# Visualizing Complex Design: The Evolution of Gigamaps


**Birger Sevaldson**

**Abstract** Around 2005 the concept of Systems Oriented Design (SOD) was slowly emerging. This happened organically through experimental design practice and education-based R&D at the Oslo School of Architecture and Design. Centrally in SOD is Gigamapping, a technique to map out, contextualize, and relate complex systems, their environment and bigger landscape, their current state, as well as preferred future states. The role of the Gigamap is constantly developing. This process has partly been a planned research process and partly a process of discovery and conceptualization through research by design. This chapter recapitulates and analyses this long-term process of developing the concept of the Gigamap. It goes through and discusses the sources and inspirations, the framing and methodology, and the concepts that were described until recently. Some of these concepts emerged as tacit knowledge made explicit; others were systematically planned and developed over time.

The paper concludes by introducing a new sense sharing model for visual collaboration.

## Introduction

Systems Oriented Design (SOD) emerged organically around 2005 at the Oslo School of Architecture and Design (AHO) through experimenting with design practice and new modes of education. A primary methodology in SOD is known as Gigamapping, a technique for collaborating groups to map, contextualize, and relate complex systems, revealing their environment and landscapes (of interaction), their current states, as well as preferred future states. Gigamapping has been a central tool for co-inquiry where experts, users, and other stakeholders are brought together and are immersed in dialogue across their specialized cultures and terminologies.

This chapter recapitulates and analyses this long-term process of developing the concept of the Gigamap. It discusses the sources and inspirations, the framing, and

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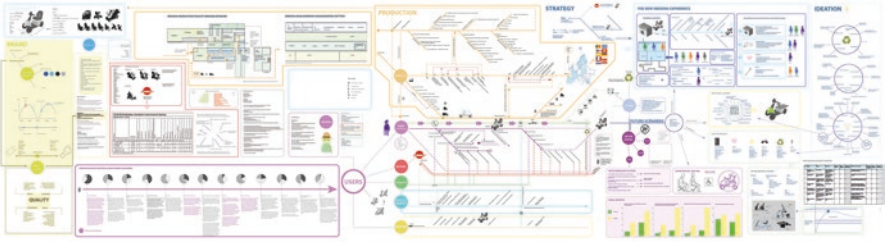

**Fig. 1** A Gigamap of a Norwegian manufacturing company (Medema). The Gigamap can express models of relations and interconnectedness to timelines, floor plans, statistics, and illustrations. (Julian Guribye and Christian von Hanno, AHO 2011)

the methodology. The dialogic aspects of Gigamapping processes are examined, and the related concept of sense sharing, describing one of the main benefits of Gigamapping, is proposed (Fig. 1).

Gigamapping has been established as an important tool in Systems Oriented Design (SOD) throughout recent years, especially at AHO, and has spread to other universities and firms (Aguirre & Paulsen, 2014; Aguirre-Ulloa & Paulsen, 2017; Hensel & Sørensen, 2014; Jones & Bowes, 2016; Jones, Shakdher, & Singh, 2017; Sevaldson, 2011, 2013; Singh, 2013). Gigamaps have been developed further into more systemic variations, for example, the synthesis maps taught at OCAD University (Jones & Bowes, 2016). The use of Gigamaps has started to spread to public organizations (Bogen, Jensen, LeBlanc, & Tveit, 2014) and private companies[1]. While these processes were seen as time consuming and cumbersome in the beginning, there is a growing understanding of its usefulness and the benefit for deep systemic developments (Fig. 2).

Throughout this period, the role of Gigamapping has been discussed and developed. From the start, the role of the Gigamap was to be an inclusive and undogmatic approach to large-scale system mapping. Its main purpose was to help designers get a grip on complexity in larger-scale projects. Through the map, one could harness the design process and the practice of design to become a strong mode of inquiry for understanding systems as well as designing them.

The Gigamap is a tool for *design inquiry* as defined by Nelson and Stolterman (2012). Design inquiry is a special form of knowledge production at the same level as scientific and artistic inquiry. Design is concerned with different kinds of knowledges, including the sciences and arts, but what sets it apart is its focus on "what ought to be" rather than describing, analysing, and understanding "what is." When design as knowledge production is conducted systematically and it is discussed critically and disseminated academically, it is called research by design (or research through design) (Birger Sevaldson, 2010). We consider Gigamaps as devices for design inquiry rather than analytical tool like those used in systems engineering or in hard systems models. Therefore, the maps are seen as design artefacts, a con-

[1] Most notably is the Norwegian design consultancy Halogen (www.halogen.no)

**Fig. 2** A leader group in a private company participating in a Gigamapping workshop. Typically, there are multiple actors involved in working on the map and temporarily engaged in side conversations. (Photo Birger Sevaldson, 2014)

struction similar to the final design product, service, interaction, social process, urban plan, or building that might be its final design output. This approach is theoretically grounded in constructivist learning (Hein, 1991) and draws on constructivism as influenced by Piaget, Dewey, and Vygotsky. Developing the Gigamap through design iterations is a strong way of refining the insights into the complexity of the systems at hand and to cut across scales from myriads of details to large-scale patterns.

## Design on the Move

Design is moving into evermore complex fields and advanced forms of application (Jones & VanPatter, 2009). Systems Oriented Design and the use of Gigamapping are very useful in this dynamic situation, where so-called very rapid learning processes are central (Sevaldson, 2013a). This migration of design is driven by a fourfold action:

1. Design is enlarging its scope through specializations like service design, interaction design, and social design. Richard Buchanan described this higher level as the fourth order of design:

   > It refers to all the design initiatives that are particularly responsive to the goals of democracy. It may deal with the provision of human rights, and fundamental freedoms (such as access to food, shelter, health care, and education) and, more in general, with the transition towards a more resilient, fair and sustainable society. (Buchanan, 1992)

Tony Golsby-Smith writes in his interpretation of Buchanan's four orders:

> …. Widening of the influence of design outwards into the surrounding medium – the life of organizations in the modern world, or of governments and communities. (Golsby-Smith, 1996)

This well describes the situation of how and where design is moving.

2. The notion of design has become increasingly blurred. This started long ago with Herbert Simon's proposal for a definition of design:

> Everyone designs who devises courses of action aimed at changing existing situations into preferred ones…Design so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design. (Simon, 1969)

Interesting in this is that there is a growing realization that designerly ways of thinking partly are at play in many practical situations and that some designerly approaches might be useful in a much more general sense than just for the design professions. On the other hand, this definition erases the boundaries of design to a degree that makes it absurd and nebulous instead of pinpointing what is the essence of the design professionally speaking.

3. Following the above there has been a spread of ideas from the design professions into the business world and other professions. Perhaps the most popular manifestation now is the diffusion of Design Thinking into many fields. Initially Design Thinking was defined by people including Rowe, Buchanan, Goldschmidt, and Lawson (Buchanan, 1992; Goldschmidt, 1994; Lawson, 2006; Rowe, 1991), influenced by Schön's concept of the reflective practitioner (Schön, 1982). Later it was brought to the business world by Boland and Collopy (2004), Roger Martin (2009), Brown and Katz (2009).
4. Globalization and the need for sustainability, as well as the rapid development of new technologies and cultural changes, forces design to become better at understanding and interpreting causes and effects, trends and dynamics, and requirements and parameters influencing the design process. Simple object-oriented perspectives[2] that ignore interrelations and networks of connections as well as contexts and environments simply are insufficient. Golsby-Smith puts it this way:

> Just as the product is not only a thing, but exists within a series of connected processes, so these processes do not live in a vacuum, but move through a field of less tangible factors such as values, beliefs and the wider context of other contingent processes.

The common denominator for this fourfold development is that design has become much more complex and diversified, as well as interconnected beyond its professional boundaries. This has significant implications for design methodology

[2] The term object-oriented is used here in a generic sense. The object is any entity from physical object to service, incident, and event. Designers traditionally tend to have their attention geared towards such design entities or objects without questioning their boundaries or relational webs.

and perspectives. There is a need for the diverse fields of design to better understand its conditions, its entanglements, and the assumed and counterintuitive effects of its activities.

## Systems and Design

Systems thinking is the science of interconnectedness. Design could be described as the science and practice of "what might be." As such, it moves into evermore complex fields and faces increasingly complex challenges. Therefore rejuvenating its relation to the science of interconnectedness (systems sciences and systems thinking) is needed.

Systems approaches in design are not new, but they have failed to create and hold a wide-reaching impact on the field (Collopy, 2009). Among the notable precedents, we find Christopher Alexander, Bela Banathy, Russell Ackoff, and Horst Rittel (Ackoff & Sheldon, 2003; Alexander, 1964; Banathy, 1997; Protzen & Harris, 2010).[3] Typical for these authors is that they describe and discuss ways of implementing systems approaches to design, but they fail to develop and demonstrate a substantial systemic design practice. In most of the attempts to introduce systems thinking to design, the perspectives in the outset alien to design practice have been imported into the field of design as additions. This means they have not gone through an adaptation process so that it made sense and was convenient or even possible for designers to change their practice. The imported methods were disturbing to the psychology of the design process, which is imaginative, visual, and judgement-based, (Arnheim, 1969; Gedenryd, 1998; Schön, 1982) and where creative flow incubation and illumination is important (Csikszentmihalyi, 1996). This dissonance between the imported systems approaches and the design process was notably debated by Collopy (2009).

The imported perspectives tend to explain design through something other than its self, e.g. as cybernetic feedback circles or "circularities" (Glanville, 2014) or design as conversation (Pangaro, 2016). These images of design are valuable not as fulfilling explanations but as contributions to the many descriptions of design, a field that is too diverse and varied to be captured in simple definitions. While such descriptions are useful, they fail to talk about the inner nature of design as a specific activity based on visual thinking.

The emerging field of systemic design has grown from Systems Oriented Design into a pluralistic, inclusionary, and pragmatic discourse community. With no canon or disciplinary gatekeeping, differing approaches exist together, some more theoretical, others more derived and developed from practice.

The traditional systems theories and their application in design have slightly faded in the light of the designerly perspective in systemic design. Not all of them

[3] Ackoff was studying architecture. Rittel was a professor at the Ulm School of Design. Banathy, at Saybrook for some time, was connected to design methodology movements.

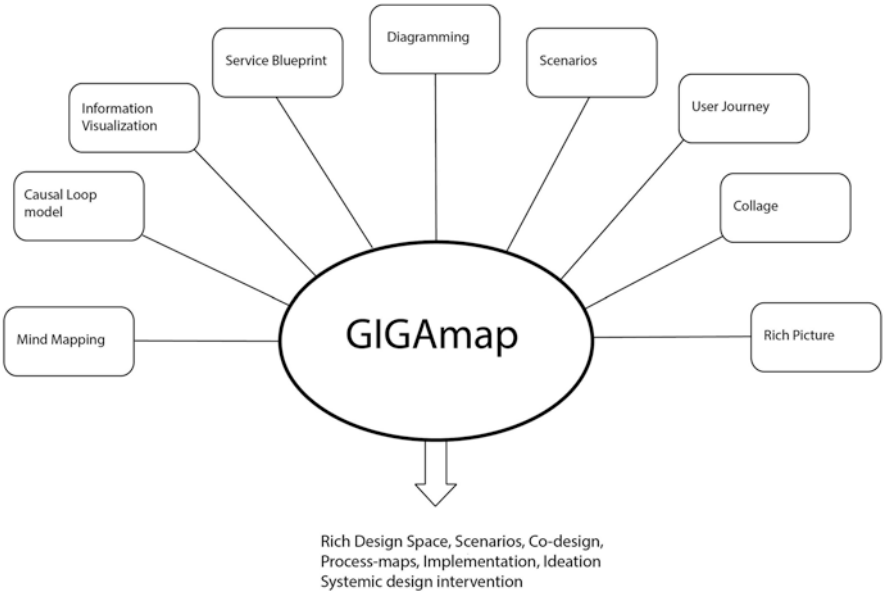


**Fig. 3** The Gigamap earns its name not only from the number of elements that it should contain but also from the numerous representative modes and models it might integrate (Sevaldson, 2013)

are equally useful for design action. Nevertheless, they are still forming an important backdrop and inspiration for Systems Oriented Design. Soft systems methodology (Checkland & Poulter, 2006) in particular, with its visual technique of the Rich Picture and its orientation towards intervention, change, and action, and the methodology of action research adopted by design and systems research (Ison, 2008; Swann, 1999) have been important inspirations and anchoring points. At the same time, we were aware of the limitations and advantages of harder systems models and therefore adopted a pragmatic and eclectic view on the existing systems approaches. This position is grounded in Critical Systems Thinking (Midgley, 2000; Ulrich, 1983). This implied the inclusion and integration of various systems models as well as different types of other information, like texts and images, collages, diagrams, narratives, cartoons, storyboards, service blueprints, etc. into the Gigamaps (Fig. 3).

Design often considers what we call composed perspectives. This means that we are navigating complexities that are crossing technological, biological, and social realms. Design deals with both deterministic and unpredictable systems—framed and tamed ones as well as wild and wicked ones (Rittel & Webber, 1973). This implies that we might find ourselves at both soft and hard ends of the systems approaches, as well as in qualitative realms that are not well handled by the traditional systems models. In fact, Systems Oriented Design is more oriented towards the qualitative and visual than most other approaches and therefore leans on and benefits from these core competences of design (Sevaldson, 2014).

## *Interdisciplines*

Design culture suggests design practice exists more on the soft, ambiguous, and fuzzy side of the spectrum of innovation and development, than on the harder technology-driven side, which traditionally is handled by engineers. In reality, designers in teams more often than not work with technology and sociotechnical systems. Technological systems at large are "hard" and deterministic. We compensate for our lack of grips with hard systems through interdisciplinary collaborations with systems engineers, process and computer scientists, and other technical experts. This is not limited to the hard end of the spectrum, but it also expands to fields involving other experts, like social scientists.

In addition, we find ourselves working in interdisciplinary networks of users and other stakeholders representing different cultures and different fields. These might be sorted within a spectrum between "hard and soft" process and culture, but there are likely to be enormous gaps and variations across any network of stakeholders. These gaps and variations can be bridged by systemic design methodology such as Gigamapping. Bridging means not necessarily a common view rather than establishing empathy where diverging views are not necessarily reconciled but understood.

The complexity of the institutional, organizational, and social networks involved in design activities is increasing at pace with the growing challenges to design. Information and knowledge exchange is critical to the bridging process in the complex social constructions that make up a design project. This is not limited to the exchange of facts and data. Data is interpreted into information and constructed into knowledge, creating the basis for particular worldviews and wisdom[4] (Ackoff, 1989). The different types of expertise and interests represented and affected by a design project touch on widely different worldviews. A synchronization of perspectives and worldviews is called for, and this demand is not resolved by information exchange. We need high-level collaboration methods. Codesign methodology based on shared visualization through Gigamapping has proven to be a highly efficient tool for sharing worldviews and detailed perspectives across disciplines.

In such situations, Gigamaps function as bridging tools for dialogues across cultures. It is hence important that the Gigamapping process does not submit to any predefined systemic model nor creates its own resolved modelling of systems. The Gigamap's role is instead to be the in-between, the infill, and the multiple bridging system between expertise, knowledges, models, and fields.[5] Gigamaps are not models as such. They can embrace and contain particular systems models and relate those to other types of information. Hence, they are slightly unique for each situation and case and need to be designed accordingly for each instance.

[4] I am referring here to the DIKW pyramid: data, information, knowledge, wisdom (Ackoff, 1989).

[5] This includes other stakeholders, like users or inhabitants in communities who are treated as experts.

In particular, tension between models and worldviews, expertise and stakeholder, can be turned into productive richness where the Gigamap is the arena of co-existence.

## A Knowledge Framework

Gigamapping has been extensively developed previously by the author (Sevaldson, 2011) and has been presented and taught at conferences and workshops. It is a multipurpose and multilayered visualization with multiple uses and intentionalities and corresponding design actions. Among them, we find:

- Grasping complexity: the system, its sub- and suprasystems, its environment, and its landscape
- Designing, sharing, aligning, and criticizing an image of a complex situation
- Understanding and sharing problem fields (problematiques)
- Modulating relevance and prioritizing importance
- Critiquing and adjusting boundaries
- Moving seamlessly between the descriptive and generative

The framework of knowledge (epistemology) for Gigamapping is based on pragmatism, a way of knowing and working we refer to as *praxiology*. The term praxiology was first used by Cross (Cross, 1999) in the field of design as a systematized accumulation of practice-generated skills, experiences, and knowledge. Though Cross does not define praxiology precisely, it is implicit in the way the term is employed. Much earlier, Gasparski developed a model of praxiology in design as a systemic approach (Gasparski, 1979). While methodology seeks generic description of how to proceed in a design process, praxiology is registering, describing, and critiquing particular situations in practice. The aim of praxiology is to reach a level of "wisdom" and experience where the practitioner can combine their resources with experience, judgement, and intuition. This also includes motoric skills and motoric memory, depending on the practice[6]. This is closely related to the concept of adaptive expertise. The Dreyfus skill acquisition model emphasizes the ability of experts to act on intuition (Dreyfus & Dreyfus, 1980) which they propose as the hallmark of expertise (Fig. 4).

Praxiology is the systematic and continuous study, analysis and pragmatic development of skills, explicit and tacit knowledge, approaches, libraries of concepts, technical methods, conventions, and heuristics and strategies in advanced practices. As a knowledge framework, praxiology leads towards an understanding of design as *practice* rather than through theory and methods. For this the term and concept of praxiology seem adequate. Strictly speaking, methodology is the systematic analy-

[6] For example, for designers the motor skill of visualizing through drawing is important in Gigamapping. It aids the sketcher in the internalization of large amounts of information as well as participants viewing the process.

| | |
|---|---|
| **Novice** | Little context and situation awareness.<br>Sticks to basic rules provided by boss. |
| **Advanced Beginner** | Limited context and situation awareness.<br>Little ability to prioritise.<br>Knows and follows basic rules.<br>Follows standards and routines given by boss. |
| **Competent** | Increased context and situation awareness.<br>Able to cope with complexity.<br>Can see long-term goals.<br>Knows and follows rules, standards and routines.<br>Follows guidelines given by boss. |
| **Proficient** | Holistic perspectives and ability to prioritise<br>Can see deviations from normal patterns.<br>Less dependent on rules, standards and routines.<br>Follows generic guidelines and principles, e.g. best practice. |
| **Expert** | No longer dependent on generic guidelines and principles.<br>Deep tacit understanding of situations.<br>Follows intuition based on long experience.<br>Adaptive expertise, able to adapt to new situations. |

**Fig. 4** Five levels of expertise. Interpretation by the author based on the Dreyfus skill acquisition model

ses of methods and strategies in doing (scientific) studies. Methodology is also the systematic relationship of methods to a problematic context. It's how we know which methods to apply. The aim of methodology is to produce prescription of how to go about a problem. It is based on repetitiveness. Methodology in this sense is not very easily applicable to design practice where context variations require adaptations based on judgement and experience. In addition, design problems are typically processes of negotiation between large numbers of requirements, parameters, and variables. Such networks of interlinked problems, which change dynamically according to real-time forces playing out in the midst of the planning process, are described as wicked problems (Rittel & Webber, 1973).

Prescribed methods are only partly useful and could even show to be counterproductive. Because of this nature of the design profession, design methodology has been in a constant crisis and continuously critiqued and developed (Broadbent, 2003; Cross, 1984; Gedenryd, 1998). In contrast, praxiology as understood in this context does not seek prescriptions but is more concerned with collecting samples, experiences, and demonstrations to help in guiding the development of judgement, context awareness, intuition, and adaptive expertise (Kolko, 2010; Smith, Ford, & Kozlowski, 1997).

In Systems Oriented Design over the last 10 years, a substantial foundation for praxiology has been developed (Birger Sevaldson, 2009) with a recent example being the *Library of Systemic Relations* (Birger Sevaldson, 2016). This is a practice-based systematization of the characteristics found in relations when working with Gigamaps. When turning the attention from the object to their interconnectedness, working with real-world systems and without the restraints from orthodox systems models, it became clear that the common use of systems relations in those models was insuffi-

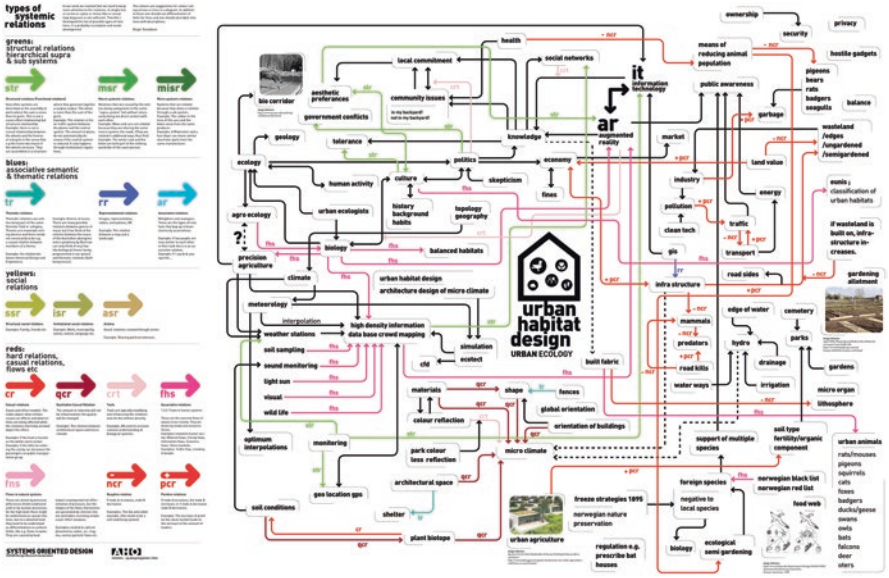


**Fig. 5** A Gigamap with heavy emphasis on the relations. The relations are colour-coded according to the suggestions from the "Library of Systemic Relations" web page. The library is part of the Gigamapping praxiology and not seen as a method of rigid classification (Young Eun Choi, Birger Sevaldson, AHO 2013)

cient. The format of the Gigamap, allowing and encouraging the mix of differing categories, graphic expressions, media, and mixed methods approach, results in a very resilient and adaptive mapping model because they are design constructs and not obliged to follow predefined rules. This robustness allows unlimited types of information to be mapped out and networked within the same image. Turning attention from objects to relations is a central feature of systems thinking. Describing the relations in detail was a natural consequence, and from that, the Library of Systemic Relations was built. We regard it a library and not a typology, to emphasize its openness and incompleteness, so that it could be developed further. It is also not meant to establish a convention, but it is meant to provide a repertoire of variations (Fig. 5).

## *Myriadic Quality of Gigamaps*

While mapping in general is a way of ordering and simplifying issues, so to say "tame" the problems, Gigamapping is not a problem-taming methodology. Wicked problems are not resolved through "taming" and framing. Gigamaps try to grasp, embrace, and mirror the complexity and wickedness of real-life networks of interrelated problems (problematiques). Hence they are not resolved logically nor is the designerly urge for order allowed to take over too much and hence bias the interpretation of reality.

This can be seen as the *myriadic quality* of the Gigamap. One cannot represent the lived reality of rich experiences or truly appreciate complexity with a reductive and simplified expression. The myriadic quality of the Gigamap communicates other qualitative levels than a simple registration of numerous entities and their relations. Anderson (1972) demonstrated that scientific laws that are valid in simplified situations are not necessarily valid when things pile up in large quantities. His treatise on the limitations of reductionism in *More Is Different* (Anderson, 1972) was a substantial contribution to the understanding of emergent phenomena. Gigamaps break the restraints of formalized systems methodologies, such as systems dynamics modelling, which can be costly and reductive with the necessity for rigour and computational simulation. Gigamaps are therefore not a replacement of other systems models or approaches but an addition to the field of design methodology.

## *Managing Map Complexity*

Gigamaps are intentionally vague and unresolved. The simplification needed for clarity would unavoidably lead to reductionism and singular interpretations of the map. This does not exclude simplification and singling out particularities of the map for operational and tactical reasons. This is often done on separate documents like so-called minimaps or lists of strategical actions. The ZIP analysis, a regular tool in the SOD toolbox, is helping this derivation of strategies, actions, ideas, and interventions. It is a simple method for developing Gigamaps and to find potential areas for interventions and innovations. ZIP analysis has been described before so we will only quickly recap it here (Romm, Paulsen, & Sevaldson, 2014; Sevaldson, 2013b).

ZIP stands for Zoom, Innovation, Potential. The analyses are conducted by marking the Gigamap with the three points where needed. One can do this while developing the map or in separate analysing sessions where one would investigate the map to search for these points.

**Z**: Zoom is used to mark areas or points in the map that need more research. It is a reminder that one lacks information and is an initiator to make additional maps for zooming into the marked area.

**P**: P stands for potential, problem, or problematique. If there is an obvious problem, this is always a potential for improvement. There could be big potentials in things that work very fine. One could learn from them and use the principles on other similar situations. We might also think of P-points in the sense of leverage points for intervention (Meadows, 1999).

**I**: I stands for idea, innovation, or intervention. If one gets a new idea or a solution to a problem or one can link things in new ways by creating new relations, these are I-points. Interventions are not necessarily new and innovative, but they are actions that tweak and change the system, e.g. resolving a bottleneck in the system (Fig. 6).

While the extracted documents from the ZIP analyses can be precise and well defined, the Gigamap itself should be allowed to maintain its vagueness and unre-


**Fig. 6** Gigamap with additional minimaps and texts that describe potential actions and interventions. The yellow dots depict the ZIP analyses (*Lucie Pavlistikova, Martin Malek, Mirka Baklikova, Mariia Borisova, Georgia Papasozomenou, 2016)*

solvedness, its unfinishedness, and "myriadic quality," so that it is maintained as a source for alternative design proposals, criticality, and reflections throughout the design process.

Gigamaps represent composite perspectives. This means that the codesigners do not necessarily settle on a shared perspective, but they share an understanding of the multiple perspectives that are constantly and dynamically at play in the process. This helps in developing the needed empathy and mutual agency for complex codesign projects to work. In design, we are navigating complexities that are crossing technological, biological, and social realms. This position is argued for in Critical Systems Thinking (Midgley, 2000; Ulrich, 1983) where an appraisal of fact-based reality, human and social values, and multiple system boundaries is taken into account. The Gigamap earns its name not from the numbers of entities and relations, which may range beyond a few hundred, but from the potential of myriads of connections, meanings, interpretations, and layerings that are implicit in the mapping.

We can summarize the following:

- Gigamaps are an inclusive and undogmatic approach to large-scale mapping.
- Hard framing and imposed rules are counterproductive and limiting.
- They are a tool for *design inquiry*.
- The maps are design artefacts developed through design iterations.
- They span from myriads of details to large-scale patterns.

## Ruptures

Ruptures are a common problematic phenomenon when groups of people collaborate to deal with high degrees of complexity. Ruptures take place in the form of information or communication breakdowns as well as misaligned perspectives between people involved in, and influenced by, a project. Such breakdowns commonly occur between people in the system and between systemic and cultural perspectives. Ruptures can appear because of structural reasons (the systems information structure is insufficient) or over time (things get lost in the process) or by general misconception of the implications.

The most common error causing misinterpretations and communication ruptures is that the models representing the problem or task are oversimplified. For example, a company can be conceived according to its organization chart, which is more an organizational abstraction than a model reflecting the real, interpersonal dynamics of the organization. These erroneous models could be caused by ignorance or by biases, such as to get a sale quickly and cope with the problems later. Ruptures can result from many different interactions:

- Lack of ability to cope with information overload causes decisions based on short memory.
- Clients and stakeholders are not understood well enough.
- Dis-alignment within the organizations causes unaligned perspectives.
- To narrow or wrongly framed horizon.
- Implementation problems that were not foreseen.
- Different conceptions of system shape, structure, extent, connectivity.
- Different sensitivities towards the system.

Sooner or later ruptures will surface. Typically issues will emerge in transitions, such as when moving from planning to implementation. We might say a rupture results from a mismatch between the models one operates accordingly and the reality these models represent. Another example are the well-known problems accumulating over generations of software development where there is a rupture between older and new generations of software developers, causing loss of overview, or where new features are added that might conflict with earlier intensions manifested in the software architecture. The ZIP analysis in Gigamapping can assist in unearthing potential ruptures in the context reflected in mapping.

### *Stakeholders and Actors*

Ruptures always appear between actors in the project. They are a natural part of our co-existence. In addition they are not necessarily negative but might be moment for creative tension. The different experts making up a development team have different perspectives, priorities, and worldviews. It is unavoidable that misunderstandings

| | Designer | Design team | Client | Experts | Users | Society | Agency |
|---|---|---|---|---|---|---|---|
| Designer | A | | | | | | B |
| Design team | C | | | | | | |
| Client | D | | | | E | F | |
| Experts | | | | | | | |
| Users | | | | | G | | |
| Society | | | | | | | |
| Agency | | | | | | | H |

**Fig. 7** A matrix with the simplified stakeholder and actor list can be used to search down potential ruptures before they appear

and conflicts of interest appear. However these ruptures can be turned into leaps of innovation for the team. A list of actors or matrix of stakeholders in a systemic design project can become quite lengthy; Fig. 7 presents a notional set that limits it to consist of the individual designers, the design team, the client, experts, users, society, and agency (stakeholders who cannot represent themselves, e.g. elderly, future generations, and nature). We can map out the relations between this simplified set of actors in a matrix to determine where the most critical ruptures might emerge among relations.

The letters in the matrix indicate potential ruptures by locating and assessing relationships. Interestingly, ruptures can appear even within the worldview of an individual designer, when a composed picture of a situation contains unresolved contradictions caused by insufficient information or incomplete pictures of the situation (**A**). This is probably a very common rupture. Traditional design educations did not teach designers to systemically investigate the design problems and the new problems they could cause by solving singular problems. Other ruptures might appear between:

(**B**)—Designer and agency, e.g. the designer is not able to represent absent interests well enough.

(**C**)—Designer and the design team. The team is not synchronized in their worldview.

(**D**)—Designer and client. The intentions of an architect might be different from those of a property developer.

(**E**)—Client and users. Clients might have a lesser understanding of the users or stakeholders they involve.

(**F**)—Client and society. Property developers are regularly in conflict with general preservation interests.

(**G**)—Users and users. Different user groups do not necessarily share worldviews and interests.

(**H**)—Agency and agency. Representing elderly or children might be in conflict with taking agency for other living beings.

A central intention in SOD is to act proactively on complexity. Shying away from potential difficulties to resolve them when they eventually emerge is a poor strategy for knowledge production and design. It is both expensive and delaying, and the window for responding in a good way is already closing. Imagining possible problems in advance is a better strategy. Even quick analyses like indicated in the matrix above would help searching for potential trouble and help to avoid gaps in information flow and to maintain ownership. This does obviously not guarantee a smooth process, but it reduces the number of ruptures and trains the awareness and readiness for action when unexpected issues emerge.

One function of the Gigamap practice is to help bridge relationships around possible ruptures and to find, *if possible,* synergetic or balanced solutions. We cannot solve all conflicts through design and communication, but such approaches and perspectives help at negotiating ruptures and conflicts better.

## The Gigamap as Bridging Device

Many of the mentioned types of ruptures can be bridged before they develop into serious problems. Bridging does not mean to agree on the same worldviews. It rather means to create the needed mutual co-understanding and empathy for diverse positions. Empathy based on knowledge of other perspectives is the precondition for dialogue and the prevention of destructive conflicts. Negotiation to reach balanced solution is dependent on such empathy.

The Gigamap has proven to be an ultimate bridging device. It is easy learned and easy to apply. Especially within groups of collaborators, the bridging and synchronizing effect is remarkable. We have run a large number of workshops with business leaders and other groups where they report on this effect. Even for people who have worked together for years and who should be fairly synchronized, hidden ruptures are unearthed and addressed (Fig. 8).

**Fig. 8** A quick draft, describing the typical project timeline for the TPG management consultancy

In 2011 AHO worked with a leadership development consultancy to include Gigamapping, especially in the form of timelines, in their methods and workshops. This work was done through the involvement in management consulting activities by AHO staff over a long period of time (2012–2016). This was centred around a collaboration with the management and leadership development consultancy TPG (The Performance Group).[7] The collaboration also included student projects and internships where methods and perspectives were developed further. A particular useful output was the booklet "Complexity and other Beasts" addressing practical issues (praxiology) when dealing with complex issues in group work (Skjelten, 2014).

The consultants from TPG reported on very high satisfaction in the feedback from the leader groups participating in the workshops. The dynamics of such Gigamapping dialogic workshops was described as follows:

> Gigamapping helped them to have a "rambling" discussion that makes it possible to get an overview of a whole, relationships and consequences -and they continually worked on a proper (high) level. This demonstrates two typical problems for management groups; A) when they are decomposing a complex situation to discuss a portion at the time it becomes impossible (difficult) to stick to the case because it has so many links to other issues (and if one does not have a Gigamap each individual in the management team will jump on the links they associate without others having a chance to follow). B) When discussing individual cases the discussion tends to be too detailed – they dig themselves down into things and become more officers than leaders. As leaders, they should focus on the major relationships, balancing risk and burden of organization and priorities. It slips when they go too deeply into the issues. Gigamapping helps us to stay on the right (high) level. (Wettre, 2012) (Translation by the author)

Typical phenomena are:

- The capacity to have open and jumping discussion where jumps between issues are not a big problem because the map is used as a dialogic support. When jumping from one issue to another, represented in the map by jumping from one place to another, typically the participants would point at the new place on the map where they think the discussion should divert. This brings the rest of the group immediately to the new perspective.
- Synchronizing or creating awareness of unequal worldviews and perspectives. Even within teams that have worked together for a long time ruptures in perspectives are relatively normal.
- Controlling the level of discussion: The visual dialogue helps the discussion to remain on the same level or allows diving into details or zooming out to helicopter views whenever needed.
- Individual resources and different expertises are externalized and shared.

This mode of conversation is immensely valuable, but there has so far not been a developed format for this. A traditional meeting will be restrained by its agenda except the misc. section that normally comes at the end when time is short and people are tired. This format limits the content of the meeting to the points the leaders

[7] TPG has since merged with Rambøll.

**Fig. 9** Different situations of dialogic Gigamapping. (Photos: The author and Linda Blaasvær)

regard of importance and it is not well suited for unearthing contradictions and ruptures. In addition, the Gigamapping process combines the free development of discussions with documentation. Very little is lost when done well (Fig. 9).

"On the Same Page" was a master studio project at the Oslo School of Architecture and Design collaborating with the directorate office for elderly homes in Oslo (Bogen et al., 2014). This case demonstrates the problems of ruptures when an organization is thrown into an unfamiliar process of reconfiguration. This caused severe communication problems.

The office was monitoring and administrating over 50 long-term care units. They were going through a major revision of their care model system by introducing a model with three different levels of care intensity (Home Care, Medium Intensity Care Home, Nursing Home) shifting from a model with two levels (Home Care, Nursing Home). The process was dependent on very high-level communication between large groups of administrators and staff.

The main problem was on the level of dialogue where the planning meetings were hampered with ruptures in the form of misunderstandings and lack of overview because of the complexity of the task at hand. A group of five master's students were taking on the project. The process was originally based on traditional meeting schematics with a plan for working meetings among the many groups. The participants reported and the students observed and recorded frequent communication breakdowns caused by the level of complexity of the process.

The students worked out a dialogue tool (Fig. 10) that was tested and developed through participatory design and at some point a workshop with over 50 participants

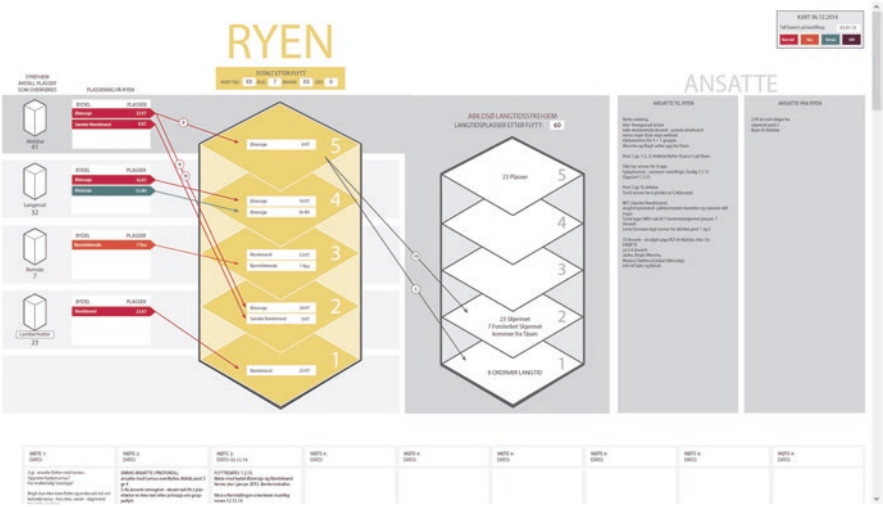


**Fig. 10** Dialogue Map used by the directorate for elderly homes in Oslo (Bogen et al., 2014)

(Fig. 11). The effect of the tool was evidenced through observation and voice recordings of working meetings before and after the introduction of the communication and collaboration tools. The effect was very satisfactory, and the office adopted the tools, methods, and processes to further develop the tools on their own.

The final pillar in the praxiology of Systems Oriented Design that explains how we can overcome ruptures is the concept of the Rich Design Space (Fig. 12). This is the simple idea that very complex processes that need time also need space to make all information accessible. Such processes would normally produce a range of Gigamaps as well as other types of information visualization. A dedicated space keeps the information in play and helps a team to synchronize their different perspectives (Sevaldson, 2008).

## *New Developments in Bridging*

Until recently, our conception of what the Gigamap's role might be in a collaborative setting was restricted to providing a shared picture of a complex field in an advanced design project. We have realized that these are constructed pictures, that we codesign a co-understanding of the complexity. In addition, it was clear that the sharing of facts, data, and information as well as opinions and conceptions from participants and stakeholders was formed or weighted and calibrated in the process of sharing them to form a coordinated understanding of the issues. Active co-interpretation is central.

**Fig. 11** Example of Gigamapping process involving a large number of participants from a public service in Oslo. (From "On the same page" Bogen et al., 2014)

**Fig. 12** A rich design space (IUVO project AHO 2017)

In Gigamapping one actively designs the interrelations between the different modes, domains, and types of information (this means a constructivist or rather a "designist" approach). This design process involves describing and designing how existing and found relations are represented, interpreted, and graphically illustrated. However, it also involves finding ruptures and designing new relations and developing ways of initiating them in an organization or process. From this follows that the strength of the Gigamap lies obviously not in the accurate description of the world but in an active designed interpretation. Further on, the Gigamapping process seamlessly transforms from the descriptive to the generative.

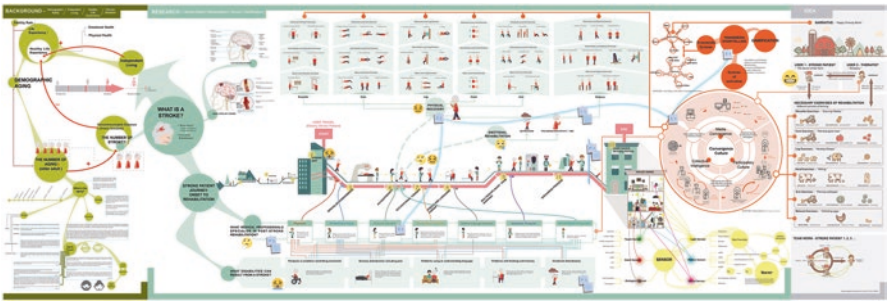

**Fig. 13** Gigamap showing existing and proposed links and relations in a process of treating a stroke in the Norwegian public health system. (Cong Li, 2016, University College of Oslo and Akershus)

This implies designing a picture of not only how the world might be interpreted but also how it ought to be (Fig. 13).

Focussing on these qualities of the Gigamap forces a reinterpretation and reflection upon what the Gigamap really represents. Revisiting the role of the designer and the role of the Gigamap and Systems Oriented Design has led to a shift and clarification of the view on the role of the Gigamap. This shift has moved attention from the myriad (quantity) of information, entities, and links to the qualitative appearance of the map as a whole. This is summed up in the Sense Sharing Model.

## The Sense Sharing Model

A significant value of the Gigamap is that it produces aligned and shared *sensitivities* for the task at hand. The Sense Sharing Model is a perspective that describes shared sensitivities. Codesigners can share as much information they want and codesign the Gigamap and create a shared picture, but they can still have a different view on the issue. Therefore the attention has to move from information fragments to holistic pictures.

The Sense Sharing Model builds on a common notion of sensibility training that one could argue is implicitly central in design education. However, it also refers to sensemaking as described by Russell et al. (Russell, Stefik, Pirolli, & Card, 1993) who relate sensemaking to systems engineering, Weick (Weick, 1995; Weick, Sutcliffe, & Obstfeld, 2005) and others who relate sensemaking to organizations, and Lurås (Lurås, 2012) and Aaltonen et al. (Aaltonen, Barth, Casti, Mitleton-Kelly, & Sanders, 2005) who have related sensemaking to systemics and complexity. In this paper and context, these sources are of less importance than the designerly sensibility skills that have been inherently and tacitly present in the practice of design from the very beginning of the discipline with much older roots into the arts and craftsmanship. I argue that activities that bear relationship to sensemaking have been central in

design for a long time before it was defined and described by Weick and others. Making sense of things through visualization, narratives, and solving needs and problems and providing experiences has been at the core of design and Design Thinking. It is unthinkable without this component of common sense, judgement, and reasoning. Kolko describes sensemaking as an inherent part of design synthesis (Kolko, 2010). He also describes how mapping might be central in sensemaking:

> Because of the complexity of comprehending so much data at once, the designer will frequently turn to a large sheet of paper and a blank wall in order to "map it all out." Several hours later, the sheet of paper will be covered with what to a newcomer appears to be a mess—yet the designer has made substantial progress, and the mess actually represents the deep and meaningful sensemaking that drives innovation. (p. 16)

Klein and Moon relate sensemaking to a systemic perspective by describing sensemaking as oriented towards understanding relations, but also related to other aspects that are naturally present in the design process:

> By sensemaking, modern researchers seem to mean something different from creativity, comprehension, curiosity, mental modelling, explanation, or situational awareness, although all these factors or phenomena can be involved in or related to sensemaking. Sensemaking is a motivated, continuous effort to understand connections (which can be among people, places, and events) in order to anticipate their trajectories and act effectively. (Klein & Moon, 2006)

While Kolko talks about sensemaking as an internal individual process, Klein and Dervin talk about sensemaking as making sense of other people, e.g. users. Sense Sharing is about both these modes and about additional issues, e.g. sharing between individuals in a work group. It includes sharing sense of non-human beings and non-biotic phenomena. These could be natural or synthetic like the structure of a city.

Since the start of the research with Gigamaps, it was clear that there was more to it than the facts only. This has led to a long process of developing the insight about this form of mapping. This has developed through two steps of concept development. The first step was the realization and clarification of the Gigamap as a design artefact. This had implications on how the mapping process was seen and on the relation between the map and the reality it first depicts and later redesigns. This realization did solve some of the qualitative questions the mapping raised. However, there were still more tacitly sensed issues to it. Intuitively we were drawn towards certain types of maps that depicted richness and depth on the cost of clarity. I needed to clarify this attraction to the messiness of certain maps (Fig. 14).

By studying exemplars of such maps, the realization emerged that what these maps mainly communicated and shared were soft but nevertheless very important and central issues when bridging ruptures. Instead of dominantly communicating information, these maps communicated and depicted a sense of the qualitative features of the system. These features are the components of the Sense Sharing Model.[8]

[8] I relate this theoretically to Zwicky's Morphological Analysis (MA) but a designerly less ordered version based in design work. This has some disadvantages compared to MA but also some advantages, though this discussion would exceed the frames of this article (Ritchey, 1998).

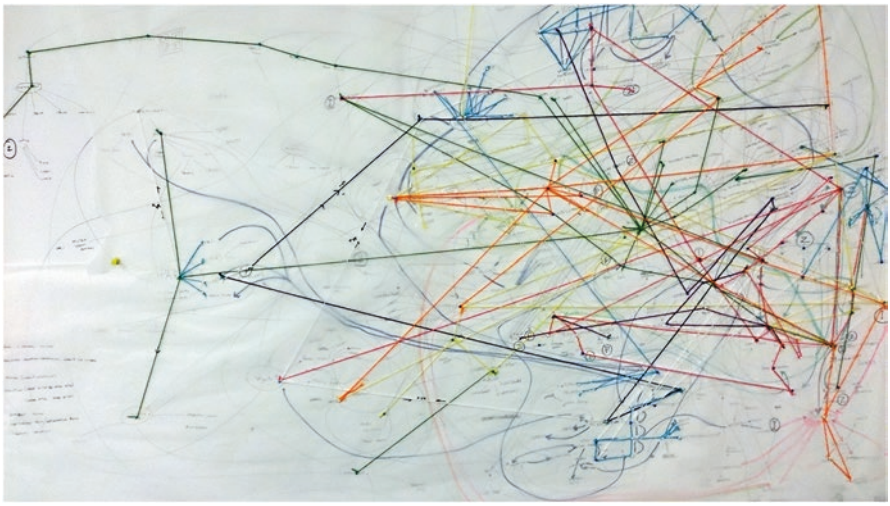

**Fig. 14** Richness and depth on the cost of clarity. Such maps were intuitively attractive, but what they depicted and emphasized was not immediately clear. The map is developing the relations found in a task, given to master's students at Chalmers University, Gothenburg. The task was to design an integrated social housing project for immigrants on the campus of the university. (Karin Backlund, Maxwell Kevin Otieno, Evelina Peterson, Chalmers Architecture, 2015 Photo: Birger Sevaldson)

These were pinpointed to include the following features:

- Sense of the field
- Sense of Gestalt
- Sense of degree of complexity
- Sense of timing and dynamics
- Sense of needed effort
- Sense of resistance

## *Sense of Field*

A shared sense of the field in which the client organization or the project is situated. How extensive is it? How solid or blurry is its boundaries? How enclosed or fragmented is the field? How vast does it stretch? How diverse is it? Failing to share this sense of the field can result in fragmented project work.

*For example, when designing a car, this involves a multitude of experts spanning from all sorts of engineering, software development, ergonomic, form-giving and styling experts, interior and material experts, cultural and aesthetics, marked and business understanding, emission, laws, regulations, environmental issues, safety, etc*.

### *Sense of Gestalt*

A shared sense of the main figure of the system at hand. Is there a clear head? Is it a top-down or bottom-up organization? Is it old and grown over time? Is it worn and fragile? What shape depicts it best? Failing to share the sense of Gestalt might result in hidden ruptures in the process.

*For example, if one wants to induce organizational change, one needs to know who to bring on board for what and how resilient the organization is*.

### *Sense of Degree of Complexity*

A shared sense of how complex the challenges ahead are. If the team has very differing views on how challenging the task is, there is a serious rupture. It is not needed to understand the system in all its detail to generate a sense of degree of complexity.

*For example, marked and business strategies need to take into account technological, cultural, and economic challenges for an innovative product. Ideally, the strategies also need to understand trends and politics as well as the need for sustainability.*

### *Sense of Timing and Dynamics*

A shared sense of how dynamic the system is. Is it changing quickly or slowly? Is it able to absorb change within a reasonable span of time or will change take longer time. How is the timing for suggested interventions? Failing to share the sense of the dynamics of a system can result in serious ruptures and desynchronized and erroneous planning.

*For example, architects used to plan according to static room programmes instead of planning for revisions, flexibility, and change from the outset.*

### *Sense of Required Effort*

A shared sense of the effort needed to successfully implement a suggested systemic design intervention. Is it expensive? Are there technical difficulties? Failing to share this sense leads to serious implementation problems.

*For example, information technology projects are notoriously known for breaching economic and time frames.*

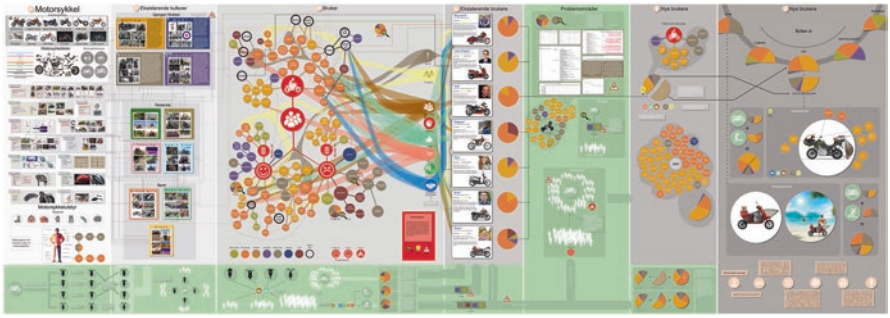

**Fig. 15** A Gigamap capturing the complex world of motorbikes. Sharing a sense of the field would be important for those who want to design an innovative motorbike. (Arnt Kåre Sivertsen and Levi Lynau Celius, University College of Oslo and Akershus 2016)

## *Sense of Resistance*

The inherent resistance to change that affects the systemic design intervention. Resistance can be found on all levels in the system, its environment, the landscape it lives in and globally (Fig. 15).

*For example, sharing an understanding of technological, economic, and cultural thresholds as well as the difficulties in meeting the needs for sustainability is important.*

## *How to Practise the Sense Sharing Model*

The significance of the Sense Sharing Model is mostly about building awareness of what the goal of Gigamapping is in collaborative settings. It is beneficial to emphasize the less tangible output from this mapping process. Besides the mapping of real-life data, the interrelating of mixed information sets, and the externalization and internalization of knowledge about a subject, it is important to realize the value of synchronization of the different individual perspectives. The Sense Sharing Model partly explains why Gigamapping, in the overwhelming majority of cases, feels useful and meaningful in group work across disciplines and positions.

On an initial level, the model can be practised as checkpoints for discussions to repeatedly check the shared awareness of how synchronized the views in a collaborating group actually are.

However, the steps forward would include developing frameworks for sessions for each of the features where they are discussed through using the Gigamaps as the backbone where it would be possible to point out and grade the different sense sharing levels. This makes sense because there could be a high degree of sense sharing at certain areas or points in the Gigamap, while the shared understanding could be broken at other points.

## Conclusion

In this paper, I have addressed some seemingly vague issues that have emerged from the practice of Gigamapping, issues that are crucial for the dialogue that is so central for participatory and interdisciplinary collaboration. The most important issue is to identify those vague ruptures in the interpretation of the map, ruptures that have been frequent and that at the same time have been unveiled and often solved through Gigamapping. This issue has not been addressed particularly nor solved methodologically earlier. Though this text emerges in the midst of a development process, it has quite central implications on how we look at the role of the Gigamap in SOD. While the usefulness of discussing and scrutinizing these issues in a SOD process seems obvious, future developments would refine and develop and evidence this further.

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