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Co-designing Team Synergies within Metadesign

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Abstract

In seeking solutions to the world’s major problems this paper calls upon governments to support the development of a more comprehensive, ‘joined-up’ field of co-design that would facilitate the required behavioural changes within society. This will entail re-designing design as a form of ‘metadesign’. Where, traditionally, ‘design’ delivers desired conditions in the future metadesign would also need to attend to conditions in the present. It would not only focus its attention onto objects, images, services or relations but it would also combine them in ways that produce synergy. Here, the term ‘synergy’ refers to an abundance of value that exceeds the sum of its ingredient parts. The ultimate indicator of success for metadesign would be an emergent ‘synergy-of-synergies’. While metadesign offers enormous advantages by reducing our dependency upon finite resources, making it work is not straightforward. For example, broadening the repertoire of design would make it more complex and elusive, because metadesign methods tend to blur distinctions between design and designer, and between foreground and context. Teamwork within metadesign therefore becomes far more important than it is within design. The paper offers a theory of ‘team-consciousness’ and describes how collaborative team synergies can be mapped.

Background context

The underlying context of this paper is human survival – i.e. the growing possibility that, despite its extraordinary advances in science and technology, the human species may make itself virtually extinct within this century. Humanity has not yet learned how to harvest abundance safely. Worse, we are destroying the ability to create abundance faster than we are harvesting it. Current levels of carbon in the atmosphere have been the highest for a million years and species extinctions are at levels exceeding those of 63 million years ago. Populations need to change the way they feed, cloth and shelter themselves. Assembly, travel, communication, governance and work habits will all need to change. But major shifts in behaviour, are not only driven by technologies and government policies, but also by habits, expectations and beliefs. If the news media present the economic ‘crisis’ as more serious than the environmental ‘crisis’, for example, many citizens may see little need to change their behaviour. This kind of profound confusion must be addressed as part of the problem.

Increasing the effectiveness of designers

Many designers find it easy to reflect creatively upon future scenarios while reconciling many disparate interests and factors. This suggests that they would be able to make an important contribution to the work of scientists, planners, politicians or civil servants in addressing our ecological crisis. Unfortunately, while it may be true that individual designers have the potential and capacity to work at this much higher level, few have been trained to meet challenges on this level. The design professions evolved in order to service the needs of commerce in the 19th and 20th century. These still tend to survive as 'silos of practice' (industrial design, graphic design, landscape design, etc.) each with its own habits and mindset. Despite valiant attempts to challenge these disparate 'realities', very few educators have managed to coordinate and revise these traditions as a way to address the frightening realities of the 21st century.

Teaching Metadesign

The paper advocates an augmented mode of design practice that it calls 'metadesigning'. This is a co-design methodology that has grown out of our research and teaching at Goldsmiths, University of London, over the last two decades. When we launched our first BA (Hons) degree, in 1989, few universities seemed to challenge the assumed role of designers as catalysts to economic growth. Nor were there any professional bodies powerful enough to re-direct specialist design practices as a radical force for aiding the survival of the human species. The deeper ethical and environmental issues we raised proved attractive to increasing numbers of applicants. Many expressed a wish to work primarily for the common good, rather than the profits of shareholders. Instead of emphasizing specific 'design skills' we therefore encouraged our students to challenge accepted beliefs and to think about the 'big picture'. This soon became a non-specialist design degree that was far more speculative, cross-disciplinary and entrepreneurial than any we could find. Controversially, instead of training our students with the traditional skills allegedly required by industry, we employed philosophers, anthropologists, entrepreneurs, scientists, visionaries and inventors to help them to imagine what the world might need from them. It was a pleasant surprise to find that our graduates were at least as employable as their strongest rivals from other top universities.

Defining Metadesigning

One aspect of our approach resembled what others (e.g. Maturana, 1997; Giaccardi, 2004) have called 'metadesign'. It is an emerging and shareable set of principles, practices, tools and benchmarking methods that draw upon a wide range of disciplines to facilitate human survival. Here is how we have defined it:

1. Metadesign is a superset of co-design methods adapted from anywhere.
2. Metadesign seeks survival strategies via a radical and pragmatic approach.
3. Metadesign resists entropy by emulating how living systems conserve energy.
4. Metadesign is eco-mimetic in that it is inspired by how ecosystems work.
5. Metadesign intervenes in many places at once – to seed new paradigms.
6. Metadesign steers itself by using words to 're-language' actions and meanings.
7. Metadesign seeks, brokers, cultivates and orchestrates a synergy-of-synergies.
8. Metadesign creates holarchies, in which their 'parts' maintain 'wholes'.
9. Metadesign synergises its own teamwork by orchestrating synergies within it.

10. Metadesign seeks ‘ecologies-of-scale’ by ‘scaling-up’ in an organic way.

Researching Metadesigning

The idea that designers, aided by other experts, might considerably expand their professional role is not new. Some (e.g. Manzini & Cullars, 1992; Marzano, 1999; Manzini, 2001) have developed new approaches, such as ‘service design’ and ‘high design’. These remind educators that new design approaches must be profound enough to cope with the complexity of global markets. Others have called for ‘comprehensive’ (Fuller, 1969) or ‘strategic’ practices of design (Jones, 1980; Archer, 1985). Since 2002, our research into ‘metadesign’ has attracted major research grants (e.g. AHRC and EPSRC) and we are applying our findings to practical projects. We recently launched our ‘Metadesign Open Network’ that runs as a not-for-profit, limited-by-guarantee company. We will soon be in a position to make some of our metadesign tools freely available under a Creative Commons license. More recently we have wondered whether our findings might be applicable to governance. In the present scheme of things central governments struggle to coordinate the many specialists – e.g. civil servants, judges, politicians, urban planners, healthcare managers, scientific advisors, economists, journalists and bankers – who maintain the social order. However, few of these professions intervene directly people’s daily lives. Many of their methods are bureaucratic; and it has been argued that the methods governments use (e.g. setting targets, fiscal policies and laws) are probably the least effective for achieving effective changes (Meadows, 1995). Achieving a genuine paradigm shift is a huge task. As Albert Einstein noted, ‘We can't solve problems by using the same kind of thinking we used when we created them’. Metadesign acknowledges this difficulty and therefore expects to have to challenge, and revise, its own discourse by introducing perspectives that are ‘external’ to itself.

Design and Metadesign

Since Aristotle, design has been widely understood as a predictive practice, in which outcomes are defined in advance of an agreed deadline. However, there are ethical and organizational reasons why human behaviours and lifestyles cannot be ‘designed’ in the same way that we might design a chair or a website. The idea of metadesign is appealing because it encompasses the benefits of design, whilst avoiding its predictive expectations. An effective mode of metadesign would therefore replace 'design as planning' with 'design as a seeding process’ (Ascott, 1994 in Giaccardi, 2005). This might place the ‘metadesigner’ in the role of ‘systems integrator’ (Galloway and Rabinowitz, 1983, in Giaccardi, 1995), rather than autocrat, or master planner. The word ‘meta’ originally meant ‘beside’ or ‘after’. In modern parlance it now implies a ‘higher order’, ‘different order’, or the ‘re-siting’ of something. It can be seen as a shared, inclusive and continuous process of systemic cultivation and management, in which the design process occasionally re-defines it. At the political level, this resonates with what John Dewey (1939) and John Chris Jones (1998) have referred to as ‘creative democracy’, and with what is now emerging in the ‘Creative Commons’ movement. Jones believed that designers might work with, ‘not individual products but whole systems or environments such as airports, transportation, hypermarkets, educational curricula, broadcasting schedules, welfare schemes, banking systems, computer networks‘ (Jones, 1991).

Synergizing the ‘Law of Increasing Returns’

One important role for teams of metadesigners would be to find, cultivate and harness different types of synergy (c.f. Corning, 1983) at different levels. This means locating non-destructive synergies, both known and hidden, and to synergize them to create even more comprehensive, self-renewing synergies. Obviously, this is an ambitious aim. What does ‘synergy’ mean, in this context? Richard Buckminster Fuller’s definition is as good as any we have found i.e. "…the behaviour of whole systems unpredicted by the behaviour of their parts taken separately" (Fuller, 1975). The problem is that synergies operate on many disparate levels. Few appear to be as simple and quantitative as those at the physical level. Stainless steel, for example, is up to 35% stronger than any of its ingredient materials. Other synergies are a little more qualitative. By combining chlorine and sodium it is possible to create table salt. Interestingly, although salt is a food, both chemicals are poisons when ingested by themselves.

Synergy can deliver free abundance

Here, Fuller's term 'relative abundance' emphasises that 'abundance' is neither extrinsic to the system, nor is it intrinsic to the individual parts (c.f. Wood, 2007:2). It is a property of the combination of existing assets and means. At the biological level, 'synergy' is usually referred to as 'symbiosis' (Margulis, 1998). This endorses the 'Law of Increasing Returns' (Young, 1928; Romer, 1986; Arthur, 1996) that defies the belief that the world can sensibly be audited as a balance sheet of raw resources. For example, a competent chef de cuisine can create a dish that is more satisfying and nutritious than one from a bad chef, even though the quantity of ingredients is the same, or less. However, what this also illustrates is that synergies are seldom simple. It is normal for many different orders of synergy – e.g. physical, chemical, biological, social, economic, cultural, etc. – to become entangled in forms that may be indescribable or, even, unthinkable (Wood, 2007:1).

Co-creating knowledge is synergistic

Most designers are accustomed to working on 'wicked problems' (c.f. Rittel & Webber, 1984) that defy deductive analysis. This paper argues that metadesigners must integrate their best skills of intellectual reasoning and creative judgement to synergise many processes on many levels, simultaneously (Wood, 2008). One of the reasons why humanity is creating so much ecological damage is our tendency to disconnect everything so that specialists can improve each part in relative isolation. It is common in academia for specialists within a research team to send their individual contributions to an editor who will combine them in a single research document (Hollis, 2001; Newman, 2004). But this method is unlikely to enrich the working synergy within a cross-disciplinary team (Nieuwenhuijze & Wood, 2006). In his 1991 book *Designing Designing*, Jones spoke of 'designing without a product, as a process or way of living in itself', and he foresaw the emancipation of the non-specialist in a process that would augment the practice of design, as we know it.

Team consciousness

However, living in a world that is non-hierarchical would mean that it is also less predictable (Arthur, 1996). This means that responsible professionals will constantly need to challenge and refresh their assumptions, expectations and habits. They would therefore need to remain vigilant, adaptable and creative. This vision resonates with the organizational structure that Arthur Koestler (1967) called 'holarchy'. A holarchic organization is one in which the whole is governed by its parts. Functionally speaking, this means that each player, or agent, within a given 'whole' (or 'holon') must feel accountable, and act responsively and appropriately, in helping to maintain the status of the whole system. This is an ambitious quest that would be impossible without the emergence of what we call 'team consciousness' (Wood & Backwell, 2009). This is an important idea because it is helpful to have a variety of cognitive and emotional types in the same team (Belbin, 1993), even though this may cause friction. This raises both political, and organizational challenges.

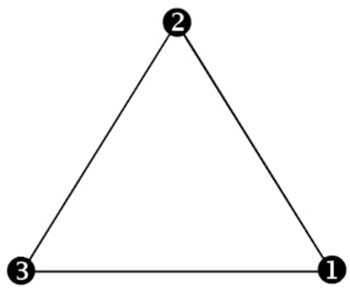
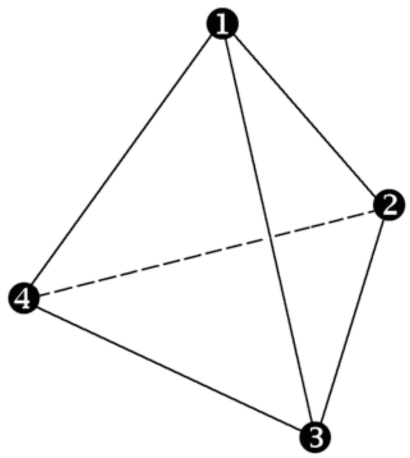
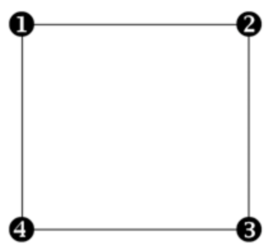
Mapping team consciousness

This qualitative notion of synergy cannot be confined to a specific domain, or category (Bussracumpakorn, 2006). If we are to achieve high levels of synergy within co-design the whole system will need to attain a high level of consciousness'. This may sound strange to some readers, because we are used to thinking of consciousness as an attribute of individuals, rather than groups. Marvin Minsky once remarked that consciousness is merely a "low-grade system for keeping records." (Minsky, in Horgan 1994). Using this assumption I realised that we might be able to map 'team consciousness' by mapping the team as a network of agents, and by evaluating the level of adjacency between each agent. It follows from this simple model that 'consciousness' (Minsky's term) is likely to diminish as the system's size increases. This can be illustrated by what Koestler (1967) called the 'paradox of the centipede'. This notes that most of the centipede's cognitive capacity is absorbed in the task of walking. This extreme example of an organism's ability to monitor its internal components illustrates Minsky's idea of consciousness, and how it implies a balance between the inward-facing and outward-facing aspects of awareness. How might one depict, and measure the team consciousness that is implicit in Minsky's simple model? Leonhard Euler (1707-1783) devised a famous schema for mapping 'agents' and their relations, by using dots (vertices) and lines (edges). These can be applied to create strings, fans, nets and polygons, etc. Figure 1 illustrates how it can represent simple relational criteria. More importantly, it identifies the implications of a team's size. This also helps us to visualise several basic configurations of interdependent 'players' and the way they might relate to one another.

Auspicious forms

It is possible to map relations using topographic forms. For example, the tetrahedron (see figure 3) offers uniquely auspicious properties (Wood, 2005). It is a Platonic solid with 4 faces, 4 vertices (corners) and 6 edges. Euler's famous theorem of 1751 showed that, out of all known polygons, it has the maximum edge-to-face ratio and the maximum edge-to-vertex ratio. Why is it useful for co-design purposes? For one reason, although it has the same number of nodes the tetrahedron is less 'hierarchical' than the square, because it enables every player to have an unmediated link to every other player in the cluster. Figure 2 shows how the number of relations rises in comparison with the number of players in a given instance. Notice that the rate of increase in relations as the number of players goes up. The biggest jump is from 3 agents to 4. In other words, the number of relations doubles from 3, to 6. Going from 3 to 4 players obviously doubles the advantage of clustering and, therefore, enhances the potential for 'consciousness'. But, using the 3D model, as we add more players to our original 4, a hierarchy begins to emerge. Psychological studies have indicated that, although some people may be able to visualise and remember, up to nine, or so, interdependent factors, others can envisage only four or five (Miller, 1956). Our empirical studies show that, although four is a convenient and easy number to use, odd numbers (3 or 5) seem to work better for mapping, sharing and discussing specific issues in creative teams.

Players & their relationships	Features	Implications for Co-designers
	2 players have a maximum of 1 direct, internal relation	Theoretically, any non-synergistic relation may be transformed into a synergistic relation by ingenious re-design. When this happens, each player receives a maximum benefit of 1 synergy. There are no chains within this system.

	3 players have a maximum of 3 direct, team relations	When all of the relations are made synergistic, each player experiences a maximum benefit of 2 synergies. This represents two thirds of the total synergies shared. There are no chains within this system.
	4 players with the maximum possible number of direct, internal relations (6) within the team	The total number of possible synergies is 6. When this is attained, each player experiences 3 immediate synergies, i.e. half of the total number of synergies shared across the whole system. Topologically (i.e. mapped in 3D space), it represents the largest number of direct, peer-to-peer relations. Mnemonically (i.e. as a concept) its level of complexity is easily graspable and memorable by most people. There are no chains within this system.
	4 players connected so that there are only 4 direct relations 2D figure	Team misunderstandings may build up if some collaborators only deal indirectly with some others. 'Looping' a chain raises the average number of direct relationships. In this case, looping increased 'directness' significantly. In much longer chains the looping process this is less effective, relatively speaking.
	4 players connected so that there are 3 direct relations	As a chain emerges and get longer, player-relations become less direct. In the illustrated example, only 2 players (2 and 3) have relations with more than one other player. This means that, out of 6 possible relations, only 3 are operative; and some are secondary, tertiary, or even

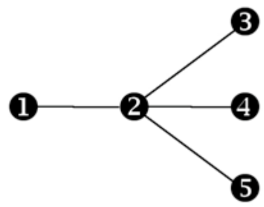
		further down the scale of connectedness.
	5 players 4 direct relations	A ‘fan’ format implies a hierarchy. When we create long chains of command we risk introducing alienation. A hierarchical management system is therefore unlikely to be highly synergistic. To achieve synergy we may need to de-centralise.

Figure 1. Examples of player-relations, mapped using Euler’s notation

Some relational arithmetic

Synergies can only emerge from within relations. If we can count the possible relations, then it would be possible to identify some latent opportunities for creating synergistic outcomes. First, the arithmetic that calculates how many possible relations there are among a given number of agents is simple:

$$\mathbf{R = \frac{(n - 1) \times n}{2}}$$

Where:

n = the number of fully mutually aware agents

R = the number of relations that exist among them

The number of mutually aware agents	Some notes	The number of possible direct relations	The number of possible relations between the primary relations	The number of possible relations between the secondary relations
1	No potential for relations	0	0	0
2	A single relation, but no potential for secondary, or other relations	1	0	0
3	Mnemonically easy, but no potential for additional relations	3	3	3
4	Smallest number of agents required to	**6**	**15**	**105**

	produce an infinite number of subordinate relations (beyond column 5). Can be grasped either consciously, or intuitively			
5	Practically useful as a cluster of agents, but cannot be modelled satisfactorily in 3D (without forming an indirect relation)	10	45	990
6	Would probably require ‘chunking’ of the factors involved	15	105	5460
7	Relies increasingly heavily on experience and/or intuitive skills and insights	21	210	21945
8	Probably beyond the average person’s ability to have a conscious grasp of all primary relations	28	378	71253
9	After this point the exponential increase in the ratio of direct to indirect relations continues. Ultimately, this reduces the team’s ability to achieve a high level of consciousness	36	630	198135
10	Ditto	45	990	489555
11	Ditto	55	1485	1101870
12	Ditto	66	2145	2299440

Fig. 2: Some notes concerning peer-to-peer relations

The jump from 3, to 4 fully interconnected agents reveals a doubling of relations. If we may assume that each relation is synergistic we may assume that synergies can be persuaded to synergise with other synergies. We call these ‘second-order synergies’.

Practical Work

In seeking a suitable strategy for paradigm shift, our approach was to look for synergies that already exist at many levels within the system. This is not always easy because it calls for a sophisticated level of teamwork. In our empirical work we have conducted a number of metadesign workshops as a way to evaluate our theories of holarchy and how it might be usefully applied in a practical way. The most recent study took place on behalf of a Californian-based energy company. Previous experiments have taken place over several days. On this (one day) occasion, there was not enough time to use many of the 90, or so, tools we have devised. The underlying assumption behind this work is that our metadesign methods can enhance business thinking. We carefully selected a team of thirty experts that included distinguished innovators from design-related fields and we organized them into four, interdependent teams. Finding new synergies in the short time available to the workshop was a challenge, because many of the group did not know one another. It was therefore important to ensure that team members would bond quickly in order towork together synergistically. This calls for emotional intelligence as well as intellectual intelligence. The first session therefore emphasized shared experiences, rather than intellectual ideas. We asked each individual to take turns at initiating a drum rhythm in front of the group. We repeated the experiment and asked the whole group attempting to clap, in unison, to this rhythm.

Fig. 3: Participants quickly engage with one another via a drumming workshop.

This tool worked better than expected. It is easy to facilitate by a non-expert. It took less than fifteen minutes to run and it relaxed and 'bonded' the whole group.

Fig. 4: Layout of Team Tables

Fig. 4: Four Teams interconnected by Six Relations

We set up four teams of experts, each placed at a table. The four tables were arranged in a square, with a fifth table at the centre. Each team consisted of three invited guests, one facilitator, one observer (note taker) and one video-camera operator, standing slightly away from the table. Although a 2D square does not quite make the teams equidistant from one another, conceptually, it signifies our avoidance of a hierarchy. Each team on the four (outer) tables had a particular theme – shelter, mobility, clothing and food. The broadening of the agenda, and the non-hierarchical nature of the group structure, were key aspects of our approach. We wanted to challenge received ideas of what an electric car, or energy utilities, company might be expected to do, or to be in future. We invited each of the teams to question the usefulness of their assigned category. The results confirmed that any product category could be stretched, shifted, or morphed into another one because of innovations from competitors in their own market, or even from other industries.

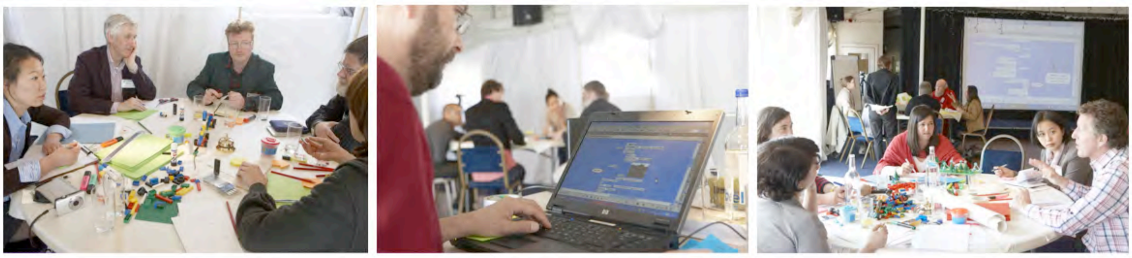


Fig. 5: Progress of the four teams was made visible to all via a mind-mapping display

The central (fifth) table was the 'base camp' for someone who monitored activity from all four tables (via post-it notes), and compiled an up-to-date mind-map that was projected onto a large screen and could be seen by each of the four groups. Much of the discussion was characterized by the simultaneous making of sketches, models and diagrams. This was not something that is required, but is behaviour that emerges from the type of participant that we invite (also because suitable art materials are made ready-to-hand). We concluded that synergy can be increased (Nieuwenhuijze & Wood, 2006) when the following four elements become enmeshed and, or integrated:

1. **Author-autonomy**

   The individual viewpoints of the co-authors (and/or co-designers)

2. **Effective author-relations**

   The relationship between/among the co-authors (and/or co-designers)

3. **Team-consciousness**

   The inner/inter-active dynamics, of the group of which they are member

4. **Co-creative, purposive innovation**

   The new meanings in their joint context of embedding, extending the context of their original meanings.

The components of collaborative synergy outlined above reflect the importance of changes that must take place within/across the co-authorship team. Viable solutions are likely, therefore, to orchestrate events at many levels – including, say, the organisational, cerebral, somatic and emotional faculties of each participant, in the context of the whole. They may also be trans-disciplinary. A positive aspect of this process is that the boundaries of separation between our disciplines, and our cognitive modes are also the interfaces through which our differences can be bridged, creatively (Nieuwenhuijze & Wood, 2006).

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