’s scaffolded approach features modularity, which offers flexibility and tailoring of the practical involvement of stakeholders. This entails practical ways to enact Morin’s principles by working with iterations and parts–whole perspectives.

Through this overview, we see scholars from different knowledge traditions meet at the intersection of TD to contribute with guidance for its practice. Hence, their principles and thinking skills provide us with important ideas for different scaffolding needs that require attention when groups work with complex issues. Additionally, processes that unpack complexity also speak to human uncertainty and emotional affects, which we address next.
Navigating Uncertainty and Conflict

The affective consequences of collaborations are rarely discussed in the literature on TD research approaches. We suggest highlighting these aspects, as different dynamics need to be balanced for a constructive dialogue to occur, both for the internal process of each participant and for the interactive process between the stakeholders. As previous research has shown, when relational conflicts occur in groups, task conflicts have a directly negative effect (Salas et al., 2015).

Increasing complex thinking on a personal level involves the willingness to open and move beyond individual prevailing perspectives, to first understand the perspectives of others, and then to accept a process that lets new and more differentiated perspectives emerge. This can be a painful process for the individual in need of both support and protection because it enables a vulnerable state ‘of no longer knowing’. To arrive at the edge of one’s own knowing, and of what one thinks is knowable, means handling uncertainty. Jordan (2016), a conflict researcher, has defined six categories of functions that need to be supported in collaborative processes, four of which address the needs of the individual. These are a relational support to the participants’ interaction; an attentional support to the feelings of the participants; a support of the understanding of different aspects; and a support to enable creativity and empowerment.

To maintain the dialogical principle of complex thinking, proposed by Morin as keeping diversities together without diffusion, may be challenged by stakeholder diversity, particularly their knowledge cultures, values, and institutional positions. Without scaffolding, conflicting contributions may fragment discussions and unhinge the collaborative knowledge process as well as perturb the interactive process. However, keeping tensions alive is an important aspect, and it means that conflicts that occur, both between stakeholders and within the one and same stakeholder, are a necessary part of integration of contrasting perspectives (Ross, 2006). Morin’s second generalisable principle of organisational recursion or recursivity states that a process is at the same time ‘the product and the producer of itself’ (Teixeira de Melo et al., 2019, p. 155). This resonates with Ross’s (2008) framework for how accomplished tasks make up the building blocks of new, more complex tasks. So, in view of the issues that a group discusses and explores, as an evolving construction site, each output is both a process outcome as well as the input and base for new actions that involve, change, and develop task complexity awareness. Hence, when a group discussion is constructive, the participants build on each other’s inputs in ways that fill a joint scaffolding function: a coactive scaffolding (Mascolo, 2005). Scaffolding that both supports the awareness of each other’s perspectives, as well as the ability to include and build on each other’s inputs, is essential for both the individual builder and the group as a team. We thus find how perspective awareness (Jordan, 2016) and learning can become transformative at the individual and group levels.

In sum, we suggest that in recognising differences, whether based in epistemologies, ontologies, or institutional practices, and giving them sufficient room to remain integral is essential for integrative TD work – hence the need for scaffolding. Further, to support and protect transformative learning on both individual and group levels would be a scaffolding purpose. Here, learning is not just the outcome of TDR but a function that needs to be continuously nurtured to form steppingstones in the process. Finally, and most difficult, it is essential to support TDR processes in achieving relevant, and even radical, impact, affecting real-world complexities.
SCAFFOLDING AS A LEARNING SYSTEM

Although an attractive metaphor, scaffolding risks the association with one single means of support (Tabak, 2004), as the notion of multiple supports is not inherent to the term. Tabak (2004) argues for a ‘systems of scaffolds’ perspective in which patterns of scaffolds are studied to distinguish diverse learning environments, from which further differentiations and synergetic potentials of scaffolds are uncovered (p. 330). Hence, scaffolding is applied through multiple means – embedded in artefacts and distributed across agents – to equally account for the complexity and diversity of support needs. When scaffolding is synergistic, Tabak (2004) suggests that different kinds of supports interact to provide the scaffolding (p. 315). This conceptualisation of scaffolding is advantageous for transdisciplinary inquiry when multiple agents collaborate to co-produce more complex knowledge.

This view also has implications for how we understand the role of facilitation. When approaching scaffolding from a coactive systems perspective, the facilitator is not conceptualised as an external form of structuring support, the same way that scaffolding is not conceived as enacted by an external expert. Instead, facilitation roles are understood as parts of ongoing activities where knowledge is coactively generated – co-scaffolded – by all participating in the process (Andersson, 2018).

Next, we will delineate a model that unpacks different elements of scaffolding as a learning system. To do this, we will first turn to educational research, by looking at a model developed for the teacher-and-learner environment. Scott (1998) focussed on a process-oriented view, suggesting that entailed in scaffolding is an ongoing cycle involving three elements, namely, analysing (the gaps between present level and goal level), assisting and guiding (offering of appropriate support), and monitoring (responses and emergent learning). This model indicates
cognitive elements of assessment; an openness to finding appropriate means; ongoing guidance and reflection-in-action as new emergent needs call for adjustments; and the reduction or removal of scaffolding when the goal level is reached.

We have adapted Scott’s model to elucidate four elements of scaffolding for group activities. In our adaptation of the model, we have made some important changes. We have (1) added an element that highlights the significance of navigating uncertainties that emerge when knowledge is coordinated towards new, higher-level integrations. As we point to the nonlinear unfolding of learning, we have also (2) refrained from using causal arrows between elements. To the extent that there is a progressive movement of the elements in any specific and scaffolded process, it is indicated by one process arrow (Figure 1.1). The elements in our adapted model (3) overlap, as, in resonance with Morin’s hologrammic principle, parts are in the whole and the whole is the parts (Molz, 2010). This overlapping indicates how each element has a recursive flow of information that both feeds forward and feeds back.

Analysing and Orienting

Analysing is a place to set the fundaments for the process, or, in Klein’s (2012) words, ‘platforming’. Analysing is also a cyclical and returning feature, serving to discern learning gaps and developmental possibilities, hence implying an iterative movement between the ‘right now’, the group’s sub-goals, and its more long-term goals. Such attention calls the group to become more deeply aware of itself and its goals, concerns, and hopes.

When starting out, the group is aware of some of its needs, goals, and tasks, such as the information gathering and coordination needed to reach its goals; but there might also be aspects the group is unaware of, which have been neither voiced nor understood. Scaffolding may therefore involve creating a broad platform as an initial exploration, a collective voicing of perspectives on issues, goals, and points of departures, so that the group can explore the gap between where it is ‘right now’ and its goals, as well as its information needs. To reach beyond what it does not know, it needs to build on what it does know, as well as what can be learnt from others, including helpful models, heuristics, toolboxes, and so on. To delineate the boundaries of focus, a broad starting point is suggested, such as a relationship mapping or an inventory of needs and group motivation. This may provide clarity and create a safe space for all participants.

Coactive Assisting and Guiding

The employment of appropriate kinds of scaffolding also involves how different components of scaffolding may contribute to achieve shared goals. Depending on priorities, scaffolding ‘means-whereby’ may take shape as adopting a whole model, or as a modular design with mixed methods that functions to support different tasks and subtasks – be they attentional, relational, or creative. Different scaffolding components serve, for example, to bridge perspectives, translate specialised knowledge, or zoom in to unpack a specific topic, and the means-whereby may involve using relevant open-ended questions and artefacts, such as a flipchart. Scott (1998) distinguishes between instructional and pedagogic support, where the instructional support is pre-planned and the pedagogical is spontaneous and immediate. Jordan (2016) differentiates between hard and soft scaffolding, thereby distinguishing the methods used and a facilitator’s guidance. When scaffolding is coactively enacted it may be
meaningful to distinguish between the methods chosen pre-process to fulfil certain needs; the instructions needed in the moment to enact it; and the ongoing coactive support that happens when groups coordinate both their process and task awareness towards their common goal. To help and guide may also be the role of a facilitator, or of a group member with more experience in specific process tools. Facilitative guidance needs to be clear so that the group can focus on the content of their issues, instead of struggling to comprehend the chosen process tools. The guidance of how the group collectively makes use of the process tools also involves maintaining focus on how – or whether – such scaffolding is *foregrounding* the issues that are being worked on. When the methods themselves determine the outcomes, or become the product of the process itself, it is important to discern how they functioned as scaffolding for achieving the intended tasks (see Andersson et al., 2018).

**Scaffolding Uncertainty**

Scaffolding may function (intentionally or unintentionally) to defamiliarise the participant stakeholders from their issue understanding, and the group may enter a period of uncertainty, a certain space which requires adept attention. The experience of recognising a moment when things can ‘be different’ or fail is described by O’Hara (2014) as a liminal space of ‘here but not yet’ (p. 3). This is a space which at its best is ‘disconcerting and confusing’ (p. 7).

As hard-held assumptions are called into question, the inclination to continue to process an issue may become compromised (Andersson, 2018). Group members could become impatient and feel an impeding need for closure. An important function would then be to (re)elicit the commitment and motivation inherently there, but temporarily removed. For the coactive scaffolding by the group, there is a need to face the inherent dilemma of staying open to the organic unfolding of a process while climbing the scaffolding. This uncertain state of the group is not to be avoided and can instead be seen as an integral part of scaffolding because, as argued above, complexity is an inherent source of uncertainty. Hence, uncertainty, along with all possible emotional responses that it may trigger, is an inevitable characteristic in processes when groups work on complex issues. Scaffolding here implies to grasp what brings about uncertainty. In doing so, the group is more apt in choosing constructive and adequate emotional support – such as working with commonality, allowing time, and developing trust – or cognitive support – such as linking knowledge and delimiting focus (Andersson, 2018; Murray et al., 2008).

In any creative process there are flashes of insights into the anticipated result as being radical, overwhelming, or truly ‘new’. These moments can also occur in group processes when glimpses of what might be the outcome shine through and become ‘drivers of hope’ for the process. Returning to the construction site, we can imagine such a moment when a tarpaulin flutters and reveals a glance of something unfinished. To transition from the old to the new, *transformational hope* (O’Hara, 2014) is required to draw us into the future, as a deep struggle for new meaning. For this kind of hope to become accessible for the individual, the affective regulating functions, such as contentment, safety, or affiliation, need to be engaged. That implies, O’Hara (2014) argues, that transformational hope emerges in the paradox of holding desires and passions in a contemplative and reflexive state. This also points towards paradoxical features of scaffolding, by both protecting process, participants, and outcome from disruptive situations, and, at the same time, allowing passions (as sometimes disruptive forces) to emerge as visions of change. By managing this inherent paradox, the sensation of reaching
that which is truly ‘different’ could be maintained as a driving force in the process. A new equilibrium between hope and motivation may emerge, as increases in complexity awareness conceivably dampen some sources of hope, while new emergent pathways strengthen the capacity and motivation to ongoing action (Andersson, 2016).

Monitoring and Evaluating

To collectively monitor and evaluate involves reflection in (Schön, 1991) and on (Torbert et al., 2004) action. The foremost promise of scaffolding is learning; hence, interim harvesting is important for several reasons. When discoveries are voiced, they strengthen the scaffolding, and make it integral to the group itself; in other words, it enables the group to appropriate the process. A process where learning raises the complexity awareness of the issue, the context, the perspectives of others, and of the individual participants’ own location in relationship to these implicates a revision of aspirations and conceptions of what is possible. Perhaps previously unarticulated problems crystallise, while matters that were taken for granted become problematised.

As results, it is not possible to predict the inputs of the group members, nor what they will choose to explore, discard, or transform to jointly developed synthesis. This means that process designs may have to adapt along the way to match evolving needs and trajectories. Scaffolding must therefore be flexible and adaptable in redirecting its supportive function when the group may opt for a new focus. To monitor this sometimes unpredictable development, an important paradox is that, to stay with a process by stepping away from it, one must figure out where the boundaries of importance to the discussion are to be found. To understand how the learning dynamics can function as iterative and developmental is a valuable analytical capacity for introducing new scaffolding components as the next progressive element.

Finally, as the usefulness of the scaffolding components must be continuously considered, we suggest that process evaluation is an essential element for the TDR design.

Summary – Scaffolding as a Learning System

The model shown in Figure 1.1 offers an introductory view on scaffolding as a learning system and serves as an entry point for understanding its integral elements, each of which could comprise very short timespans, or longer periods during which the group is completing specific tasks. To grasp the progression emergence of the elements, it is important to see how one element can flow and transform into a subsequent one. Scaffolding uncertainty, and eliciting participant commitment, may imply a connection to the liminal space of not knowing. In contrast, monitoring commitment where motivation is voiced in combination with new learning, a temporary landing is likely to emerge. When a new, interim platform thus materialises, the group feels it is possible to proceed, as it feels safe, and perhaps also inspired, to look ahead and to voice new needs and goals. In that way, monitoring feeds forward into analysing by accomplishing some of its tasks.

In sum, scaffolding as a learning system could become a living practice in TDR as a system of knowledge integration, where we, in line with Repko (2008), understand integration as a process. Our model (Figure 1.1) can be lifted beyond practical group models that target specific scaffolding principles or thinking skills, but as already stated, it should be seen as
a top-layer exploration. To elaborate the model, different layers need to be made visible, including deeper-level dynamics and unpredictable flows.

CONCLUSION: THE PROMISE OF SCAFFOLDING IN TD INQUIRY

We have explained that by ‘taking a walk on the construction site’ we reveal numerous connotations of scaffolding as a metaphor, thus casting light on its possible contributions to transdisciplinary inquiry. What we found were the developmental supportive and protective functions of *construction process*, *builders*, and *buildings*. Further, we acknowledged the need to dismantle the scaffolding when the building is completed, while being aware that reminiscences of the scaffolding are still discernible in the outcome. We also took note of pitfalls, such that scaffolding may hide what is being built and that its applications may not be flexible enough to anticipate shifts and changes in the building process. These findings convinced us that scaffolding should be discussed as an integrated and dynamic system, shifting attention between support and protection, as well as between process, participants, and outcomes. The purpose of this chapter is to elicit the relevance of scaffolding for TDR as a nonlinear process of learning: a learning system. This systemic understanding elevates scaffolding above and beyond the more general conception of a supportive function, like specific methods or facilitative guidelines. We have argued that a learning system needs to be integrated within the research process. When this is accomplished, scaffolding may take on a central role in TDR by becoming a system where co-production of knowledge for collective thinking about complex issues occurs. In other words, scaffolding becomes both means and ends.

One of the pitfalls of TDR processes, especially if they are recursive and experienced as slow, is a single focus on process-related outcomes, such as increased trust, a common understanding, a shared perspective awareness, and so on. While these outcomes are indeed important, we need to discern what kind of ‘building’, in terms of knowledge, then remains when the scaffolding is removed. This points to a critical issue discussed by Westberg and Polk (2014), notably, that learning in TDR is situated, thus often difficult to apply outside the TDR process. In other words, instead of knowledge becoming robust, which is the purpose of TDR knowledge production, it becomes ‘homeless’ in the sense of not finding its way back to, nor making an impact on, the organisations represented by the different stakeholders. Further, situated knowledge of TDR is not transferable to other contexts, which is indeed a problem when stakeholders need to be motivated to participate in the complex processes of TDR. Scaffolding should ensure knowledge production that includes transferability beyond home organisations. Further, it needs to affect participating organisations beyond being transformative for individuals, or to support the institutionalisation of new meta spaces for learning and reflection, for example, around governance or knowledge production. A legacy of scaffolding would then imply that the knowledge produced is separated from the knowledge process; a broad and continuous communication between participating organisations; and, ultimately, that scaffolding as a learning system is maintained as an embedded practice either in participating organisations or as an entirely ‘new’ practice emerging from the TD process.

It is important to acknowledge that there is no universal blueprint for scaffolding transdisciplinary inquiry. The purposes of each task need to be recognised to the extent that they can convey what kind of scaffolding components are needed next. It is therefore valuable if TDR practitioners can develop a process awareness, where iterations and process outcomes
are understood to be integral. This, we suggest, may be enabled by viewing scaffolding as an adaptive learning system. Scaffolding may thus become both a living practice filled with very practical, in-the-moment tools, as well as a resonant metaphor that acts as an attractor for a group to face their complex collaborative challenges. Lastly, to protect the building in a TDR process, the scaffolding cannot exclude decision-making, as it would inevitably reduce the ability to implement research results, thereby reducing the potential for impact. The challenge for scaffolding here is grand and manifold, as it includes making sure that the process reflects the complexity of the real world while making an impact in the real world.

REFERENCES


The promise of scaffolding: a metaphor for transdisciplinary inquiry


