Chapter 3
Innovations in Organisational and Community Learning

Lisa Vos

3.1 Introduction

Human beings have an extraordinary capacity to self-organise and accomplish great results. We have proven so since ancient history. Mankind also has an amazing capability to learn collaboratively and to create innovative solutions by combining a diversity of multiple perspectives, brains, personalities and ideas. Despite overwhelming evidence of the effectiveness of self-organising systems, the dominant approach to organising and design is top-down, structured and planned. In this chapter the argument is made that the dominant mental model and approach in organisations and in learning are ineffective in the face of most of the challenges people and organisations need to handle today. An alternative way of thinking and acting is needed to effectively deal with adaptive challenges. One possible alternative model is that of self-organisation and collaborative learning. The dominant mental model will be explained first, then a framework will be introduced which helps discern in which circumstances this model is effective and which circumstances require a different mind-set. Then self-organisation is offered as an alternative mind-set. When self-organisation is applied to knowledge creation and innovation, "collaborative learning" is discussed as mental model and as a set of methodologies. The argument will be made that collaborative learning methods have proven to create novel solutions to wicked problems, enabling input from many and diverse stakeholders, establishing ownership and alignment and doing all this more efficiently than traditional top-down learning models. The chapter will draw on research and publications on the nature of learning in social contexts, organisational and

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system change, chaos theory and complexity theory. In addition the author's professional experience in Organisational and Leadership Development in The Netherlands, Australia and New Zealand provides a source of data.

3.2 The Dominant Mental Model: Newton's Mechanics

The Organisation as we know it is not a God given 'thing' that has been around since the beginning of human existence. It is a human creation and in fact a relatively recent one. We have invented this hierarchical top-down structure with formal role descriptions, communication lines and a power distribution which allocates the power to think and decide to a small number of people at the top, presuming they know best, and allocates the power to execute and act on those decisions to the people at the bottom, who are presumed to be similar, mutually replaceable parts which need to be externally motivated by middle managers. It is worthwhile noticing a few characteristics of the collective mind-set that was dominant in the time that we created The Organisation, the time of the Industrial Revolution. Thanks to the inventions of the "new" science of that era, business needed to organise itself on a large scale for the first time. The steam engine and large factories enabled mass production, railway lines enabled mass transport and new communication media (mass printed newspapers, telegraph lines) enabled mass marketing. Chandler refers to these developments as a "historical increase in economies of scale and scope" (Chandler 1990). Where previously the owner of the company would be able to oversee the running of the business, now professional managers entered the stage, which were in charge on behalf of the owners of the capital. Masses of people who were formerly working as farmers, craftsmen or tradesmen in mostly rural communities were now flocking to the cities to man the new machines.

The dominant mind-set of the time was fed by the enthusiasm and promise of the new scientific discoveries and inventions. This new science was predominantly based on the seventeenth century science as represented by Isaac Newton: rational, logical, orderly, predictable and controllable. The dominant branch of science was mechanics, which led to the creation of brilliant new machines. Modern medical science had only just started and the humanities like psychology and sociology did not have a place on the scientific radar yet (Fig. 3.1).

In addition, there were two examples of powerful large-scale organisations known at the time: the army and the church. Characteristics of both examples were: top-down hierarchical; structured; with a separation of the thinking and the acting; with powerful rules about what to think and do. In these organisations most of the knowing and deciding was to be done by "the few" at the top and most of the acting without asking questions was to be done by "the many" at the bottom. One could grow in power, status and salary by climbing the hierarchical ladder, which was done by playing by the rules and 'being a good soldier'.

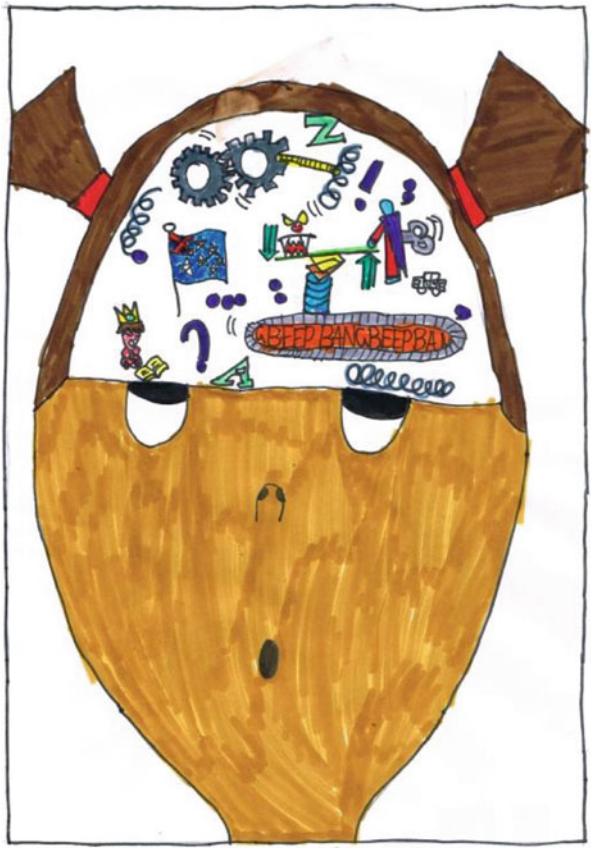

Fig. 3.1 Mechanistic mental model (Drawing: © Inez Roggema)

So it should come as no surprise that The Organisations that were created during this time mimicked the characteristics of the dominant mental models and the known examples of the time: they were created as top-down hierarchical structures and resembled many aspects of machines. They were supposed to be logical, rational, structured and planned. Its parts were to be mutually replaceable, with no mind of their own, merely supposed to carry out orders that were decided on at the top. As people tend not to enjoy being depersonalised and deprived of their capacity to think AND act, they need to be motivated externally by higher ranking officers, either by punishment or by reward. This organisational model replicates the mechanistic worldview complemented with the positional power distribution of church and army.

This is the organisational model we inherited and which is still dominant today. In summary, the assumptions that underpin this model are:

- The world is orderly, certain, predictable and controllable

- Difficult problems can be solved by dividing them into the composing parts, scientifically analysing them and reassembling them in a different and better way.
- Knowledge sits with a few people who ‘know best’, hold the most crucial information and hold the capacity to take the best possible decision
- People are similar in their skills, drives and motivations and are mutually replaceable
- Because people at the bottom only see their small part of the system, they need to be externally motivated by others; good work gets done by instruction and control.

To a certain extent these assumptions have held true and in those circumstances this type of organisation has worked quite well. We have been able to handle many large scale issues by reducing them into their parts, analysing them using our scientific methods and deciding on better mechanistic structures to deal with them more effectively. So what is the problem?

3.2.1 The Problem

The problem is not that his traditional mental model of organising is ‘bad’ or that we should get rid of it all together. There are issues that are dealt with effectively by using a structured, planned and reductionist approach. One problem is that the assumptions that underpin the effectiveness of the mechanistic model might hold true in some cases, they are clearly untrue in the majority of circumstances as experienced by people in organisations and in learning situations. In fact, most leaders of organisations would describe their world as highly uncertain, ambiguous, unpredictable and uncontrollable. The issues and challenges that arise in this uncertain and ambiguous world are of an entirely different nature than the ones that were effectively dealt with by the reductionist analytical approach. Yet, the majority of leaders in organisations still approach these different challenges in the same old mechanistic ways. Examples of Newtonian interventions in modern organisations in response to difficulties are: restructuring, creating a new division/team/task force, changing management, asking for more resources (the common term used for “people”), and bringing in external experts. Change the machine, fix or replace parts that are not working, realign the flow in the factory. All done by well educated people with all good intentions. The problem is that we keep applying a mental model to circumstances that are inherently different than the ones for which it was created. An additional problem with the mechanistic mental model is that by applying it to organising social systems we have organised the meaning out of our organisations. We deprive the majority of people of their sense of ownership, meaning and contribution and we lose the value of knowledge of “the many”. People are being reduced to cogs in a machine.

3.3 Tame and Wicked Problems, Technical and Adaptive Challenges

Before moving on to an alternative mental model to the mechanistic one, it is helpful to look into the different nature of different problems in a bit more depth. Why are some problems not so much 'more difficult' than others, but rather 'difficult in a different way'? What exactly is the nature of those problems and how might we discern when which mental model would be most effective? The work of Ralph Stacey (Stacey 1999) provides us with a lot of insight into social systems, derived from complexity theory. The following is a model that has proven to be helpful in framing the different nature of circumstances in which organisations function, the different nature of 'problems' associated with these and thus the different approaches in dealing with these problems that would be appropriate. It is commonly referred to as the Certainty/Agreement Matrix (Stacey 1999).

Stacey distinguishes two dimensions which he puts on two axes of a grid (see Fig. 3.2). The first dimension, on the horizontal axis, is the degree to which a situation is considered to be either close to or far from certainty. Where one is close to certainty, it is more or less known what will happen next, one can predict the near future reasonably well. Cause and effect linkages can be determined; the outcome of actions can be predicted based on experiences from the past. Likewise, when one is far from certainty the future is unknown and cannot be predicted.

The second dimension, on the vertical axis, is the degree to which there is agreement on the best course of action to take. When one is close to agreement, there is

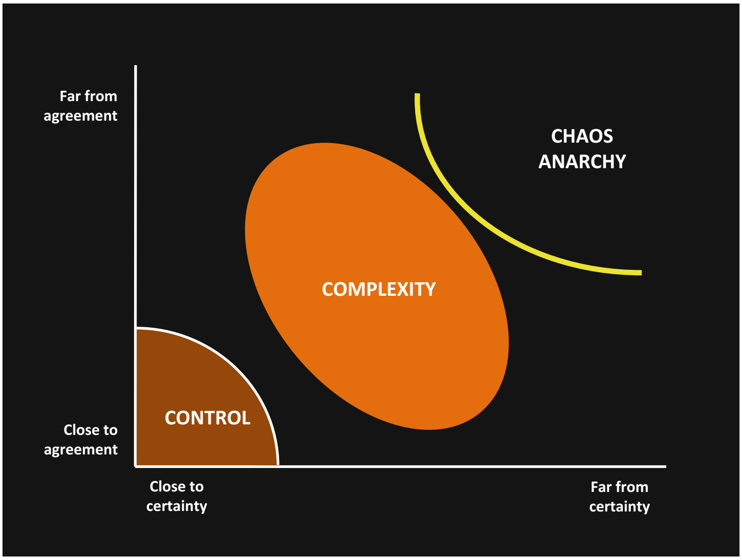

Fig. 3.2 Certainty/Agreement Matrix (Adapted from Stacey 1999)

broad consensus on what the best solution to the problem would be. When one is far from agreement, there is a diversity of views on what to do next and each view might be equally true and valid. When put on two axes as shown in the figure above, the two dimensions create a grid that maps different types of circumstances in which organisations function. Stacey identified five distinct zones within the grid (Stacey 1999). For the purpose of this chapter the discussion is limited to three. In the bottom left hand corner, situations are relatively certain and there is a large degree of agreement on what to do. This area can be referred to as the area of “Control”. Examples from organisations of this area are parts of the business where routine behaviour and procedures are effective. Problems might be very difficult and complicated, but the expertise and methods required to deal with them is known and available. This is the area where traditional management & control are effective, procedures and systems are helpful, operational excellence is a relevant aim.

At the top right hand corner, far from certainty and far from agreement, is the area that Stacey refers to as “Chaos” or “Anarchy”. The uncertainty and disagreement are so high, that there are no reasonable things one could do to solve an issue. The system might glide into anarchy or disintegration. Another potential response Stacey notices is avoidance. In Stacey’s logic this area of Anarchy is not productive and organisations would be wise to avoid it.

The area between “Anarchy” and “Control” is the area which Stacey calls the zone of “Complexity”. Others call it the “Edge of Chaos”, where the potential for innovative breakthroughs is high. The term “Turbulence”, as used by Emery and Trist, contains similar meaning. They referred to an organisational environment as ‘turbulent’ when “the dynamic properties arise not simply from the interaction of the component organisations, but also from the ground itself. The ‘ground’ is in motion” (Emery and Trist 1965). This area of “Complexity” or “Turbulence” is where most of our current day challenges occur. The environment is ever changing, ambiguous and the near future is unpredictable. There are multiple views on what is ‘right’ and different agents in the system each hold crucial pieces of knowledge.

Issues or challenges that occur in the area of “Turbulence” are difficult in a different way than problems in the “Control” area. In “Control” problems are difficult because they are complicated: they consist of many different components and it requires expertise to solve them. Yet, the type of problem is known, it can be understood within the known frames of reference, it can be decomposed and solved, provided that the right expertise is available. This type of problem is also referred to as ‘tame’ as opposed to ‘wicked’ (Rittel and Webber 1973). The distinction between ‘technical’ and ‘adaptive’ problems is relevant here (Heifetz and Linski 2002). With a ‘technical challenge’ the know-how and procedures to solve the problem are available. The issue can be dealt with in an ‘expert’ way. With ‘adaptive challenges’ the problem itself cannot easily be understood, there is no quick fix that can be provided by an expert. Solutions have to be novel and require a shift in thinking. The road to a solution consists of experiments and new discoveries which involve multiple people from the organisation or community (Heifetz and Linski 2002). A ‘wicked’ problem is used to describe complex multidimensional problems, with incomplete, contradictory or changing requirements (Rittel and Webber 1973). Problems located in the bottom left hand corner of the Stacey grid, which can be characterised as 'tame problems' or 'technical challenges', can be effectively dealt with by using methods that stem from a Newtonian mechanistic mind-set. For example: well-trained surgeons can perform difficult heart surgery by applying their expert knowledge and skill and following procedures. However, with 'wicked problems' or 'adaptive challenges' which occur in the space of Turbulence or Complexity, a different mind-set or mental model is needed.

3.4 An Alternative Mental Model

3.4.1 Self-Organisation

In situations of a high degree of uncertainty and a low degree of agreement on the best course of action, there are no known solutions; there is no single right answer. It is irrelevant to look at experts to come up with the solution, since there is none. What is needed is an open exploration of all aspects of the problem, a joint process of data gathering and sense making that involves many people. These views might even be paradoxical or contradictory. Most of all, there is a need to draw on the full capacity to think and act of multiple people involved.

Where the traditional default ways of organising and responding to problems is rooted in the mechanistic science, it pays off to consider developments in science as they evolved in later eras, most notably in the twentieth century. Research on quantum physics (Capra 1982, 1996; Wheatley 2006), systems thinking (Beer 1975; Senge 1990; Wheatley 2006), and chaos and complexity theory (Capra 1982, 1996; Prigogine and Stengers 1984; Kuhn 1962; Peters and Wetzels 1997; Homan 2005) have offered critical new insights in the nature of complex problems. As with seventeenth century mechanics, these insights offer useful mental models to apply to social systems as well. A useful alternative mental model that emerges from these branches of science is the model of Self-Organisation (Morgan 1986; Wheatley 2006; Senge 1990; Peters and Wetzels 1997; Swieringa and Wierdsma 1990) or Complex Adaptive Systems (Stacey 1999). A self-organising system is seen as a collection of individual agents, each acting autonomously in a purposeful way, interconnected and influencing each other's behaviour in multiple visible and invisible ways. Many examples are known from nature, where highly effective self-organisation occurs in complex flocking of birds, schooling of fish and swarming of bees. Ecosystems, water systems and the human body are other examples of systems that create and maintain themselves, combining forces of change and stability to adjust and adapt to ever changing circumstances, constantly changing shape yet maintaining their core identity. Processes of organisation occur, not planned and controlled by a single entity, but by the complex interaction of autonomously acting individual agents. There is order, but not by design and control from 'the top', but rather emerging from within the system. The system behaves purposefully and

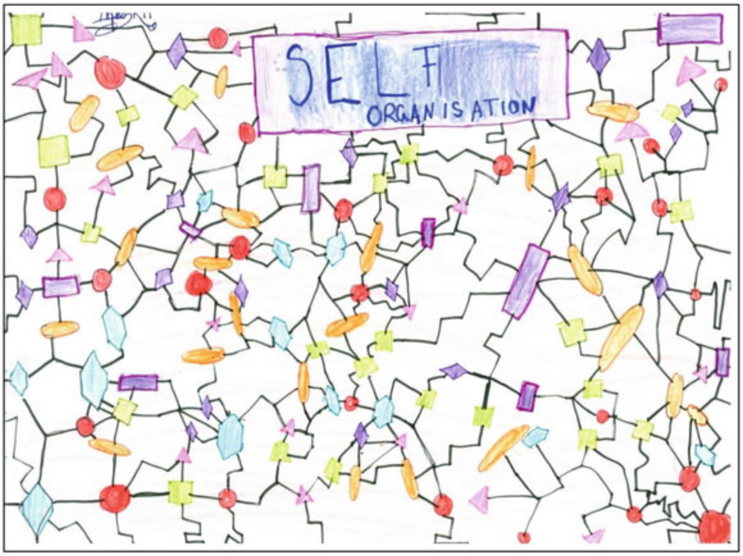

Fig. 3.3 Self-organisation (Drawing: © Inez Roggema)

produces highly complex forms in response to triggers from its environment. It is proposed here to apply a self-organising or complex adaptive mental model to social systems and it is argued that this lens is useful in helping social systems deal effectively with 'wicked problems' or 'adaptive challenges' (Fig. 3.3).

Human beings have the capacity to effectively self-organise and accomplish remarkable results. In addition to the examples from nature and physics, there are many examples of human systems that show effective self-organisation. Large scale examples are social changes like the recent revolution in the Middle East, which started with a single florist in Tunis burning himself, thus igniting a revolutionary fire that spread throughout the region; responses to crisis, like the 7,000 ordinary Australians who went to Queensland after the 2011 floods, and were effectively helping cleaning up people's houses within a day without instruction or control. Smaller scale examples are jazz orchestras that improvise and perform at a high level without the guidance of a conductor and countless small scale examples in our organisations where teams of people connect to get great work done without (or sometimes despite) instruction by management, sometimes breaking organisational rules and procedures to make sure problems are fixed. These examples demonstrate the extraordinary capacity of human beings to self-organise, think and act together to achieve a common purpose, without formal structure, plan or management.

'Wicked problems' or 'adaptive challenges' require the capacity of multiple parties and people to think and act purposefully together. They require deliberate experimentation and discovery. They require abundant sharing of information about 'what works' and 'what doesn't work' and the acceptance that there is no expert with the single right answer. They require the mandate for individuals to act locally and immediately, informed by the most recent information. They require the permission to take calculated risks and to "fail early in order to succeed sooner" (Brown 2009). Structures are fluid and temporary and exist as long as they are helpful. Rather than by an elaborate web of role descriptions, accountabilities and formal communication lines, organisational effectiveness is achieved by establishing and monitoring a small set of "simple rules" (Wheatley 2006). Elsewhere it is referred to as "minimum critical specification", the "facilitating or orchestrating role managers and organisations can play, creating enabling conditions that allow a system to find its own form" (Morgan 1986). The choice of which specific "simple rules" are relevant depends on the context and situation of the system. But a few commonalities can be derived from different sources of research about the type of simple rules that are in place whenever effective self-organisation occurs:

1. **Common purpose, meaning or identity**
   Effective self-organisation requires a strong sense of common identity, meaning or purpose. In addition individuals need to be able to connect an individual sense of meaning to this overall identity, either consciously or subconsciously. In the case of flocking birds this common identity can be described as 'survival of the flock' and related to this an 'increased likelihood of survival of the individual'. With the Queensland flood help the shared purpose is 'to help people (clean their houses) in an emergency'. Individuals connect individual meaning to this purpose that can be described as the 'desire to help others' or 'the desire to act and do the right thing'. A clear sense of identity and common purpose gives direction to the behaviour of individual agents and to the behaviour of the system overall. Identity is the key 'boundary' that provides containment for the complex of individual drives and actions and enables commonality and purposefulness to exist amidst conflicting forces and ambiguity.
2. **The nature of relationships, connections, interaction**:
   It matters in which way individual agents in the system are 'supposed' or 'allowed' to relate to each other and interact with each other. These terms are inadequate in the sense that they seem to imply a 'controlling or permitting' entity. What is meant is that effective self-organising systems have a rule that governs the way individual agents relate and interact. This rule is not designed by an 'expert' or 'manager' but rather it has emerged from the system's behaviour itself and/or is agreed upon by the members of the system. In nature and large social systems this is solely an emergent process in which rules get 'codified' or reinforced when they improve the system's chances to achieve their purpose or maintain their identity. In organisations this rule can be established via a joint process of dialogue, discovery and agreement. Examples of this type of rule in nature: in complex flocking each bird will follow the bird in front of it, yet will avoid colliding with it. In Organisations an example could be: 'we will include anyone who has information that is relevant to the accomplishment of the task or who will be affected by the results' or 'we talk with each other and not about each other'.

3. **The flow of information through the system**:
   Effective self-organisation requires information to flow freely from where it is available to where it is needed. Whilst this sounds self-evident, most organisations following the mechanistic mental model demonstrate the polar opposite: information is highly controlled, compartmentalised, fragmented and confined to formal communication lines. Self-organisation requires each individual to be able and 'allowed' to act on local information immediately and autonomously, adjusting their behaviour in line with the common purpose and identity. Individual people or parts of an organisation need to have explicit and full permission to act locally based on local information combined with their best intent to help achieve overall purpose and individual meaning. The people who went to help in Queensland set foot on Queensland soil, were handed a bucket and a mop and could direct themselves to where they saw help was needed. When work was done they could individually choose to move on to a different house, join forces with other people or go home all together. Jazz musicians agree on a genre, tempo and key after which each individual applies the best of their skills autonomously to achieve superb musical quality.

3.5 Collaborative Learning

3.5.1 Self-Organisation in the Context of Learning

The basic ingredients for finding new solutions to problems are knowledge, information and ideas and the ways in which they can be made applicable to the problem context. Similarly as with organisations, the way mankind has approached education and learning has been mechanistic in nature since the seventeenth century. This mechanistic approach has been reinforced during the industrial revolution, when for the first time in history education was seen as relevant for more than just the elite and in the wake of labour liberation movements was made available to the masses. Where the classical principles of 'universitas' (from Latin: 'the whole', 'total', 'universe') and 'schole' (from Greek 'free space') advocated a broad offering of multiple disciplines that could meet in an interactive and conversational approach, leading to an emerging understanding and the creation of knowledge in students' minds rather than transfer from the teachers mind into the student's, the industrial age saw the establishment of institutionalised education systems the characteristics of which were similar to the factory type organisations that were created in the same era (Robinson 1999). Education was based on the assumptions that the correct knowledge was to be delivered by experts, students were at the receiving end until they had proven sufficient mastery, the disciplines were offered as separate streams or parts, without integration, education was reductionist, planned, orderly and rational. And in education and learning as well as in organisations this mental model of learning is still dominant today. And as with organisations, this 'teaching' style of learning works well as long as the problem context is 'tame' or 'technical'. Where the problem context requires novel combinations of different knowledge disciplines, high degree of input and ownership of multiple stakeholders and innovative knowledge creation applicable to a specific context, the mechanistic mental model does not work. The model of self-organisation offers a valuable lens on learning and knowledge creation that offers the potential of high quality, innovative solutions that provide answers to wicked problems or adaptive challenges.

Several scholars offer valuable insights and concepts that help frame different types or levels of learning. I describe five angles on this collection of insights and will then offer an integrated model representing different levels of learning.

3.5.2 Individual and Collective Learning

A first distinction which is relevant here is that between individual and collective learning processes (Homan 2001; Swieringa and Wierdsma 1990; Argyris 1992). Individual learning refers to transfer or creation of knowledge in individuals, increasing their individual ability to act. Collective Learning means more than the sum of the individual learning results. In collective learning processes collective sense making processes occur which not only add to individual capability, but also lead to increased capacity of the group to behave effectively as a collective. This collective learning can be extended to organisational learning (Argyris and Schön 1974, 1978; Senge 1990), "Team" Learning (Homan 2001) and Large Group Interventions, which aim at whole system learning (Bunker and Alban 1997). The distinction is relevant, because aspects of group behaviour, group dynamics and group life impact the learning as a collective, either in a helpful or in a hindering way. Effective collective learning requires knowledge and awareness of these areas of expertise. The focus in this chapter is on collective learning processes.

3.5.3 Learning Domain

A second variable to consider is the "Learning Domain" (Homan 2001), which is described as the area the learning is meant to be focused on, or that "which is formally on the agenda". The nature of the Learning Domain plays an important role in assessing which type of learning interventions would be applicable. If the learning domain is of a 'tame' or 'technical' nature, mechanistic interventions, like teaching by an expert, are effective. When people have a knowledge gap that prevents them from doing their job well, the best way to go is to offer them some formal training or teaching to fill that gap. Wicked or adaptive Learning Domains clearly would be better 'taught' in complex interactive settings.

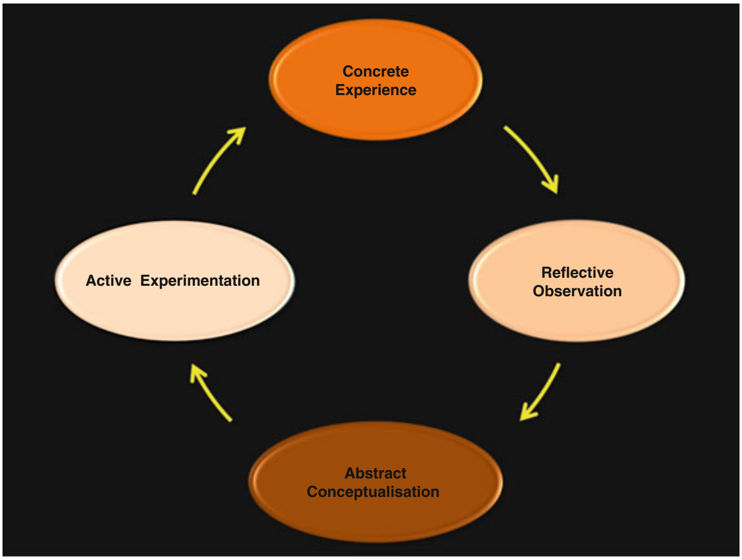

Fig. 3.4 Experiential learning cycle (Kolb 1984)

3.5.4 Experiential Learning

The 'Experiential Learning Cycle' (Kolb 1984) frames how learning actually takes place. The interventions need to encompass all four stages of a cyclical process (Fig. 3.4) for actual learning to occur, in the sense that you observe people 'doing' differently in the context of their learning domain.

There needs to be concrete experience ("acting"), conscious reflection on that experience, abstract conceptualisation, which can consist of expert knowledge being taught, books being read or other methods, after which a learner decides on new types of behaviour to experiment with in practice, which again leads to concrete experience, etc. So where traditional education almost solely focuses on transfer of expert knowledge onto learners Kolb's cycle implies that no meaningful learning will occur from that activity alone. Knowledge needs to make sense in the context of a learner's experience, which they could only gain awareness of by reflecting on that experience. And knowledge only makes sense if it would then lead to new behaviour experiments in the context of the learner's practice.

3.5.5 Depth of Learning Impact

Furthermore, it is important to consider the "depth" (Homan 2001) of the learning impact or the level at which learning occurs. In social systems the terms "single-loop" and "double-loop" learning are defined (Argyris and Schön 1974, 1978;

Argyris 1992). With single-loop learning there is “direct modification of the behaviour itself”. “An error is corrected without questioning or altering the underlying values of a system”, like in the example of the thermostat, which will adjust its behaviour when the actual room temperature is too high or too low compared to the set temperature, but which will not question the fact that it had been set to that specific temperature. In double-loop learning “mismatches between intended and actual behaviour are corrected by first examining the governing variables and then the actions themselves” (Argyris 1992). With collective double-loop learning, which is particularly applicable in social systems like organisations, this examining of “governing variables” involves getting an “understanding of the meanings people create when they deal with each other”, surfacing mental models or value systems that might either support or hinder effective actions. In addition they stress that “the learning occurs in the action” and that acquisition of new knowledge should not be called “learning” yet. Single-loop learning is applicable to routine, repetitive issues and double-loop learning is needed for complex, non-programmable issues. The connection with the previously used terms ‘tame’, ‘technical’ problems and ‘wicked’, ‘adaptive’ problems cannot be made one on one. Yet it is fair to state that in the case of ‘wicked’ problems, single-loop learning will not be sufficient and that double-loop learning is necessary (Argyris and Schön 1974, 1978).

Referring to Conant and Ashby’s “Law of Requisite Variety” (Conant and Ashby 1970; Homan 2001) identifies three levels of learning, each of which is applicable to a different level of “variety of the Learning Domain”. “1st level learning” or “Framing” refers to applying current views to a task or problem. “2nd level learning” or “Reframing” means exchanging views and generating a shared set of new and richer views. A continuous and cyclical process of challenging existing views on an ever-fundamental level is called “breaking the frames” or “3rd level learning” (Homan 2001). The lower the level of variance in the learning domain, the more “framing” learning methodologies are relevant; the higher the degree of variance in the learning domain, the more the cyclical, continuous approach of “breaking frames” is needed.

3.5.6 Self-Organisation and Learning

Self-organisation and self-organising systems are useful metaphors in the realm of learning. Section 3.4.1 gives an overview of characteristics and conditions for self-organisation. The relevance of self-organisation for collective learning is demonstrated by a number of researchers (Senge 1990; Morgan 1986; Homan 2001; Mitra 2006). A few relevant examples of this research are mentioned here. The work of systems physicists in the area of cybernetics demonstrates how complex dynamics in systems influence the system’s behaviour and the importance of considering the self-organising characteristics of system behaviour as instrumental in collective learning (Senge 1990; Morgan 1986). Morgan describes the learning capacity of organisations as a "brain metaphor". The key characteristics of the brain are "requisite variety", "learning to learn" (similar to double-loop learning) and "enhancing capacities for self-organisation" by applying "minimum critical specification" (comparable with "a few simple rules") and "redundancy of functions". Senge postulates Systems Thinking is the key "discipline" for establishing a "learning organisation" (Senge 1990) and describes similar "loop" mechanisms as in Organisational Learning (Argyris and Schön 1974, 1978).

Insights from Chaos Theory are seen as useful for understanding and creating collective learning. A few examples from research are mentioned here. "The self-organising, self-referential and autopoietic nature of chaotic behaviour in systems" cause new order emerging from chaos in systems that are out of equilibrium (Homan 2001). "Transformational learning at the 3rd level in response to wicked problems occurs by increasing the complexity in a system or bringing it out of equilibrium, so new order can emerge". "Group Learning processes are in principle complex unstructured processes of a self-organising nature". Chaotic and self-organising processes can help new insights and solutions emerge.

The "Hole in the Wall Project" (Mitra 2006) demonstrates another example of the self-organising nature of learning, in response to a challenge which was inherently wicked: "The areas in India where the need for outstanding teachers is exceptionally high are the areas where outstanding teachers are least likely to go to", i.e. teaching primary school age children in poor areas in India. In the "Hole in the Wall" project internet connected pc's are placed in a hole in a wall and left to local children to find their way with it. What these children would be able to learn together is noticed and recorded, leading to the proposition that "education is a self-organising system, where learning is an emergent phenomenon" (Mitra 2006).

3.5.7 Integration: Learning at 3 Levels

An integrated representation of levels of learning, complexity of the issues in the learning domain and learning interventions is found in Fig. 3.5.

The vertical axis represents the Learning Objectives at different levels of learning with "information transfer" at the bottom end, "skills and competency building" at the intermediate level and "mental model shift and knowledge creation" at the top end. The horizontal axis represents the Delivery Approaches, ranging from "Instructor/Expert centred", via "Learner centred" to "Team, Partnership or Community Centred". Combined these two dimensions show collections of learning technologies that are applicable to an increasing level of complexity of both Learning Domain and learning approach as you move from bottom left hand side of the grid to the top right hand side.

At the bottom left hand side one finds methodologies which are based on the mechanistic mental model, referred to here as "Distribution Technologies". The assumption is that knowledge is held by the expert and is transferred to receiving

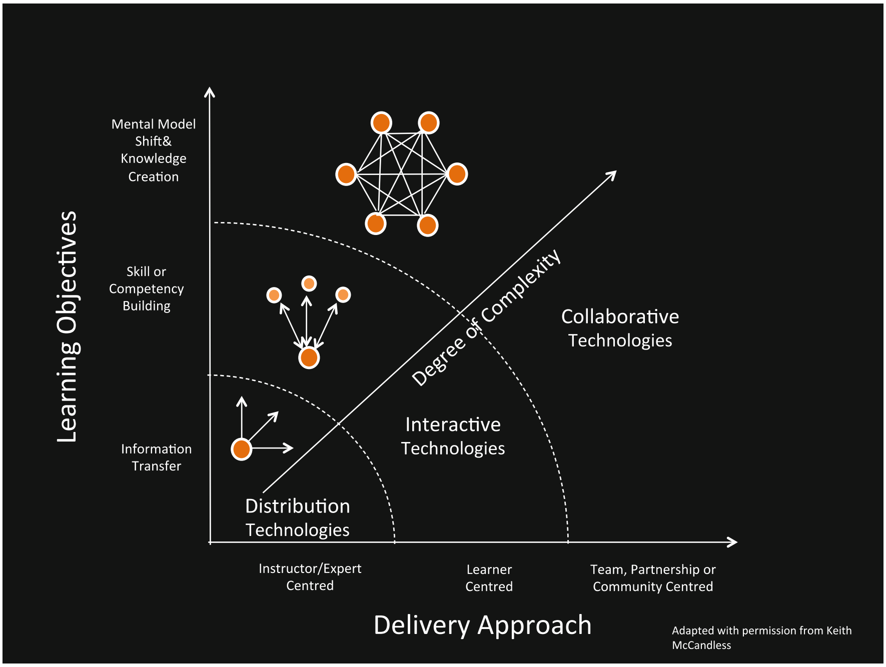

Fig. 3.5 Learning at three levels

non-experts in one-way traffic often referred to as "sending information".[1] All knowledge is known and pre-existing, the expert knows the right and correct set of knowledge, the expert decides what is relevant for recipients to learn and which would be the best way to learn it. Once the information has been transferred, the assumption is that the recipients will know how to apply it to known problems in known situations. This level of learning is individual and single-loop; applicable in 'tame' or 'technical' Learning Domains.

Interactive Technologies are characterised by two-way traffic, a combination of sending and receiving expert information and responding to that information by learners. The assumption is that experts still know better than learners, but the way in which learners can use new skills in their context is crucial. The interaction between learners and experts partly determines the content and approach of the learning. This is still single-loop learning, since the objectives are known in advance. The interactive process provides feedback loops that inform the learning process, but the learning objectives themselves are not up for discussion. It is also still individual learning. Whilst interpersonal interaction might be part of the learning domain and approach, at this level there is no conscious use of collective sense-making processes or the generation of changed collective mental models or values.

[1] Please note that the metaphor itself of the transmission device with a 'sender' and a 'receiver' is highly mechanistic.

This level of learning is often aimed at increasing participants' level of competencies against the values of a predefined 'competency framework'.

At the highest degree of complexity we find Collaborative Learning Technologies. These are based on the assumption that relevant knowledge is present in all members of the learning setting, in 'facilitators' and 'learners' equally. There is no single right answer, no differentiation in 'experts' and 'non-experts'. Knowledge is created in a collaborative process which is characterised by self-organising processes encompassing multiple connections and interactions between all group members, most commonly in combinations of individual, small group and large group activities, using learning activities that include the four cycles of Kolb's Experiential Learning Cycle (Kolb 1984). Learning is collective, "breaking the frame" and double-loop. Sharing a diversity of multiple perspectives is used to generate a new shared set of meaning in order to produce novel effective behaviour. Examples of Learning methodologies at this Collaborative level are multidisciplinary design sessions, Large Group Interventions (Bunker and Alban 1997; Homan 1998), Action Learning Methodologies (Revans 1980), Appreciative Inquiry (Cooperrider and Srivastva 1987; Cooperrider et al. 1995, 2008), dialogue methods, World Café (Brown and Isaacs 2005), whole system adaptive change approaches and projects like the "Hole in the Wall" (Mitra 2006).

To generate new knowledge in order to create novel solutions to 'wicked' or 'adaptive' problems, Collaborative Learning Technologies (CLT's) are indispensible. Collaborative Learning interventions aim at the 3rd level or transformational learning (Homan 2001). They require challenging of current mental models and belief systems, make use of the input and commitment of many stakeholders. CLT's involve collective learning and sense making processes in which new shared views and mental models are created, which then serve as new and more effective Theories-of-Action (Argyris and Schön 1974, 1978; Argyris 1992). In addition, interventions in this Collaborative Learning realm are inherently cyclical and non-linear in nature, using self-organising processes to create ever new responses to changing situations.

Figure 3.6 provides an overview of the three levels of Learning Technologies with their characteristics.

3.6 Assumptions, Characteristics and Conditions for Collaborative Learning

3.6.1 Assumptions

In summary the effectiveness of collaborative learning approaches is based on the following assumptions:

- The context is unpredictable, turbulent and ambiguous
- Problems (the learning domain) are of a wicked or adaptive nature

	Individual or collective learning	Nature of learning domain	Kolb experimental learning cycle	Depth of learning impact
Distributive	Individual	Tame problems Technical challenges	Conceptualisa-tion only	First level learning
Interactive	Individual	Tame problems Technical challenges	Conceptualisa-tion and experimenting with new behaviour	First or second learning level
Collaborative	Collective and individual	Wicked problems Adaptive challenges	All stages of cycle (and multiple times)	Third learning level

Fig. 3.6 Framework of learning technologies

- There is no single right answer, there is no expert who can provide the solution; knowledge and ideas resides in many agents
- There are no known or fixed solutions, the problem itself is multidimensional
- Solutions require input of multiple stakeholders and the ownership and commitment to execute the solutions from multiple stakeholders
- Solutions require new ways of thinking rather than applying old knowledge to a new situation.

The collection of Collaborative Learning methodologies itself is broad and diverse, the examples in the previous section are just a few. The research referred to in this chapter so far provides a broader range of practical examples.

3.6.2 Characteristics

Whilst it is impossible to give a comprehensive list of examples of Collaborative Learning Technologies (CLT's) here, there are a number of commonalities in their characteristics and conditions that are worth describing. CLT's are characterised by a high level of energy in all participants, which ebbs and flows from highly active to highly reflective and back. The energy is created by the fact that work is done on real world issues that participants experience as relevant to in their context, combined with the freedom to contribute their best. This leads to a high level of intrinsic engagement, commitment to put in their best effort and preparedness to take responsibility for the outcomes, decisions and actions that result from the intervention. In addition to the content and outcomes, participants experience a safe holding environment, in which they feel free and able to have frank conversations, surface mental models and work through potentially difficult issues. The process is often referred to as 'liberating' and 'rewarding', whilst also 'exhausting'. Commonly CLT's lead to results which participants had not thought possible beforehand and breakthroughs in processes that had been 'stuck' for a long time (sometimes years or even decades). Whenever there is a systemic issue which requires input from multiple stakeholders, commitment and ownership by those multiple stakeholders, alignment of individual and collective identity and objectives, speed and timeliness, Collaborative Learning methodologies are the most effective and impactful approach (Bunker and Alban 1997). In addition, the shared experience helps build a common base of experience knowledge, sense of 'common ground' and appreciation of differences. A CLT can help break down the "walls" between different parts of the system ("siloes") and build a community: members develop an identity which is connected to the whole rather than to the parts. Identity becomes more 'whole of system' rather than 'my team' or 'my department'.

3.6.3 Key Process Steps

Three high level process steps are crucial for creating constructive CLT processes: Thorough Preparation, a Holding Environment and Closure.

1. **Thorough preparation**
   Most people would consider the actual events with participants in a room as 'the work'. In actual fact the scope of 'the work' is much broader and includes the process before you actually have people in the room. The importance of a thorough preparation cannot be underestimated. This preparation is ideally done with a 'Design and Preparation Team' which includes a representation of all key stakeholders to the issue. The purposes of Design and Preparation are to establish a shared understanding of the issue that should be dealt with (the Learning Domain), the purpose and objectives of an intervention, potential approaches and ultimately a structure and agenda for the intervention. It is crucial to dig deep enough to surface the issue that should really be dealt with, explore mental models that might be keeping those issues in place and start building permission with different stakeholders to stretch their comfort zones and challenge their assumptions. Responses to the intervention in the Design Team are often a good

predictor of responses of the larger system. These data can further inform the design in structure, methodologies, activities and facilitation styles of the actual intervention. The learning work is being modelled in this preparation process, approaches can be tested and collective sense making processes within the Design and Preparation team lead to a genuine and "felt" ownership of and commitment to the design.

2. **Creating a Holding Environment**
   To create a free flow of information exchange, in which mental models can be explored and shifted and new content can be created, without this process escalating into chaos, a "few simple rules" need to be in place. At the start of the actual event it is crucial to "set up the learning system" and explicitly contract with all participants on a few aspects of the learning approach. A good holding environment consists of a safe web of relationships and boundaries within which people can freely share their ideas and concerns and can work through potentially difficult issues. Creating this holding environment starts with providing clarity on purpose, objectives and intent of the intervention; then providing clarity about the structure and flow of the day(s) and explanation of the different learning settings that will be used. The learning approaches and the nature of activities should be made explicit and explained if needed. The second step consists of explaining the importance of safety and confidentiality within the boundaries of the learning intervention. This applies particularly when the Learning Domain has issues to which participants might have emotional responses. Participants are asked to explicitly agree to guard this confidentiality and safe learning environment. It is then useful to do a whole group activity in which participants are invited to explore some of their initial responses to the topic of the intervention. Depending on the nature of the learning domain and purpose of the intervention it is more or less crucial to establish a climate in which potentially difficult emotions are legitimised and can be surfaced in a constructive way. Firstly, to prevent these emotions from 'firing up' and leading to defensive routines rather than learning; secondly to use these emotional responses as potentially useful data while working on the learning domain.
3. **Closure**
   It is important to mark each time boundary in an event or series of interventions with good and explicit closure. The nature of this closure will be different for a 1 day event than for a longitudinal process of multiple events and interventions. Important elements of good closure are: an explicit sharing of the learning experiences and the new 'sense' that has emerged on issues in the learning domain; any agreement on outcomes that have been achieved; if appropriate an explicit agreement on actions or next steps to take; agreement on how to engage people who did not attend the event in the process and outcomes; agreement on how to capture and process the data and information that were generated; collective reflection on the processes and experiences during the event.

3.6.4 Practical Design Principles

The following 12 practical design principles have been proven to be helpful in most CLT's:

1. Establish a **clear and explicit understanding of the learning domain** and objectives. This should be an issue which is "real", relates to the participants' real practice, the solution of which is relevant to each. The issue should be systemic (cross boundaries, cross hierarchy, multidimensional and affect multiple people at multiple levels) and of a wicked nature. It does not make sense to create an intervention with high complexity when the issue could be easily dealt with by a small subset of specialists. A clear purpose is one of the factors that provide containment for the productive energy of a large group of people and for emotions that might surface when a group starts engaging with challenging issues.
2. Get the **Whole System in the Room**: it is crucial to invite all relevant people to participate. Once the learning domain has been agreed on, the issue could be rephrased as a purpose statement. Then everyone who is needed to achieve this purpose should be part of the intervention. It is important that key decision makers who are relevant to the issue are involved, present and visible.
3. **Mandate and permission** from key decision makers to work in the adaptive realm and challenge the current belief systems. It is good to have a clear sense of the boundaries of the playing field: which things are up for discussion, which are not? Which are the degrees of freedom with which participants can approach potential solutions?
4. Organise **multiplicity and diversity of voices, points of view and perspectives**. New shared meaning and novel solutions to wicked problems can emerge from a constructive 'clash of opposites'. If views are too similar from the start, a group might move into solution mode very early and defer to 'safe' single-loop learning rather than engaging in the more challenging double-loop 3rd level learning.
5. Structure the activities as **combinations of individual, small group and large group** conversations, interspersed with collective sharing and sense making. Conversations will be structured as dialogues rather than discussions, aimed at generating many views rather than agreeing on one best. Deep listening and inquiry are the preferred communication styles, enabling open, frank and explorative conversations.
6. Common database and **free flow of information**: every participant should have equal access to all information available and there needs to be permission and infrastructure that allow information to be shared freely.
7. **Equal participation**: everyone's contribution is equally valuable. The design of the intervention needs to enable a conversational flow in which hierarchy or expertise do not have a perceived advantage.
8. In many CLT's the creation of a **shared image of a preferred future** plays a powerful role. It provides stretch between the 'now' and 'desired future', which creates tension that generates action and commitment.

9. Build in **time for reflection and 'break through moments'** regularly. Reflection is a crucial activity in 3rd level learning and is easily overlooked in our action biased western culture. Conscious reflection on new sets of information and on complex experiences is pivotal in the process of individual and collective sense making.
10. **"Touching the data"**: it helps when participants are required to do a lot of capturing of ideas and reporting back themselves on "touchable" media (post-its, flip charts, objects, modelling), which forces everyone to be explicit about their ideas.
11. **Perfect organisation and logistics** (room set up, catering, materials) to ensure smooth and seamless delivery of the intervention. Bunker & Alban refer to this as the "Zamboni principle", creating a process without glitches or unexpected bumps.
12. **Data Assist team**: the amount of information shared and generated is vast and of diverse nature. It is important to keep as much of this diversity alive and present and retain the "rich picture". It is valuable to have a specific group of people who have the task of capturing and collecting *all* data generated and assisting in reporting back to participants and people who did not attend the intervention.

3.6.5 Role of the Facilitator in Collaborative Learning

The previous sections have made it clear that in Collaborative Learning Technologies there is no place for a traditional 'mechanistic' top down expert who is in charge of 'leading the intervention'. It would be a mistake however, to conclude that there is no role for a facilitator at all. On the contrary, Collaborative Learning Methodologies require highly skilful design and facilitation to be effective. The facilitator's role is a crucial one, yet distinctly different from a traditional 'teaching' role. Facilitate means the process by which "the facilitator makes the group work easier and more effective by serving as a content-neutral guide to the process" (Kraybill and Wright 2006). Referring back to the three levels of learning as described in Sect. 3.5.7 and the Framework of Learning (Fig. 3.6), the assumption in Collaborative Learning Technologies is that each member of the learning setting holds relevant knowledge, the facilitator and the other members. The role of the facilitator in this is to help the group in and through *their* thinking process rather than thinking for them. He is catalysing rather than directive, enabling the learning process to occur rather than controlling it.

One crucial thing a facilitator of this level of learning must do is to take responsibility and initiative in key process steps as described in Sect. 3.6.3. This is where the expertise and craftsmanship of good facilitators in the space of Collaborative Learning are found. The facilitator must lead the joint process of preparation and design, help establish the containing boundaries of clear purpose and intent, structure, methodologies and time and strictly monitor these boundaries. The facilitator will ensure that good closure takes place on multiple levels. In addition a good facilitator needs to have mastery in guiding complex combinations of conversations, holding the space for the group to work on tough issues, monitoring and maintaining the level of energy in the room; all of this with the purpose, intent and flow of the event in the back of their mind at all times. He serves as the keeper of the structure, time and rules that were agreed on. He will help the group reflect in meaningful ways and will make sure small group outcomes are shared for collective sense making. Depending on level of adulthood of the group and the nature of the Learning Domain, the facilitator will surface emotional responses to the Learning Domain and offer the group to reflect on and work with those as learning data. A facilitator might also hold content knowledge which is relevant to the Learning Domain. If and when providing concepts or new perspectives is helpful in the overall flow of the learning process, the facilitator might offer their content knowledge, in the form of a lecture or by using concepts to help frame the understanding as it emerges from the learning process.

3.7 The Design Charrette

Design Charrettes are used in the context of architecture and spatial planning. This context can be described as highly complex and turbulent in nature (Roggema 2009, 2012) and provides challenges which are inherently 'wicked' or 'adaptive'. Climate Change and the spatial consequences of this are on example of such a 'wicked' planning problem. Roggema (2009, 2012) demonstrated that traditional planning and design approaches are not well suited to handling these 'wicked' problems. These appear to follow the mechanistic mental model as described earlier in this chapter. Roggema developed a spatial planning approach using the self-organising mental model, drawing on chaos and complexity theory. He calls this approach "Swarm Planning". Design Charrettes have proven to be a useful element in this Swarm Planning approach. The conclusion is drawn here that a Design Charrette is an example of a Collaborative Learning Technology and as such is an excellent tool to use as part of an approach to design solutions to 'wicked' planning problems. There are many Collaborative and Self-Organising aspects which apply to a Design Charrette.

The three key process steps are consciously taken before, during and after a Design Charrette. There is a thorough preparation in which all key stakeholders are involved. There is a clear purpose, structure and agenda and the flow and activities are made clear at the start. Thus there is a good holding environment. In the case of a Charrette this holding environment might be less relevant for containing emotional responses, but it does have the effect of liberating energy, creativity and diminishing participants' reluctance to offer their ideas, even though 'they might not be designers'. There is significant attention to closure, both at the end of the Charrette itself and in the process afterwards. The outcomes of the Charrette are solidified in a report which is shared and discussed with key stakeholders. Learning outcomes are sometimes published as part of academic papers or journal articles.

Many of the 12 design principles as described in Sect. 3.6.4 are applicable to Design Charrettes. The issue is 'real' and relevant to participants and the challenge is 'wicked' in nature. It is an explicit feature of Design Charrettes to have 'the whole system in the room' and decision makers of different levels are actively involved and usually participate in the Charrette. There is a diverse set of perspectives and voices. The group represents a cross-section of the community relevant to the issue, complemented with several external experts from a diverse background and other interested stakeholders. All participants become equal contributors in a collaborative thinking and doing process, once they are in the room. Relevant information that is available is shared at the start and information and ideas flow freely throughout the event. Intermediate ideas and outcomes are presented back to the whole group at set times and the flow of activities enables different subgroups to build on contributions of others. A collective understanding emerges which is made explicit by the facilitator at certain times and at the end. The creation of a shared future image could not be more explicitly present than with a Design Charrette. A Design Charrette is also a 'champion' in the use of "touching the data" in the most literal sense. Ideas are generated in small groups and immediately captured on flip charts, post-its, large print outs of maps of the region and eventually spatially modelled using coloured plasticine. The "Zamboni" principle and the Data Assist team are not widely used in Design Charrettes. It seems that the facilitators will certainly aim to prepare and handle the logistics well and often there will be a specific person who is in charge of logistics. In smaller Charrettes this role often falls back to the facilitator. And since the principles of self-organisation are part of the core expertise of good facilitators in this space, there might be a risk that the logistics are left to self-organisation and emergence as well. It is recommendable, particularly with large scale or multi-day Charrettes, to have a designated person or team to be in charge of logistics. Not only to apply the "Zamboni" principle and ensure a smooth process, but foremost to free up the facilitator's head space to fully tend to the Charrette's flow and process. A Data Assist team seems particularly relevant and useful for a Design Charrette. The amount of information and ideas generated is enormous and is captured in many forms. In current practice it seems to come down to the facilitators and the organising team to collect all materials and make sure everything is kept, digested and used in the Charrette report. Though this works well in practice, the use of a Data Assist person or team might a useful idea to keep in mind and try out.

The result of creating a Design Charrette using the steps and principles of Collaborative Learning is an event characterised by an extraordinary level of active energy and engagement of a broad range of participants, leading to the creation of truly innovative design ideas which are based on input from the relevant stakeholders. Because of this active involvement in the creation of designs, there is a high level of stakeholder ownership and commitment to the design solutions. Design Charrettes have proven to lead to innovative, relevant and 'owned' solutions to 'wicked' spatial design problems in the short time span of 1–3 days. They are truly an example of a self-organising 3rd level learning intervention.

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