Seeing the wood for the trees: Social Science 3.0 and the role of visual thinking

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Abstract

Social Science is increasingly called on to address 'grand challenges', 'wicked problems', 'societal dilemmas' and similar problematiques. Examples include climate change, the war on drugs, and urban poverty. It is now widely agreed that the disciplinary structure of academic science, with its journals, curricula, peer communities etc, is not well suited to such trans-disciplinary, ill-bounded, controversial issues, but the ways forward are not yet clear or accepted by the mainstream.

The concept of a next generation paradigm of 'Science 3.0', has emerged through work on sustainability systems analysis, and for this, multiple channels for learning, thinking and communications are essential. Visual thinking in its many forms (from technical representation or mapping, to photography or video, to design or illustration, to fine art), can bring to the table tacit and 'felt' knowledge, creative experience, and links from analysis with synthesis. This paper first sketches the contours of a Social Science 3.0, and then demonstrates with examples, how visual thinking can combine with rational argument, or extend beyond it to other forms of experience.

Keywords:

Scientific paradigm, transformation, sustainability analysis, visual thinking,

Introduction

The 'Urban Living' UK research programme recently called for – "holistic diagnosis of challenges... a breadth of expertise and knowledge... co-create[d] innovative understandings... integrated pathways to future solutions." (RCUK, 2015). Like many others, this programme had aspirations to connect social technology, industrial ecology, organizational learning, urban planning, civil engineering and behavioral economics, to name but a few fields involved.

In a similar vein there are high aspirations from research sponsors, such as the world's largest R&I programs at the European Commission. They call on foresight and prospective studies, with communities of 'high level experts' comparing notes on 'megatrends'. They frame a set of 'Grand Societal Challenges', 'wicked problems' or nexus type dilemmas, i.e. research agendas beyond a single analysis, without clear definitions, with the solutions understood as part of the problem. They then call for 'integrated projects', to combine theory with case studies, technical analysis with policy deliberation, and academic rigor with creative practice.

In reality much of this rhetoric falls short of expectations: with large public funds involved, risks are minimized, outputs are fixed 5 years in advance, coordinators have a near-impossible task of holding disparate elements together, and multi-national consortiums are formed by political necessity as much as scientific logic. At the same time it seems that most of the science establishment (with some exceptions) is pointing in the opposite direction, along with the wider community of 'R&I'.(ERA Expert Group 2008: Duckworth et al 2016) Too often, specialist knowledge is arranged into silos, disconnected from users, with an almost medieval regime of insider peer-group reviews, and self-legitimizing academic league tables. The UK Research Excellence Framework is a classic example, consuming huge efforts by leading academics, and argued by some to be destructive of real innovation, creative collaboration and inter-disciplinary thinking (Sayer, 2014).

Given this picture, how possible is it to work with more diverse forms of knowledge in a synergistic 'open-mind-scape'? In what follows we suggest ways in which visual thinking might help to connect cultural, ethical, emotional, spiritual, aesthetic, felt and other knowledges, and bring these into constructive counterpoint with more so-called 'objective' science. Rather than drawing hard lines between objective or subjective, we can ask whether such knowledge is 'useful', in the sense of public, creative and collaborative.

This paper is a brief review of a complex argument. First we sketch the contours of an emerging scientific paradigm which is framed as Science-3.0. Next, the example of climate science provides a demonstration. Third, we look beyond 'post-normal science' into new territories of multiple knowledges. Fourth, we look at how visual thinking can extend and work in combination with rational thinking. Fifth, we look at other forms of visual thinking on the art-anthropology interface working 'beyond' rational thinking. Finally a brief conclusion asks about future directions.

An emerging Science 3.0

The aim of the co-evolutionary 3.0 framework is to help with mapping of current issues for social science, and to design or navigate future pathways.

The grand societal challenges above show how 'useful knowledge' concerns not only technical problems, but conflicts of power and ideology and personalities: and more so, dilemmas (or 'trilemmas') of wicked, problematic, 'post-normal' types of knowledge. One manifesto for climate-related science calls for "societal agenda setting, collective problem framing, a plurality of perspectives, integrative research processes, new norms for handling dissent and controversy, better treatment of uncertainty and diversity of values, extended peer review, broader and more transparent metrics for evaluation, effective dialog processes, and stakeholder participation".(Cornell et al 2011).

These features can be summarized as a 'Science 3.0' agenda, which pushes at the conventional boundaries in several ways:

- 'wider', looking towards whole systems synthesis, with a collaborative approach: in contrast to reductive component-based analysis.
- 'deeper', in combining different worldviews and value-systems, with a cognitive approach: e.g. social, technical, economic, ecological, political and cultural.
- 'longer', looking beyond linear solutions to defined problems, with a co-creative approach: towards a reflexive deliberation and inter-subjective learning, better suited to wicked, messy, unbounded challenges.

The '3.0' framing as used here, is drawn from a methodology and framework currently that is emerging (Ravetz.J in press: Ravetz & Miles 2016: Ravetz J. 2015). (Note the same term, science 3.0, is used in a similar but distinct way by Roger Pielke (2013). The core concept is the capacity of any system to learn and think in synergy, where the whole is greater than the parts. We can identify several levels of synergy, each with its 'model' or paradigm of system activity and change:

- 1.0: linear model: the synergy works as a 'functional system', to be analysed as a 'problem of simplicity'.[1] The system follows instructions and responds to direct short term change: (with an image of a large or complex machine).
- 2.0: evolutionary model: the synergy works as a 'complex adaptive system', evolving in a biological autonomous model of adaptive self-organization. This can be framed as a 'problem of disorganized complexity': (with an image of a wilderness or jungle).
- 3.0: co-evolutionary model: the synergy works as a 'cognitive-creative-collaborative', open-mind, collective intelligence system: this can be framed as a 'problem of organized complexity'. This is shaped more by human qualities – learning, thinking, questioning, creating, strategizing – with a process of cognitive collaborative co-evolution: (with an image of a human community or personal development).

This '3.0' model can help to explore and understand almost any kind of human problem or challenge, (e.g. in social, technical, economic, environmental or political domains). It can also help to design responses which are suited to the level of the problem. For example, if we take the RCUK 'urban living' programme above, which called for research on the national housing crisis, a linear frame and model would focus on numbers of units: an evolutionary model would look at markets, incentives and behaviour models: and a co-evolutionary model would explore the collective intelligence, the learning and thinking capacity of the combined housing ecosystem, including public, private, civic and community sectors.

In response to this, a co-evolutionary model for science 3.0 (including many varieties of R&I) is not only inter-disciplinary (bilateral), but trans-disciplinary (multi-lateral). It starts with more systemic and inter-connected problems and responses, questions the concept of a 'thing' or 'unit of analysis', and works back to the knowledge domain (Ingold, 2010). It is part of a shift from a reductivist approach which looks for 'problems of simplicity', towards a holistic approach to 'problems of organized complexity', in which human experience is at the centre (Weaver, 1948).

Such knowledge is then more than information in a paper or text-book, becoming similar to an active component of a cognitive (i.e.'cognostic') co-evolution, towards a synergistic open-mind model, involving all kinds of actors in all kinds of domains in co-learning and co-creation. Science 3.0 doesn't suggest that we can get all the data on the ultimate super-computer: though it may use big (or 'huge') data as part of a decentralized, networked, creative-heuristic process, on the path of synergistic design of open-mind 3.0-type models for economies, technologies, energy systems or city systems. . Overall, a Science 3.0 model combines analysis and modelling with synthesis and design, bringing in the normative as an integral part of the design thinking for wicked problems (Conklin, 2012).

FIGURE 1: SCIENCE-3: CLIMATE EXAMPLE

Example: climate science

Climate change is a good example for exploring new directions in science. Scientific analysis of risks, impacts and adaptation over 20 or 40 years, has to assume that everything else will stay the same, 'ceterus paribus'. But in reality nothing will stay the same, many things will be inter-connected, and there is no scientific-technical model which can even guess at the combined uncertainties. What role is there for science, in such existential ignorance, even in our own backyards?

Globally, the climate change challenge shows fragmentation and conflict on an existential scale. Many scientists see gaps and fractures in the physical science, even while the physical world appears to move closer to catastrophic tipping points (Smith and Stern 2011). The 2015 Paris Agreement was a great achievement of aspiration, but the stated emissions targets ('national intended contributions'), if they could be achieved, are estimated to result in 2.7 degrees temperature rise

which is into the danger zone. There are raging battles between earth science, economic investment, political strategy, social divisions: together with many related issues of adaptation, disinvestment, international transfers, social justice and so on (Pielke, 2013).

The physical science of earth systems, with measurable effects of radiative forcing among others, generally seems framed as a linear, 1.0 type problem of physics and chemistry. The system is hugely complex and dynamic, with multi-level feedbacks and regulating loops. But in principle, with better data, better models and better calibration of stochastic effects, the earth system could be analysed and forecast by a technical 'model' (subject to the usual uncertainties), and we might then give better advice to policy-makers, as in SCIENCE-3: EXAMPLE, left side (Figure 1a).

A more evolutionary view sees a multilevel 'complex adaptive system' or 2.0-type model of knowledge. Climate science looks at how countless bio-physical cycles have evolved into fractal-like niches and habitats, from global scale oscillations to single-celled algae. We then add in complex economic or political models, and as long as the parameters are clear and stable (for instance, what is economic 'production'?), in principle we can get the data and build the models. But in practice such parameters aren't often clear or stable. To keep the show running, the global 'integrated assessment' models and studies stay with the safer 1.0 and 2.0 type knowledge zones. If we assume physical disruptions and tipping points, combined with socio-cultural-political 'surprises', (and history tends to be shaped by surprises), then we're beyond the models and into existential uncertainty. For example, the link between climate change and the Syrian civil war appears to be a question of profound disagreement: whether by data analysis, interviews with farmers, or agent-based modeling, the ultimate analysis of such a problematic reality seems impossible (Kelley et al 2015: Selby & Hulme 2015).

Once we add in the human capacity for disruptive or chaotic behaviour, this begins to look like a 'cognitive-collaborative-co-evolutionary' system of knowledge, in other words, a synergistic Science-3.0 model. If we try scenario modelling of emissions and climate impacts, we have to think about citizens and livelihoods, consumers and lifestyles, urbanization and migration, conflicts in Syria and elsewhere, and other societal challenges on a grand scale. As for the human qualities, there is shared learning, creative collaboration and social intelligence, alongside corruption, denial, profiteering and expropriation. In systemic terms, climate is a 'threat multiplier' or 'trigger' in an already hyper-stressed global system of hyper-complexity. And this is not just about the content but the scientific process itself, as the 'climate-gate' fiasco showed (Nerlich 2010).

So for these kinds of problems, which are more like 3.0-type societal challenges, we can revisit the boundaries of what is 'useful knowledge', how it can be generated and where it can be applied. Here, useful knowledge is not only the physical lab results, but a moving frontier of analysis, experience, communication, strategy and action. Such 'useful knowledge' is spread around different sectors and actors, global or local, powerful or dependent, scientists and citizens and everyone between: and it's distributed around the inter-connections and conflicts between different domains: social, technical, economic, ecological, political, cultural and so on.

One example from New South Wales concerns how the vulnerability of farmers was framed not only as a physical climate issue, but as a human 3.0-type issue, beyond simplistic or reductive models of land-use or economic development. As a consequence the climate 'problem' was reframed as a rural 'opportunity' for social learning and creative collaboration, which could be mobilized by a travelling

museum-in-a-bus (Vanclay 2005). Another example is the first image of 'earthrise' in 1969, as in Figure 2: the scientific information on our planet was already known, but the image had a huge influence as a cultural tipping point in global ecological awareness (Ravetz 2013).

FIGURE 2: SCIENCE-3: VISUAL CLIMATE THINKING

Overall, a 3C approach calls for a reframing or resetting of climate change science, as potentially 'useful knowledge' which extends beyond the physical science or simple economic impacts. In this wider field, useful knowledge is as much creative-synthetic as analytic: useful knowledge is part of the solution with a mutual 'action learning' approach: useful knowledge crosses as many boundaries as it needs to. This starts to look more like development process work, (with possibly therapeutic and spiritual dimensions) on a collective and global scale. A 'climate-therapeutic process' would work on inter-connections between facilitators (scientists), and co-producers (other actors in the role of 'client' or active equal participant), in a process of collective re-evaluation and self-empowerment. A vignette is in SCIENCE-3 CLIMATE EXAMPLE, right hand side (Figure 1b). We still need the physical models, impact analysis, and socio-economic cross-sections, but we also need much more.

Mapping the Science-3.0 landscape

From its origins, modern science was constructed around the search for fundamental laws, deduced from empirical observation, which increase predictive powers, with elegance and 'parsimony'. But, in the climate change case, alongside other grand societal challenges, the uncertainties multiply up, the debate is conflicted and controversial, and the rational-objective-parsimonious version of the science model doesn't seem adequate: in fact much of current scientific activity is argued to be 'on the verge', of fraud, manipulation, and corporate corruption (Kaufmann, 2011: Benessia et al 2016).This isn't all new to the critics, but it often seems easier to criticize than propose. In response, can we overlay the synergistic thinking and co-evolutionary '1-2-3' model on current concepts of science, both regular and heterodox, looking beyond problems and towards opportunities?

This starts with the notion of multiple intelligence, as in development psychology, framed here as STEEPCU (social, technical, economic, environmental, political, cultural, urban etc): again, these categories aren't fixed or 'objective', but they seem to be useful for this kind of problem. Many researchers are pressed to summarize 5 years research into 3 bullet points, then hand it to the 'policy-maker', who puts it on the shelf (Figure 1a and Figure 2a). It's easy for frustrated researchers to overlook how politicians and policy-makers play an equally complex game with its own logic, as do entrepreneurs, creative artists, or so-called non-expert 'lay people'. If we follow through the climate example, or other similar challenges, then each of these domains of knowledge, values, worldviews and systems of logic, needs to communicate and collaborate with others.

FIGURE 3: SCIENCE-3: MULTIPLE DOMAINS

This is visualized as a 3.0 type knowledge system on the right hand side, MULTIPLE DOMAINS (Figure 2b). Here we map the mutual exchange and inter-subjective social learning between different domains, each with its different worldview and logic. Some examples: we could link earth science to the political process: or social / community knowledge to technical analysis: or creative culture to new forms of entrepreneurial finance. Beyond these bilateral links, we could look for a synergistic learning process which travels right around the landscape, and weaves the many inter-connections into a greater whole. One early example was the Georgia Basin Futures Project in British Columbia, which set out to build some of these wider inter-connections and learn from the experience (Robinson et al 2006).

And if we enquire further into what is this knowledge, in all of its domains, we get into deeper levels of uncertainty and controversy. This is mapped in BEYOND POST-NORMAL, left side (Fig.3a), with a key concept graph, showing the uncertainty of 'facts', versus controversy of 'values' or 'outcomes'. These axes can be framed as 'post-normal science', and there are many similar interpretations: wicked problems, problematic knowledge, or the classic 'known-unknowns' of Donald Rumsfeld (Ravetz 2004: Stacey 2011: Leach et al, 2010).

In the bottom corner of Figure 3a, we see normal 'disciplinary' type science, on a linear 1.0 basis, where uncertainties can be quantified, and controversies can be managed: classical physics or neo-classical economics are each in their own way reductive and deterministic. Such 'known-known' type knowledge works (at least with internal coherence), where the system is measurable and the dynamics of change are predictable. However, real life isn't always so straightforward. If our uncertainties multiply up along the x-axis, into 'technical challenges' and 'known unknowns', this is more like a consultancy model, of expert best guesses and due diligence. If the controversies multiply up on the y-axis, with ethical dilemmas or social conflicts, this looks more like 'societal problems' for politics or journalism: scientists might advise but the major decisions are out of their hands.

And if we push the boat towards 'societal challenges' – of which climate change is just the start of a long list – each has massive uncertainties and controversies, ethical dilemmas, wild-cards, tipping points and discontinuities, and altogether 'unknown unknowns'. At this point, 'normal' linear scientific knowledge breaks down and we need to look beyond. Here the post-normal literature calls for 'discursive inclusive participative' types of extended peer review, but this hardly seems adequate in the face of existential challenges such as climate change (Defra, 2012).

In response, we can set up a mapping of 'synergistic' knowledge (Figure 3b, right hand side). This shows the same corners as before – technical problems and technical challenges: societal problems and societal challenges. We have the 'societal challenge' corner of high uncertainty / controversy, framed as a 'post-normal science' or 'wicked problem'. But instead of a single axis for technical uncertainty, we have a bundle of the multiple knowledge domains, STEEPCU or a similar range of multiplicity, where it seems that a technical type of uncertainty is not the same as a political or cultural uncertainty.

FIGURE 4: SCIENCE-3: BEYOND POST-NORMAL

If we follow up the societal challenge / post-normal type agenda of climate change, the physical science is accepted (more or less) but with highly uncertain predictions: the political situation may be more tangible but highly controversial: the cultural-ethical wisdom may be controversial but less tangible: and so on. So here we can visualize the role of 'synergistic knowledge', to navigate the different corners and combinations of certainties and controversies, and to mobilize the exchange and learning between different knowledge domains. This is visualized on the mapping as a circular pattern of movement: it also includes a possible 'back-loop' or trade-off between uncertainty and controversy. Note that this kind of mapping is only a metaphor, not to be taken too literally: the point is to visualize a multiplicity of knowledge, not so much as a 'thing', more as 'process'. Within this multiplicity the configuration of values and uncertainties can be constructive or 'useful': if climate science has technical uncertainty then political action might resolve it: or if social models are fragmented then an ecological awareness can fill the gap: and so on.

Finally, we should note that this is not a definitive or objective 'answer' on the table. Each of these domain bubbles as drawn here, is in reality a cauldron of conflict and controversy: in the economic bubble for instance, we have corruption and expropriation, global trade injustice, neo-liberal outrage and systemic vulnerability, to name but a few tensions. Our synergistic knowledge pathways need to understand such forces, find ways to work with them, and inter-connect with other domains. It seems inevitable that such knowledge will be entangled, co-opted or subverted: so we look for ways to enhance deliberation and transparency through channels for 'knowledge democracy'. It also seems inevitable that the institutions of knowledge have a huge inertia which produces the myopic / autistic approach to science, as above: so this knowledge isn't some abstract thing written in a paper, it's a hands-on process and pathway for institutional learning and renewal.

Overall, synergistic science – SCIENCE-3.0 in the language of this paper – calls for creative responses for complex inter-connected problems. For each 'societal challenge' there is an equivalent 'knowledge challenge': a synergistic knowledge model, which combines problems and responses, conflicts and controversies, uncertainties and ignorance, opportunities and risks. In this way we see scientific research producers and users in a wider community of learning, thinking and open-mind intelligence.

Visual thinking combined with rational thinking

To respond to this multiplicity of knowledge, multiple channels and media for learning, thinking, reflecting and communicating are essential. The performing and visual arts have their own traditions that connect in diverse ways to synergistic thinking, inter-personal communication and creative experience. But visual thinking, as a particular field, with its many forms (from technical mapping, to design or illustration, to visual arts), is the medium that perhaps most easily links with written text (Ravetz, J. 2011). Visual thinking brings several things to the table:

- Mobilizes tacit and felt knowledge, the unconscious mind and the numinous
- Focuses on the creative, experiential and personal level
- Helps to bridge the gap between analysis and synthesis,
  Offers a design thinking approach for complex problems

Generally, visual thinking (and/or visualization) can be a powerful enabler for new insights on complex problems (Tufte 1983: Horn, 2006). There is a more technical-analytic approach which can focus on human-computer-information interfaces (Humphry, 2008: Huang et al, 2010). In parallel there is a more experiential and creative approach, which uses the visual medium to access the unconscious, experiential and inter-subjective kinds of thinking (Nachmanovitch, 2007) Such visual thinking then points the way towards more holistic ways of 'complex adaptive thinking', which might be more responsive and flexible and better equipped than 'linear rational thinking', for the inter-connected and multi-scale challenges around us (Waltner-Toews et al, 2009). Through many diverse channels, techniques, audiences and cultural platforms, visualization can offer the following to the research task: firstly a trans-disciplinary perspective, grounded in social experience, with open and inclusive cognitive processes: and secondly a spectrum, from systems analysis and problem mapping: to experiential envisioning and creative policy design and synthesis.

This suggests a field of visual thinking possibilities with two main axes (Ravetz, J. 2011): (Figure 4)

- From analytic / mechanical (focusing on abstractions): to synthetical and holistic (focusing on figurative substance):
- From discreet / disaggregated (specific purpose) to fuzzy /embedded (general purpose or aesthetic communication).

FIGURE 5 MAPPING VISUAL THINKING

This analytic approach can be useful for mapping the possibilities. But there is an alternative approach where the visualization thinks and speaks for itself, rather than as an explanation of text. In the visual arts, there are many interpretations and levels of analysis, but the primary purpose is clearly aesthetic, affective and experiential. Likewise if we approach societal challenges as 'experiences' as much as technical problems, then a visual art approach can be more significant than rational analysis. This can be applied to process-oriented deliberation, which again is about experience, as much as technical information. For instance, 'graphic facilitation' is now established as a valuable technique in process-focused workshops, with an active training and practitioner network (http://graphicfacilitation.blogs.com/). In parallel the method of 'visual synergistics' emerged from sustainability and foresight methods, where visual material (from on or off site) can be a powerful catalyst to creative group thinking (http://urban3.net/visual-thinking/). To summarize, there are three parallel strands of visual thinking in combination with rational thinking:

- visualization IN process – i.e. used in workshop or discussion situations – visioning, consensus building, conflict mediation, strategy forming, negotiation and bargaining.
- visualization OF process - i.e. directly capturing dialogue, debate, argument and even conflict. The classic cartoon strip is one example where a dialogue can communicate a nuance of thinking and multiple meaning, which is hardly possible in any other way.

- Visualisation AS process – i.e harnessing everyday creativity, surfacing topics of public concern, giving voice and visibility to marginalised communities, co-producing research, preserving heritage.

Faced with a wicked problem, a crisis or catastrophe, as humans we need not only to 'know about it', but to 'see' it and 'feel' it. As such, visual thinking is not only about technical information on risks or responses, but a multi-level multi-channel lived experience which resonates with different parts of the human experience and psyche.

Visual experience beyond rational thinking

It's clear that the visual arts have long demonstrated to us the diversity of what it is to be human, but the yoking of the visual arts to institutional forms of research is a more recent and contested phenomenon. Here we review this landscape, and highlight one recent example which looks 'beyond the rational'.

During the twentieth century, science, the humanities and the social sciences used a variety of visual tools to augment established methodologies and communication strategies. Photographs, moving image, diagrams, drawings and graphics were all applied, sometimes sparingly, sometimes more enthusiastically, to questions of science and social science. Over the same time frame, the visual arts moved between doctrines of separation from the social, to those of being fused with critical understandings of the social and the everyday. During the latter part of the twentieth century, however, the visual arts began to be viewed differently in third tier educational contexts - as knowledge producing modes of research. In the sciences the visual arts and visual representation were recognised as reflecting the partial views of those who used them rather than neutral 'evidence'; in positivist circles this confirmed the visual as suspect and problematic; but for others the affecting, experiential and expressive qualities of the visual suggested newer sensory forms of social enquiry (see e.g. Pink 2007; Ravetz, A. 2005). In art and design meanwhile, the partial, subjective and experiential qualities of the visual were already well understood; what was new was the reframing of the arts not simply as ways of knowing, but as knowledge producing in ways comparable to the sciences.

Arguments for visual arts as research – with monikers such as artistic research; sensory anthropology, visual anthropology, arts-based research, practice-based research - come from at least two sides: from the social sciences, the benefits are presented as having to do with

- the extended reach lent by visual arts to research practices including methodological, analytical, and experiential
- the engagement and impact value of the visual arts (see for example https://www.publicengagement.ac.uk/ for case studies of projects invested in visual arts)
- the different dimensions of experience opened up by visual modes as opposed to heavily text- or language-based approaches

From the visual arts research value has to do with

- generative capacity: allowing research to be co-produced through a genuinely shared engagement in making
- valorisation of an 'anti-reductionist' research output (Lesage 2009 http://www.artandresearch.org.uk/v2n2/lesage.html)
- sensual and physical, "embodied knowledge", a felt knowledge. (Klein, 2010, https://www.researchcatalogue.net/view/15292/15293

What both sides share, despite their different starting points, is an acknowledgement of the power and necessity of incorporating sensual knowledge into the research landscape. Klein defines this as the means to "have a look from outside of a frame and simultaneously enter into it." (Ibid) A kind of liminal state in which our perception is comparably sensible and present. (Klein, 2010).

The implications of felt knowledge for social science, and of visual arts more widely, reflects the broader problems attending any kind of knowledge incommensurablity. The experiential knowledge associated with the visual arts has conventionally been eschewed by the sciences, with the visual most often limited to illustrative and communication purposes. Arguments for the inclusion of visual arts into humanities and social sciences are frequently presented in binary terms. Either visual art that intentionally goes 'beyond' or 'around' the rational is expected/asked to assimilate to scientific research, by providing quantitative measures of its efficacy, as has happened in arts for health research: or, it is judged by and within its own (rigorous, but different) standards. In some recent research by a team including Amanda Ravetz, looking into the inclusion of art and artists in AHRC funded 'connected communities' projects, a less polarised approach was established. Reporting on the different legacies of the involvement of artists in a number of co-produced research projects across a wide range of topics and situations, Escott et al (forthcoming) argued that while artists' epistemological approaches in AHRC Connected Communities research often went unrecognised by different disciplines, they nevertheless produced "subtle shifts in the [research] atmosphere or layout, [which] could then alter what happened in that space". Tracing the legacies of artists' contribution using mixed methods, the findings recognised the potential of the arts to productively unsettle or disorientate standard academic practices; to contribute to the conceptualization of research questions; to widen outcomes and the diversity of outputs, and to re-orientate and change how things were understood. (Escott et al. forthcoming),

An experiential approach was used to trace the experiential dimension of some of these legacies. 'Close up' analysis of three projects was conducted that involved 'slowing down the action', as a way of understanding the processes and practices of the artists involved. Some of these investigations revisited a past project through a new action. In the research involving Amanda Ravetz three participants (Douglas, Genever and Ravetz) became immersed in drawing while also distilling and articulating their experiential knowledge (Douglas et al 2014).

The experiment yielded a set of reflections with pertinence to 'felt knowledge', including not chasing goals or worrying if something looked like art or not, but allowing unexpected things to happen; valuing what was here and now; being able to grow something from small beginnings, rather than trying to match the experience against anything beyond itself; seeing what came to the surface – noticing what was happening; learning to be responsive to the pressure points within the drawing and social experience; not following a blueprint but responding to things as they unfolded; using a framework to hold open a space of "not knowing"; going beyond happenstance to a more refined

activity of drawing, as a way of trying to reach what might become a new kind of experience and understanding.

In summary the felt experience, in this case of drawing, put the researcher-participants in touch with a sense of becoming, rather than with something pre-formed. The approach challenged the idea that what artists should be doing when they work in communities is proposing new forms of access, technique, conviviality, or modes of data elicitation. Instead the researchers proposed that the 'community credentials' of their experiment of three (later four, when joined by interlocuteur Johan Siebers) should be judged on quality not quantity – the qualities of drawing, its immanence, its hovering between determined and indetermined states of being (ibid: 128) and the relationship between these and experiences and constitution of community. Rather than drawing encouraging participation, participation might be considered integral to drawing – a social practice that is not manufactured but given (Nancy 2013:35). Drawing then was found to be a means not of manufacturing community – the more people the better – but of becoming attuned to community as our human condition (Nancy, 1991: 22).

This experiential and qualitiative artistic investigation was developed during follow on AHRC-funded research led by Amanda Ravetz with partners PORe (Portraits of Recovery, Founder Mark Prest) and people in recovery from substance mis-use. (see https://wonderandrecovery.wordpress.com/).

"Wonderland: the art of becoming human" aimed to bring together experiences of recovery from substance misuse, with artistic research methods. The idea was to explore how the recovering person's inner landscape and journey mirrors wider utopian impulses. Lens-based self & co-authored representations of recovery were used to communicate participants' lived experiences. A further aim was the development of recovery as a social movement, with new organisational links.

The research hypothesis was that the path of recovery is inherently utopian, fuelled by a desire for change that requires constant transformative renewal. From 2010 the substance misuse agenda moved away from harm-reduction towards recovery-focused outcomes, self-empowering the recovery community to become more active and visible. Addiction is increasingly being seen as a 'feelings illness' that rarely resolves itself with the end of active using – "from time to time, self-destruction still tries to seduce me". The recovery movement espouses collective emancipatory principles – e.g. "I can't, but together we can get well" and "FEAR – face everything and recover" (rather than "f**k everything and run"). The research set out to explore this 'connective' impulse, asking: "How can an understanding of the utopian aspects of recovery experiences, in association with artistic research, contribute to mutually supportive, resilient and connected communities?"

Artist Cristina Nuñez was invited to run two, three-day intensive workshops, with ten participants in longer term recovery, and these workshops were punctuated by further peer-led meetings between the participants and the research team during which associated visual arts activities were shared. Nuñez, herself in recovery, used her honed and well-tested methodology, rooted in photographic self portraiture, with the participants. Between the two workshops she set various photographic activities for them to study alone and in supportive groups.

A film documenting the process of the research was directed by the PI (https://vimeo.com/171903022): this shows the progression of the workshops. It begins with people being instructed on how to take self portraits in a lit studio against a black backdrop focusing on a

difficult emotion, and follows through with group assessments of the images using a mixture of aesthetic and affective criteria – what is visually powerful about the images, what is affecting about the images? A similar process is then followed with participants working in pairs responding to one another through gestures, in silence. Finally a series of group portraits are set up and choreographed by each of the participants. Further activities involved assembling photographs taken by participants and photos from family albums into artist books, authored by them, later shown at the final showcase at Somerset House in London, as for example in Figure 6.

FIGURE 6: 'FELT' KNOWLEDGE

During evaluation interviews, conducted as conversations between participants, several characteristics and benefits of the project were identified, including:

- working with visual media and at times without words, allowed emotions denied verbally to be identified and expressed
- working with an artist who was 'part of the tribe' (i.e in recovery) made people feel safe, understood and able to take more risks in what they were able to achieve and gain from making the artwork
- working with an artist with a tested methodology, who was very skilled in 'unwrapping' people, helped participants to experiment photographically and emotionally
- the project left people feeling 'normal' and 'grown up' – rather 'ghettoised' and 'infantilised' (a familiar and uncomfortable state). This was put down in part to the reframing of recovery as something utopian rather than within medical or criminology discourses – the idea that illness might be a social asset rather than a deficit.
- Working with visual media allowed participants to connect to feelings, to make something of these feelings, and to re-evaluate them
- Working in a group that built trust via the sharing of visual images allowed people from different backgrounds and communities to connect, and to recognise both their differences and the things shared.

The implications of this work with visual arts for research of various kinds is about the need to allow felt aspects of knowledge to occupy their proper space without suffering over-constraint from science-based models and funding regimes. Artistic research is currently debating its place in research and the public world – should the research content of the visual arts be explained using external words and text: or is translation a denigration of the knowledge that is properly inseparable from art itself – lived experience which is partial, situated, contested but fused within the art? The Wonderland project and the research that preceded it about the legacies of artists working on a variety of AHRC Connected Communities projects suggests that both approaches should be allowed to co-exist. If a dominant language of scientific research is allowed to replace artistic epistemologies enunciated in their own forms, much of what characterises the visual arts will be lost; but the visual arts can make important contributions to other research paradigms, at times using explication and translation by necessity, without having to lose what is specific and powerful.

Conclusions

So: what are the next steps and future directions for the visually enabled, open-mind-thinking, social science multiplicity-of the future? There are global level tipping points in all directions, and the technical evidence for an existential crisis for our civilization seems overwhelming. Yet to generate any kind of response needs many foundations - political legitimacy, economic viability, behavioural change, collective responsibility, psychological resolve, and particularly, cultural resonance. Few of these are purely technical in nature or respond only to technical stimulus – rather they are socio-cultural hubs and dynamic spaces of learning, creative action, and open-mind collective intelligence. So, the role of visual thinking, and other types of media, is crucial in appreciating the problems and designing meaningful responses. As above, visual thinking is one part of a boundless landscape of opportunity, including theatre and role-play, music and opera, dance or performance: but the visual is arguably the most easily integrated to text-based material. We end with some speculations on possible future directions for the visual art-visual science relationship, taking some cues from FutureEverything (Lima, 2011)

- Big data combined with 'Internet-of-things': mashups of geo-located data, with complex user-feedback networks, with algorithmic co-creation, with new forms of remote sensing:
- Gaming approaches: the building of virtual mirror cities as in Grand Theft Auto, now enabling inter-penetration of real places with virtual characters, as in Pokemon-Go.
- Activist art approaches: combinations of visual art with political activism, with urban design and the 'science of cities', or in social innovation and grassroots 'zines': as seen in the art of Banksy in the UK, and similar in Colombia, Yemen, Mexico and elsewhere:
- Combinations of the above with new science channels, e.g. citizen science, crowd-science, AI /neural network based action-experience-research.

All this suggests new cognitive-aesthetic landscapes and frontiers, yet to emerge. Science / technology-enabled art and aesthetic experience will combine in new ways with art-enabled scientific research. Grand societal challenges such as climate change, may rely on visual arts to understand the human condition and design its potential, as much as on technical data or modelling. And looking towards a global 'cognopolis' of co-learning and co-creation, these domains could be part of a larger whole.

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(note: all links are last accessed July 2016)

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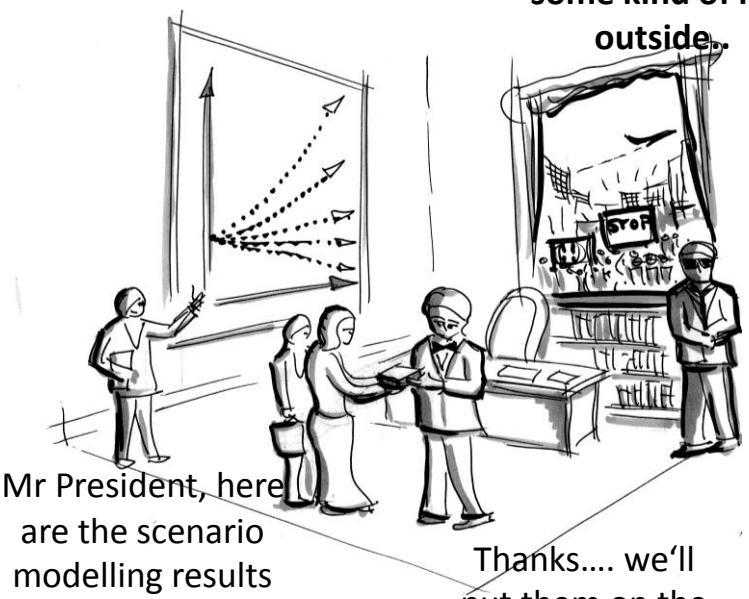
SCIENCE 3: CLIMATE

a) SYNDROMES: SCIENCE DISCONNECTED

Our research shows that economic growth as we know it will lead to the end of **civilization as we know it!!**

Sir, there **appears to be some kind of riot outside..**



Mr President, here are the scenario modelling results

Thanks…. we'll put them on the shelf...

b) SYNERGISTICS: SCIENCE CONNECTED

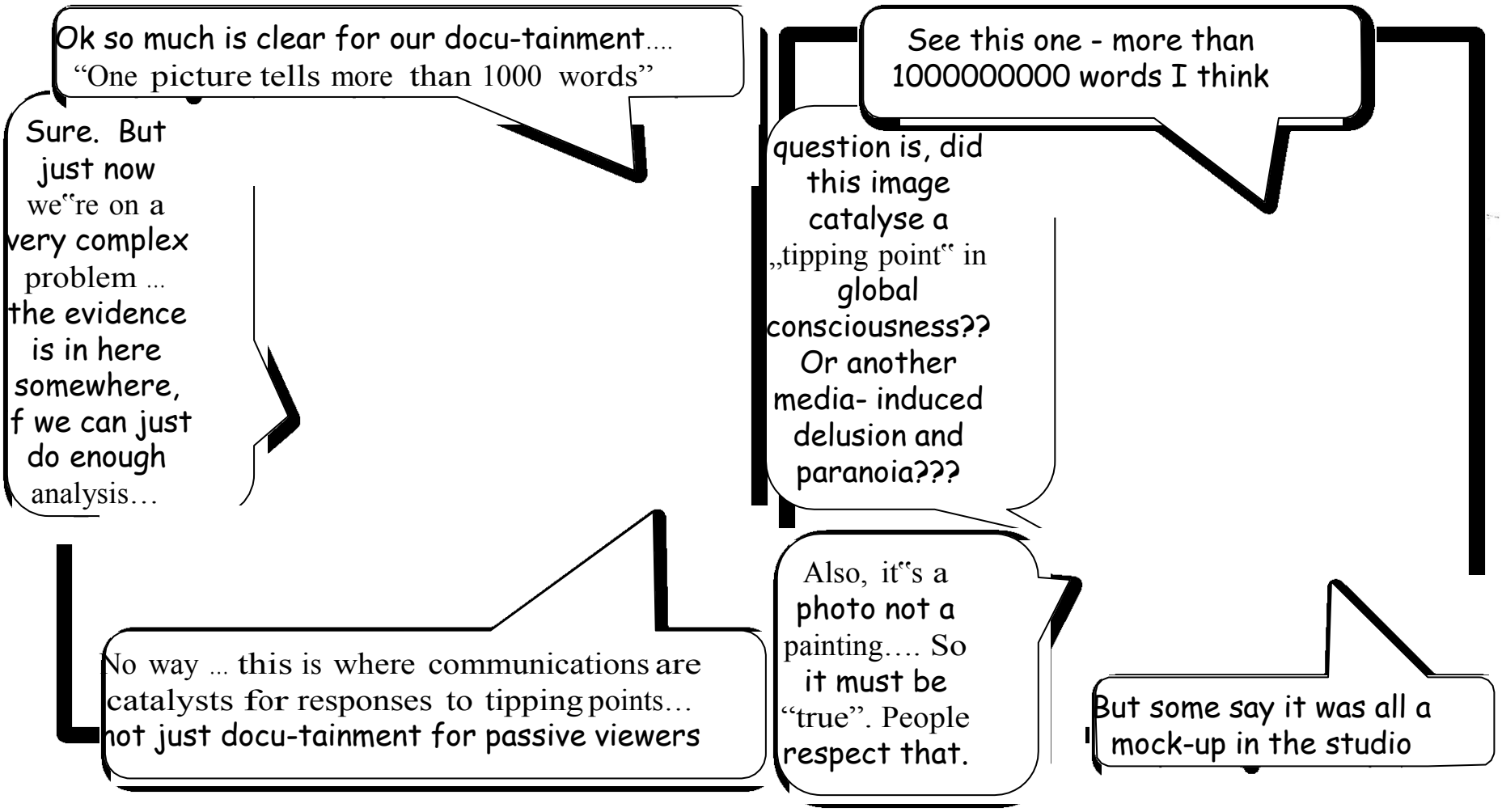
Climate is the **ultimate problem of collective action !!**

We need engineering but not as we know it!!

We need a **new climate finance** based on social justice!!!

Climate is the **archetypal** dragon on the dark mountain

Adapted from: https://urban3.net/visual-thinking/ & based on Ravetz (2013)

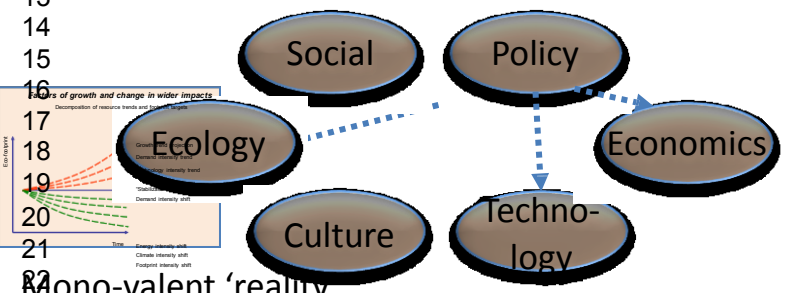


SCIENCE-3: MULTIPLE DOMAINS

(Adapted from https://urban3.net/urban-3-0-the-book/ & based on Ravetz, forthcoming)

SYNDROMES: SCIENCE-1.0 & 2.0

Research results from bio-geo-physical modelling are presented to the 'policy-makers'...

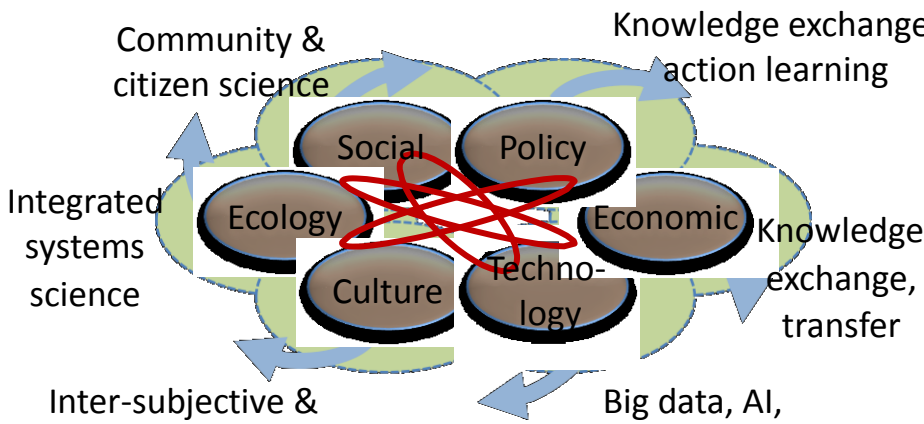


Mono-valent 'reality':
works best with technical problems, of low uncertainty & low controversy

Policy engages with business & technology

SYNYERGISTIC SCIENCE-3.0

Each domain is advancing its own agenda, but the whole is greater than the parts..



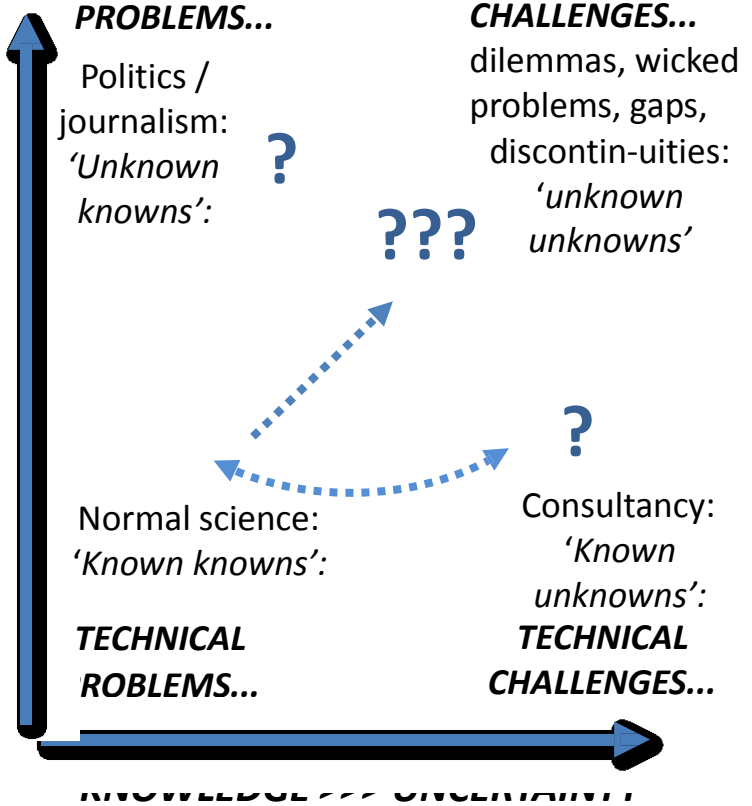
SYNERGISTIC KNOWLEDGE:
'trading zones', 'boundary objects', interfaces & inter-connectors

SYNERGISTIC LEARNING:
process of multi-valent alignment & realization

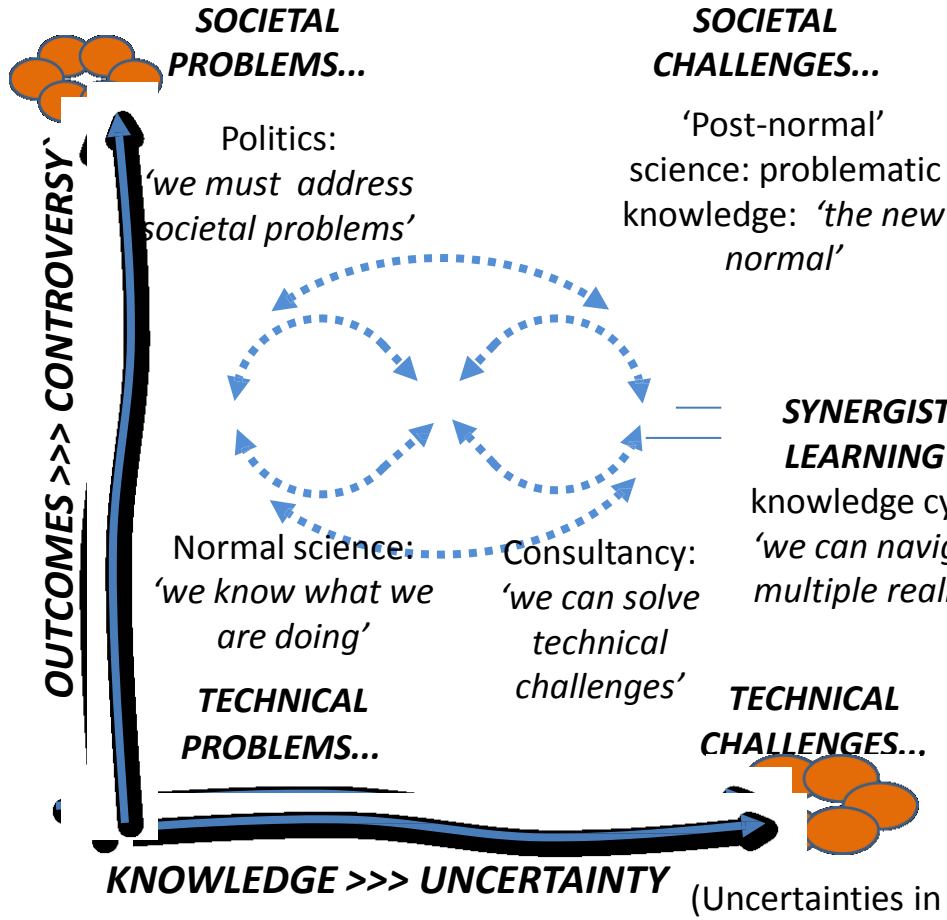
SCIENCE 3 : BEYOND POST-NORMAL

(Adapted from https://urban3.net/urban-3-0-the-book/ & based on Ravetz, forthcoming)

a) SYNDROMES: SCIENCE-1.0&2.0

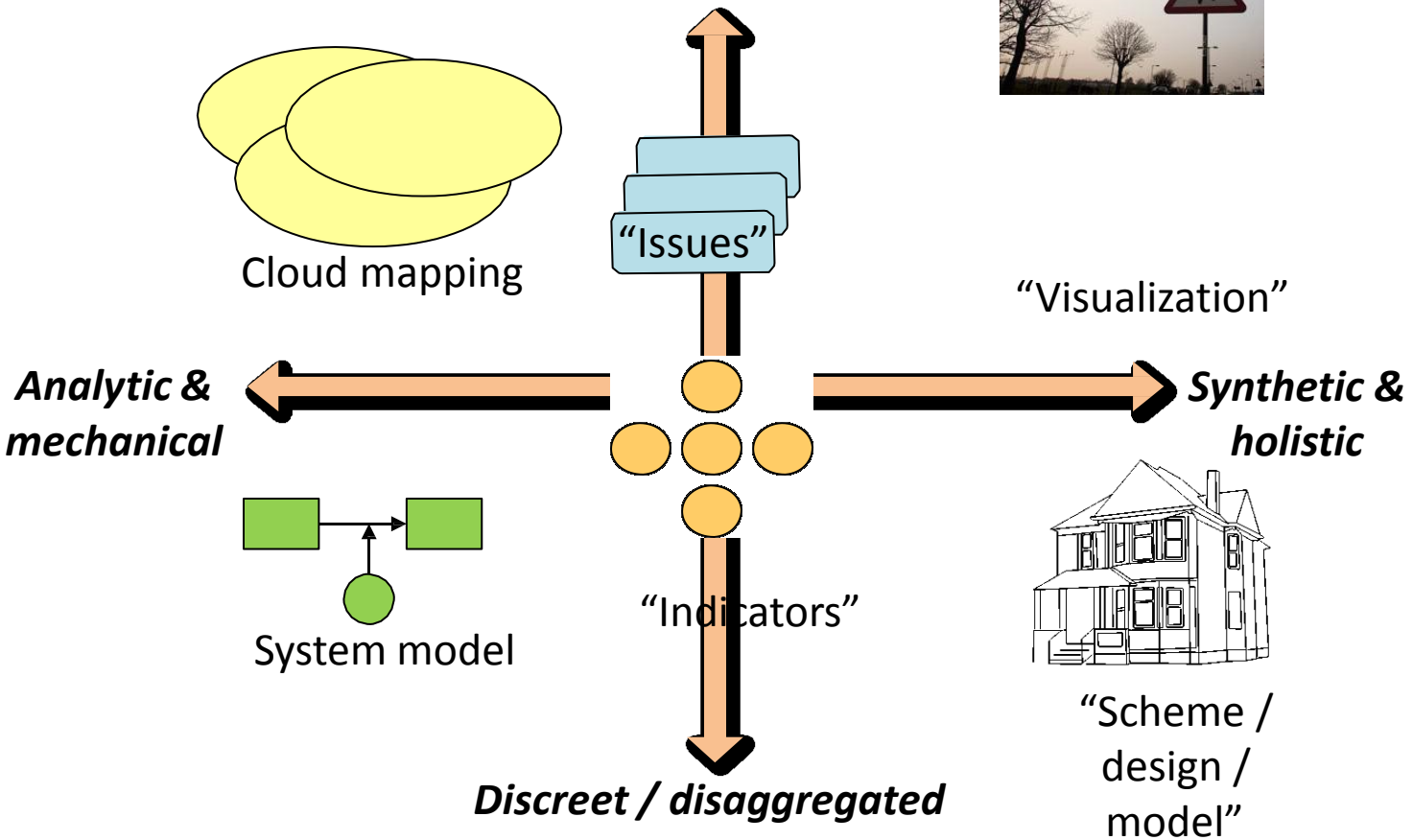


b) SYNERGISTICS: SCIENCE-3.0



Innovation: The European Journal of Social Science Research

(Adapted from Ravetz, 2013)



Photograph courtesy of Cristina Nuñez