



ATACD

A Topological Approach to Cultural Dynamics

(NEST-Path Finder Initiative)

Roadmap

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Project Description

ATACD was an interdisciplinary research network developing topological approaches to cultural dynamics. Funded under the 'New and Emerging Science and Technology' (NEST) priority of the Sixth Framework Programme (FP6), the ATACD project brought together some 20 partners from a variety of disciplines, including sociology, psychology, politics, mathematics, neuroscience, econophysics, web-based information systems, all of whom are applying topological concepts and tools in their work.

ATACD aimed to provide an infrastructure for the sharing and consolidation of topological approaches to the study of cultural dynamics across disciplines. Topological or intensive approaches to the study of culture treat change as normal and immanent rather than as exceptional and externally determined. In these approaches, cultures are defined by the possibilities they offer for change rather than by their location or essence. ATACD explored the potential to provide a set of tools and concepts to think about different levels and kinds of cultural change – learning, transmission, and innovation - as normal, relational and intensive. It developed a framework for the study of culture that is not to do with the measurement of fixed properties and their extrapolation into the future but instead enables the problematization of events in terms of the potential they offer for change. It thus offers a complex model of predictability, in which the possibility of intervention is rendered explicit. The approach is especially useful at the present time of rapid cultural change as it provides a distinctive perspective on the questions of cultural innovation.

Context

The context for the project is what the geographer Nigel Thrift (2010) describes as the transformation in the production of space associated with the birth of the information age and its new practices of organizing, analyzing, visualizing, storing and communicating information. The space now being produced is a 'movement space': a space in which movement is no longer understood as a simple displacement, but arising instead from the setting up of a surface that is itself in movement, and which is able to detect and work with the coming-into-existence as well as that-which-already-exists. This is a world of moving 'through movement moving' (Manning, 2009). It is an actualization of the space conceptualised in mathematics at the end of the nineteenth and beginning of the twentieth century in terms of topology. At this point in time topology in mathematics emerges as the study of general spaces, that is, n-dimensional surfaces of variable curvature, surfaces that are spaces in themselves. This is the topological turn whose implications are reaching a new significance as contemporary culture actualizes and operates what was previously abstraction.

Topology and topological thinking

Put perhaps too simply, this topological turn – by demonstrating the specificity of Euclidean space, establishing the more general properties of other spaces - unsettles the primacy of the mathematical relations established between algebra and geometry in the co-ordinated space of Descartes, and the associated developments in physics, engineering and the material sciences. It does not simply replace such relations with a superior rubric: post-classical or contemporary mathematics itself is not organized by the need to (re-)connect algebra and geometry, but instead by a multiplicity of sub-fields, traversed by overarching theories such as set and category theory. But the topological turn underpins transformed uses of number, calculation, and problem-solving inside and outside mathematics.

The participants in ATACD employed many understandings of topology: the notion of topology – associated with but not exclusively defined by mathematics – acted as a lure to thought. But in the project's activities there were active disagreements about the role of mathematics and physics in the development of topological thinking in relation to cultural change. On the one hand, there was a division between those who proposed that sociology – in the form of an applied social physics – will emerge as the 'new biology' in the first half of the twenty-first century, while there were others who were skeptical of the value of the use (and abuse as some might see it) of mathematical terms, and asserted the exclusive legitimacy of mathematics as the owner of this new space. Alternately, there was skepticism about the value of understanding culture in mathematical terms, and a critique of the role of number in quantifying topological spaces, or indeed in conceptualizing cultural *change* as cultural *dynamics*. Perhaps the most surprising finding of the network was that such disagreements are necessary for future research on this topic: a single, shared topological approach to the study of cultural dynamics is inappropriate and unlikely to be successful. The value of topological thinking for understanding cultural change lies in its ability to multiply the avenues it provides for future research whilst at the same putting them in relation to each other.

This finding is represented in the following diagrams that map the movement of such currents of thought in relation to each other in a space that is itself transformed in these movements.

Delicious.com - Tags related to topology and culture	Query: topology + culture Method: Query Delicious RelatedTag Scraper for topology and culture
	Digital Methods Initiative 21 March 10
Map generated by tools.digitalmethods.net	

mathematics (6) math (5) research (5) sociology (4)
 internet (4) history (4) physics (4) science (4) web(3) reference(3) education(3) technology(3) blog(3) network(3) music(3) maths(3) space(3)

Delicious.com - Tags related to topology	Query: topology Method: Query Delicious RelatedTag Scraper for topology
	Digital Methods Initiative 21 March 10
Map generated by tools.digitalmethods.net	

math (471) mathematics (309) geometry (271) network (174)
 3d(156) science(104) modeling(99) architecture(71) visualization(71) software(66) art(63) design(62) gis(61) physics(61)
 internet(56) space(53) mind(51) programming(46) graphics(45) research(45) [wikipedia_article](44) java(44) sharepoint(43) learningtheory(42)
 algebra(41) howto(40) quantumlearning(40) networking(40) bagel(39) maps(38) opensource(35) mobius(35) philosophy(34) kernelmethods(34) laplacian(34)
 geek(33) blender(32) graph(32) reinforcementlearning(29) tools(28) cs(28) algorithm(27) mapping(27) knots(27) theory(26) paper(24) map(24) surface(24) library(23)
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What follows however is a more conventional presentation of a roadmap, identifying areas of interest and concern identified in the project that warrant further research, although here too the importance of diagrams in topological thinking is indicated.

Most importantly, the ATACD network established that the actualisation of movement or topological space provides a transformed cognitive-communicational environment for the investigation and exploration of cultural change by scholars in the humanities, the social and the natural sciences.

Central to this exploration were found to be the material-semiotic practices of experimentation, mapping, simulation, and modelling, in which there is, very often, not only a movement between the quantitative and the qualitative, but also *an active, transformative relation between object or environment and method*. The operation of this relation is one of the major shifts afforded by the topological turn, and provides the basis for a new way of investigating and engaging cultural change.

One example of this new basis for investigation and exploration is the shift in neuro-scientific thinking about the brain that Catherine Malabou (2008) describes as a move from thinking about a brain-machine to a brain-world. It is a shift from thinking consciousness in terms of determination or even dialectics to becoming or being-in. As she says, the critical question for everyone, not just cognitive scientists or philosophers, becomes 'What should we do with our brain [or brain-world]?' The topological turn makes this question – 'what should we do with?' - an increasingly important mode of engaging change.

Such a shift is in part linked to changes in the ways in which problems are being posed and solved. Following the topological turn, it is no longer so much a matter of posing a problem and then finding a solution to it but of posing a problem and then exploring the space in which it has a solution. While geometry had classically been understood as the perception and organisation of a static, homogenous space that might be projected reliably into the future through the application of algebra, topology offers a way of thinking about processes of actualization in n-dimensional spaces in terms of probabilities, not certain futures.

So, for example, in relation to maps and mapping in topological space or the space of movement, the emphasis is not so much on accuracy of location in a fixed representational space, but on the precision and efficacy of the function or condition of being located – or the locative - in a moving, multi-dimensional environment. As maps take on this different role, how territory is established is transformed, at multiple scales, from the home to the nation, to the globe, as it is brought into

existence as constituted in movement, as simultaneously open and closed. Territory becomes a more flexible entity that can be temporarily held – on a permanent basis, and occupied differentially, with greater and lesser degrees of security and legitimacy. It becomes a consequence of asking ‘what should we do with?’.

More generally, the possibilities of engagement afforded by the way in which the relation between object or method and environment can be made active in topological space means that such practices are acquiring a new role in social as well as natural sciences, as the virtual is made visible for reflection, engagement or modulation as an integral part of research. One sign of this being the importance attached to design as a process or method in disciplines such as sociology, urban planning, artificial intelligence, biology and architecture. Here the role of devices, the process of devising and thinking with diagrams is apparent, with the implication, perhaps, that diagrams of thought should themselves be subject to further study and analysis.

In these design or device practices of engagement, changed understandings of the empirical and of knowledge as performative are being developed. There is a new emphasis on operationalising knowledge beyond the merely instrumental, and on criteria of scale, precision, translation, efficacy and relations to multiple users or points of view rather than validity, accuracy or objectivity. Knowledge is brought into new relations with publics, politics and the economy. That the practices in which a relation between object or environment and method is made active are typically deployed more to the production of new realities than to the representation or interpretation of existing ones makes a better understanding of their operation even more important.

Finally, it is worth noting that there is an irredeemable localism and dynamism in topological thought, not only in relation to disciplinary objects of study, but also in terms of methods. The topological turn implies no synthesis of thought across disciplines in the study of cultural change or shared methods. The topological generalization of space is a movement in thought, a process of abstraction most definitely but also a process of translation, a movement of thought across and within disciplines.

Some comments and recommendations for the use of topological approaches for the study of cultural dynamics

1. A single topological approach to cultural dynamics is inappropriate and unlikely to be illuminating. The value of topological thinking for understanding cultural change lies in its ability to multiply the avenues it provides for future research whilst at the same putting them in relation to each other. This second point is likely harder to support than the first, but the two are equally important.

2. The opening up of a topological space of representation has facilitated the development and use of research devices in which the relation between object or environment and method becomes active. The exploration of the modes of action made possible by the manipulation of this relation is central to understanding and making cultural change.

To illustrate how these points might be taken forward in concrete programmes of study, an example is given here: numbering as a device for the study of cultural dynamics.

One of the key implications of topological thinking as outlined above is that *the transformed role of numbers and numbering must be a key focus of future study*.

An example of an approach that acknowledges the topological turn outlined above involves considering *numbers as signs* that have agency. This is an approach that does not isolate numbering from culture or society and sees numbers and numbering not as operating on society from outside, but as part of culture. This approach makes visible that the workings of numbers are deeply embedded in and constitutive of the world—that they lubricate its happening: it proposes that by expressing distinctions such as same/different, relations of more or less than, and proportion or ratio, numbers partially configure the on-going emergence of our worlds.

There are two aspects to the capacities of numbers that are of central importance here. The first is that numbers engage in ordering, in making sequences and series; the second is that numbers represent order in a specific way—as value, such as, for example, putting the category values of size or distance or weight on an ordering, thus enabling measurements of bigger or smaller, nearer or further, heavier or lighter. As the anthropologist Helen Verran puts it, ‘Numbers are engaged in ordering, and in representing order as value’.

Importantly, though, the dual capacity of number – to order and to value - is very often conflated in everyday and classical scientific and mathematical uses of number, in which both order and value are given by a fixed measure, a metric, or unit of magnitude, that is applied independently of any particular situation or space. In such universalizing uses, numbers are able to function as unremarkable but powerful symbols, apparently external markers of order and value in ‘one’. As Alain Badiou puts it, ‘What counts – in the sense of what is valued – is that which is counted’. The ordering of number and the category numbered are thus conventionally treated in a universalized Euclidean space as one and the same.

Importantly, however, what emerged from the mathematical study of topological spaces is that such spaces are in fact more general than those that had been accepted as the universalizable Euclidean space. As a consequence, topological mathematics is able to explore the dynamic properties of mathematical and other objects that remain invariant in Euclidean space. There is no external metric in such topological analysis, instead space and its objects are analysed through variability. In the spaces of topological thinking, then, the capacities of number to order and value may be brought together without reference to an external measure, but rather by - or in – relations: that is, the performative capacities of number to order and to value are combined in relations that are part of the spaces they produce, that is, surfaces that are spaces in themselves.

The multiplicity of mappings of order in conjunction with categories of value thus opens up new ways in which the 'quantitative' techniques can address the 'qualitative' dimensions of natural, social and cultural life. This is what Deleuze, for example, acknowledges when he uses the term quantitative intensities. He is referring to the use of number in relation to the properties of a surface that is a space in itself, that is a space in which there is no external measure. Properties such as continuity, connectedness, compactness and density, for example, are all measures of position and relationality rather than of externality.

The more general point emerging here however is that numbers no longer just describe but are increasingly able to construct and take on virtual properties, building more and more general (but not universal) spaces of calculation. At the same time the use of such spaces for simulation and the mapping of the performativity of systems that are constituted in variability has become increasingly common in the experimental processes of architecture, design, urban planning, geography, economics, biology, chemistry and physics, amongst other disciplines.

In short, number and numbering are not only involved in understanding cultural dynamics across the disciplines, but in making it. As a consequence it becomes important to consider not only the transformed role of quantitative analyses in the study of culture but also to study cultures of quantification.

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