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Connective Cognition: Transdisciplinarity in a Precarious World

Abstract
This paper argues that the contemporary complexity of global challenges requires “connective cognition”, joined-up approaches to knowledge and innovation. These trans-disciplinary knowledge systems afford insights into complex challenges and offer prospects for remedying measures which are distilled from multiple knowledge fields and multiple locales, yielding hybrid and transcendent ways of apprehending the world. This cross-boundary collaboration enables forms of societal learning which are essentially connective and which will constitute the cognitive patterns and platforms of the future. This knowledge generation needs to be the subject of study in its own right because it is far from straightforward.

Résumé
Die gegenwärtigen Komplexitäten globaler Herausforderungen im Hinblick auf Wissensproduktion und Innovation benötigen „connective cognition“ (vernetztes Denken). Diese Wissenssysteme sind transdiziplinär sind ermöglichen Einsichten in komplexe Herausforderungen und bieten somit Lösungsansätze die sich aus verschiedenen Wissensgebieten und Erkenntnisräumen speisen, hybride und transzendierende Sichtweisen auf die Welt. Dies Wissen resultiert aus grenzüberschreitenden Kollaborationen ermöglicht neue Formen sozialen Lernens und konstituiert die institutionsübergreifenden Erkenntnisräume und Praktiken der Zukunft. Diese Form des Erkenntnisgewinns ist komplex und von daher ein Studienobjekt in sich selbst.

Références électroniques

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Connective Cognition: Transdisciplinarity in a Precarious World

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This paper addresses two foundational and interlinked questions with regard to how we address the complex challenges confronting global society and its evident vulnerabilities: *what are the forms of knowledge required to shape our collective social futures, and how are they to be generated?* In particular, how should universities gear their activities to enable these knowledge forms, and concomitantly position themselves in relation to their social partners? This problematic is addressed from a Southern African perspective, and possible approaches to the matter are illustrated by means of two indicative case studies. An argument is developed that universities need to reconsider how they provide for the 'third mission' of academia, and that this implies reconfiguring how they engage with the needs of wider society.

We must start with an acknowledgement that the kinds of problems confronting societies in the contemporary era have escalated in their implications, and their impact. The size of human populations and their inequities of many kinds are unprecedented: inequities of wealth, of technologies, of susceptibility to disease, of ways of seeing the world, are just a few. This size of human population, its increased concentration in urban areas, and the inherent instabilities generated within and between societies by inequitable distributions, combine with the ubiquity of current global connectivity to produce a world vulnerable to disruption and contagion of all kinds. Some we can predict already; others will take us by surprise. Human populations both give rise to global shocks, and are deeply susceptible to the effects of these, whether these are crises of aggression, economy, climate, environment or health (often a potent compendium of several).

Complex phenomena of this kind resist containment, and can have entailments that lie beyond the capabilities available even to governments with relatively sophisticated regulative powers. For example, the speed and elusiveness with which militant insurgencies arise and assert themselves in various parts of the globe test the mettle of many national governments simultaneously, and we know that the resolution of these turns are unlikely to be found in military action but in much deeper currents of global society. The 2014 outbreak of the Ebola disease in West Africa was a powerful example of how concerted action across multiple agencies in many countries was required to contain a threat that could easily have devastated far wider swathes of human society than it actually did. It signals a paradigm of how complex knowledge-forms (of virology, epidemiology, social psychology, international law, media studies, etc.) needed to converge and be marshalled across wide regions of the planet in a crisis-charged scramble to halt the contagion. This was possible because our susceptibility to previous epidemics had resulted in deep and sustained investments in a wide range of the health sciences, collaborative networks across national boundaries, and (it must be said) the application of pretty ruthless profiling measures at national borders.

The argument of this paper is that the contemporary complexity of global challenges requires 'connective cognition' or joined-up approaches to knowledge and innovation. These are connective knowledge systems, which are not only trans-disciplinary in nature (i.e. multi-disciplinary knowledge applied to real problems, often in partnership with practitioners) but also requiring collaboration across different organisations (e.g. universities, government agencies, private sector organisations, civil society bodies, etc.). Powerful knowledge (that affords insight into complex challenges, and offers prospects for solutions) is distilled from multiple knowledge fields, and multiple locales, affording hybrid and transcendent ways of understanding the world. This is knowledge that arises from cognitive networks, enabling forms of distributed societal learning that are essentially *connective* in nature. Seen in this way, these networks, and the synthesized knowledge distilled from them, will constitute the cognitive patterns and platforms of the future, taking shape within and across institutional contexts. This, I argue, should be one of the contemporary and future forms of

'transdisciplinarity'—or the way in which the knowledge and methods arising from disciplines within the traditional academy address these problems with practitioners in wider society, giving rise to reciprocal flows and exchanges, and unique configurations of knowledge.

Given this, the mechanics of this kind of knowledge generation, including its boundary-spanning exchange between participating agents, and its translation into innovative technologies, require close analysis, and—as this paper will argue—need to be the subject of study and innovation in their own right, because they are far from straightforward.

An early implication is the relationship between universities (as traditional—but no longer exclusive—sites of knowledge production) and the contexts in which they are embedded. More often than not, these are urban contexts, and urbanism is quickly becoming the predominant societal formation on the planet, even if cities vary dramatically in their configuration and function globally. With a steadily increasing proportion of the Earth's human population being clustered in cities, it is here that our success and failure in establishing sustainable and resilient patterns of livelihood will be most evident. Importantly, contemporary insights into how we achieve innovation in social and economic practices (understood in their full complexity, rather than in any narrower technical sense) places emphasis on collaborative processes of learning that occur between multiple actors, often situated in spatial proximity with each other, accumulating over time and achieving a nuanced and complex character that reflects the particularities of the spatial context. As Capellin[1] has illustrated, this distributed (but spatially defined) 'cognitive capacity' is assembled in a 'learning region' and enables an evolution of learning that is "not the result of individual efforts … but rather the combination of complementary capacities and of widespread interactive learning processes." (This underlines the *emergent* and *situated* character of nuanced, robust knowledge that informs changes in how we do things. This is knowledge that is assembled in time and space and takes on a character that enables problem-solving in a particular context, including dealing with the distinctive socio-political or other conditions that enable or prevent change in that context. As Roberta Capello[2] has noted, the capacity for collective learning and innovation is conditioned by both cognitive proximity and geographic proximity, and (to use Bourdieu's terms) it is how intellectual capital is mobilised together with social and cultural capital that enables conscious change to be realised in complex milieux.

There is a wide scale of variation in the orientation of university knowledge fields: either strongly preoccupied with theory and remote from the practical world of application at one end, or intensely focused on practical applications in the contemporary world at the other extreme, with both extremes possibly (even necessarily) represented in one institution. Some disciplines and knowledge fields are correctly abstracted from the ebb and flow of wider society, and these insulations should be sustained because these sites of non-utilitarian thought are investments in the long-term knowledge project, beyond the horizon of what we can conceive today. Other fields of study, however, are profoundly interested in the predicaments of the present, but often situated within institutional and structural constraints that limit their activity and reach. The inadvertent effect of institutional boundaries, of shrinking public revenues, or the more conscious effects of short-termist funding or the audit culture, all work to limit the possibilities of even outward-looking applied knowledge fields. At quite a practical level, well-intentioned approaches to universities from interested parties (often from government or industry) seeking strong knowledge partners are often predicated on a misunderstanding of what it takes to generate high-quality solutions-oriented knowledge that makes a difference in the context of application. The assumptions may be that this kind of knowledge can be generated rapidly (even that it may even pre-exist), or that university scholars can conjure it up alone. It is this enduring misconception of the quality and provenance of transdisciplinary knowledge that

1 R. Capellin, "Territorial Knowledge Management: Towards a Metrics of the Cognitive Dimensions of Agglomeration Economies," *International Journal of Technology Management* 26 2/4 (2003), p. 303-325.

2 Roberta Capello, "Science-Based Activities in European Regions: the Knowledge-Innovation Nexus," *Universities, Cities and Regions: Loci for Knowledge and Innovation Creation*, ed. Roberta Capello, Agnieszka Olechnicka and Grzegorz Gorzelak, London, Routledge, 2013, p. 13-42.

underlies the continuing structural failure to provide for the kind of cognition that is needed to shape innovative societal futures. This form of knowledge requires insight that is deeply systemic in nature, understanding both the complexity of the social world and the particularities of context, in ways that enable us to intervene in dysfunctional social, economic or natural systems to achieve more sustainable or resilient patterns.

Boundary-spanning cognition

In short, how do we create the conditions for sustained, multi-agent collective cognition that lies at the core of transdisciplinarity? Why is the widely-recognised boundary-spanning problem so prevalent and so persistent? Firstly, a word about *boundaries*, lest they be unfairly demonised. Organisations (whether of the academy, or government, or industry or civil society) are essentially constituted through boundaries that distinguish one set of purposes and codified practices from another. Boundaries and their codes enable the specialised practices that lie at the heart of societal division of labour, the resultant technologies, and the consequent elaboration of complex societies. Boundaries are therefore powerfully constitutive. However, boundaries—with their enabling and limiting characters, need carefully to be considered for what they afford (contextual specificity and functionality) and what they limit (porousness). Strong boundaries and strong codes tend to be geared to reproduce sustained patterns of performance—the deepening of specialised regimes—rather than to producing innovative responses that are sensitive to change. Boundaries are geared to preserve the coherence (or the 'purity', to use Mary Douglas's term) of the category within.

However, as Lamont and Molnar[3] remind us, boundaries also inherently enable distinctions that can be employed for deliberate hybridity and 'creolisation', or that invite transgression and liminality, and that it is the interstitial zones that give birth to new categories, fresh ways of seeing, alternative modes of being. However, although seen as eminently desirable, successful collaboration across the boundaries of knowledge fields and institutions has long been observed as rare and elusive. Scholars (like Martin Trow)[4] of academic efforts to achieve interdisciplinarity have noted that there are deep theoretical and methodological differences that must be negotiated, and that these are often compounded by the inevitable competition for resources and conflicts of interest. Building transdisciplinary knowledge is even more exacting, working both across knowledge fields and between the academy and contexts of application, and requires (as Harry Smith and Paul Jenkins[5] have shown) "context-specific ongoing negotiation of knowledge (as) a key part of its methodological approach (and) … constant dialogue between researchers and practitioners, leading to joint production of new knowledge."

It is clear, then, that sustained boundary crossing is inherently expensive in terms of time, intellectual and emotional labour, and financial resources. This applies also to contexts where cross-institutional collaboration might be strongly mandated by policy injunctions. In the 2012 review of South Africa's national system of innovation (NSI—a multi-institutional strategy intended to advance development priorities), the review report[6] found that, fifteen years after its inauguration, and in spite of repeated reviews, the NSI still remained "highly fragmented" with the "persistence of insulated

3 Michèle Lamont and Virág Molnar, "The Study of Boundaries in the Social Sciences," *Annual Review of Sociology* 28 (2002), p. 167-195.

4 Martin Trow, "Interdisciplinary Studies as a Counterculture: Problems of Birth, Growth and Survival," *Issues in Integrative Studies* 4 (1984), p. 1-15.

5 Harry Smith and Paul Jenkins, "Trans-disciplinary Research and Strategic Urban Expansion Planning in a Context of Weak Institutional Capacity: Case Study of Huambo, Angola," *Habitat International* 46 (2015), p. 244-251.

silos" leading to "only very limited horizontal and vertical coherence and integration of purpose and effort between the various agencies". Significantly, the report went on to observe the following:

> Cross-sectoral, and even cross-departmental collaboration require particular forms of expertise located internally in the organisation. Individuals positioned at the interface of collaborating organisations need to be able to manage cross-boundary interactions through, firstly, having the intellectual tools to overcome parochial specialisms and to see the potential of collaboration and hybridity. Secondly, they need the skills of facilitation to manage interfaces and integration, since successful collaboration depends on the consistent application of social, intellectual and managerial skills.

We thus need to consider what it takes to transcend, or commute between, these boundaries and to engineer the translation devices that enable this hybridity of knowledge and the emergence of innovation. How can this latent capacity of bounded scholarly realms be released and directed towards the pressing issues of the era? In particular (for the purposes of this paper), how should universities collaborate with city partners to address complex issues? Two brief case studies are provided here, taken from a Southern African context and, while not offering exemplary models, nevertheless provide ideal-typical contrasts and instructive insights into how the boundary-spanning conundrum might be understood and approached in the future.

Case Study #1: The Street-Trading Project

Outline

The metropolitan Administration of a large city in Southern Africa realises that the extensive informal economy operating in the inner-city area has taken on a character and set of dynamics that challenge the City's current regulatory measures, and the office of the City Executive provides a local university with funds for a study on possible alternative approaches to the matter. The university (in a fashion virtually unprecedented in its own history) galvanises a multi-disciplinary grouping from multiple faculties in a concerted initiative to address the problematic. Because of strong pre-existing reservoirs of research insight into these issues, and existing networks of trust with the street-trading communities concerned, the grouping of academics is able relatively quickly to produce a detailed study and penetrating analysis of the situation, as a platform for informing future policy approaches.

It quickly becomes apparent, however, that the far-sighted intentions of the City Executive's office are not necessarily shared lower down in the City administration, and various departments associated with the oversight of the informal economy still need effectively to be recruited into participating openly in the initiative.

Considerations

A new but promising relationship of trust had been forged over two years between the executive levels of the City and the university, enabling the agreement that the study should be undertaken of a domain under the aegis of the City. Within the university, there was sufficient convening power to draw academics from multiple disciplines into the project, persuading them to make time to participate, in spite of existing heavy loads of teaching and other existing research commitments.

6 Department of Science and Technology, *Ministerial Review Report on the Science, Technology and Innovation Landscape*, Pretoria, 2012, p. 11, 13, 103.

Significantly this group of academics was co-ordinated by a project manager, an extremely-well situated and experienced practitioner recruited from outside the university for this purpose. The academics, especially those from the field of Urban Planning, but others too, had long been committed to working at community-level, including with the large populations of migrants who have settled in the City, and with street traders and their associations. It was this existing knowledge base, and networks of trusted relationships across the relevant communities, which enabled the academics to undertake the study and deliver the results promptly and with a high level of detailed insight.

The executive-level personnel in the City were far-sighted and principled in the commissioning of the study, requesting a design for the study that would reflect the complexity of the situation, including the significant economic contributions of migrant traders, as well as the social conflicts surrounding their presence. The City administration, of course, (like the university) confronts the similar challenge of achieving internal cross-departmental coherence in a context where divergent views on the matter may exist, especially between the interests of the political leadership on the one hand and the wider public service bureaucracy of the City on the other. At the time that this study was undertaken, it was clear that this internal coherence was elusive, and threatened the further progress of the initiative.

Insights

Some of the conditions for an initiative that approaches a limited form of 'transdisciplinarity' are apparent here, in that:

- There was an existing nuanced knowledge base around community-level livelihoods, informal trading, and the role of migrant communities, developed by a number of university academics and civil society practitioners working in conjunction with the street-trader communities. There was, in other words, a pre-existing set of cognitive exchanges and accumulated insight that was *situated in the networks* that had been established over time across university, community and civil society organisations and which constituted a continually emergent *'cognitive reservoir'*.

- Agents associated with the initiative were able to exert a degree of *brokerage*—both externally across the boundaries that mark the distinctions between the university and the City administration, and internally within the departments that constitute the university itself. Importantly, the growth of both the internal and external levels of commitment to the initiative was driven by a *strong shared purpose* among the various participants, which was a common desire to provide strengthened and more dependable livelihoods for vulnerable communities, an aspiration located within larger social justice discourses in South Africa. Although participants may affiliate themselves with slightly different dimensions of this mobilising logic, its *transcendent appeal* enabled participants to make commitments beyond their existing respective professional entailments to a boundary-spanning alliance that promised a productive outcome.

- For a fuller transdisciplinary project to have unfolded, the collective City Administration itself would need to be a widely-invested partner in the study (i.e. at levels beyond that of the Executive), participating by offering insight into strategic intentions, current practices, past histories, constraints and opportunities, etc. This was certainly provided at Executive level, but less so from the operational arms of the administration, whose divergent interests may have perceived risk in the exercise. In other words, while the City's *external* brokerage (with the university) was adequate to initiate the project, its *internal* brokerage was still working to achieve the coherence required for a fully partnered approach to the study. So although there was a strong relationship of trust between the academic, civil society and street-trader constituencies (and thus effective reciprocal exchange of knowledge), this network of trust and cognitive exchange did not extend effectively to the street-level bureaucrats.

• The channel of brokerage between City and university, although promising, was still at an early stage and somewhat attenuated, and thus insufficiently interactive to enable steady continuity in the progress of the initiative. Strong goodwill and mutual trust remains intact at the executive level, but the exchange of reflective dialogue at this level, with remedial interventions where needed, is infrequent and does not serve to respond nimbly to difficulties that are encountered. In other words, the executive-level *architecture of exchange* between the two institutions was not yet sufficient to sustain the original mobilising logic of a multi-disciplinary, multi-stakeholder initiative with its associated entailments.

In summary, we note the salience of several key features in this case study:

1°) *A powerful mobilising logic of sufficient connective appeal to recruit various parties into a boundary-spanning initiative.* We note, though, the need for this *mobilising logic* to have sustained regulative appeal in order to hold participants within the initiative whenever it inevitably encounters difficult moments. This mobilising logic, therefore, is itself a complex entity, constituted not only by 1) a vision of an aspirational future, often normatively inflected shared social purposes, but also with elements that speak to 2) a social solidarity based on established trust, 3) procedures for addressing problems, disagreements and adversity, and (very importantly) 4) a shared capacity to learn and re-frame the initiative in the light of new insights. In view of the complex nature of this connective ideation, I would like to borrow Basil Bernstein's term and call the discursive resources that knit transdisciplinary initiatives together, and which need to be resilient across time, *regulative discourse*. As we have seen above, the regulative discourse in this case study was powerful enough to inaugurate the initiative, but has yet to prove resilient to sustain it in the longer run, required as it is to keep all the necessary participants included in the game until a satisfactory conclusion is the outcome. As I have shown elsewhere,[7] the maintenance of a sufficiently resilient commonality of purpose across changing conditionalities can be elusive .

2°) *A situated, boundary-spanning cognitive community (i.e. between university academics and community-level street traders), characterised by existing knowledge flows across established networks of trust.* This cognitive community, however, does not sufficiently include some quarters of the City administration in ways that would enable more inclusive efforts to address the problematic. To propose models for regulating street trading without the inclusion of a key implementing agent is likely to be a fruitless endeavour, and compromises any sense of a satisfying instance of transdisciplinarity.

Case Study #2: The City-Region Project

Outline

A recently-established City-region Authority realises that it requires dedicated and credible information if it is to oversee and direct the fortunes of a widely-dispersed urbanised region, constituted by a number of cities and municipalities that have effectively become interconnected and which operate increasingly as a single economic and social entity. In a formal partnership with two universities in the region, the City-region Administration provides the funding for a regional observatory committed to providing consolidated information about the dynamics and trends in the region, as well as policy advice on particular regulatory matters. The observatory is established by the two universities as a research centre, and appoints skilled staff appropriate for the purposes of the

7 Rob Moore, **"**From Concord to Conflict: a Conceptual Analysis of a Partnership for Social Innovation," *The Business of Social and Environmental Innovation: New Frontiers in Africa*, ed. V. Bitzer, R. Hamann, M. Hall and E. W. Griffin-EL, London, Springer and U of Cape Town P, 2015, p. 149-162.

project. The observatory is understood to be a long-term project, serving the purposes of the City-region Administration and the city-region more widely, but sufficiently independent of the City-region Administration for its data and recommendations to be trusted as independent, credible and politically uncontaminated. The observatory is governed by a Board constituted by senior figures from all three partners, but with the universities alternating as Chair of the Board.

Considerations

Detailed and extended discussions are held between the three partners over the constitution of the observatory, with particular emphasis on questions of, on the one hand, the academic autonomy of the observatory and its freedom to publish its insights as it sees fit and, on the other hand, the levels of confidentiality the City-region administration would require as a necessary part of its regulatory processes. An accommodation is reached, satisfying both parties, in which most material can be made public after a short period of confidentiality.

The Observatory becomes staffed with skilled individuals who, between them, combine disciplinary expertise from urban planning, political science, urban geography, economics, development, sociology, GIS and geoinformatics, among others. The research agenda for the unit is established and agreed with the Board, and consists of series of long-term thematic directions, addressing key dimensions of future of the city-region, including governance, economy, livelihoods, mobility and sustainability. Key baseline studies are carried out, and a series of regular surveys are instituted, intended to develop a longitudinal view of the trajectory of the city-region measured against a set of key socio-economic indicators.

Extended discussions have centred on the degree to which the observatory could be responsive to short-term requirements from the City-region administration, as opposed to being dedicated to the longer-term thematic research projects. Again, largely through Board-level negotiations and pragmatic accommodations between government and observatory management, an on-going balance is achieved.

At the time of writing, this project has strengthened its staff complement and output over six years, with a diversifying range of outputs provided specifically to the City-region administration, but also an increasingly wide range of public communications issued regularly, and its data-base resources made freely available to researchers and public alike. In recent years, the project manages consistently to win approval from both political and academic quarters, and continued resourcing seems secure, growing from both the original and new sources.

Insights

Some of the conditions characteristic of a transdisciplinary initiative could include:

- The conditions existed for successful inaugural brokerage across the respective institutional boundaries, in the form of relations of trust between key players who conceptualised the observatory and then gave effect to its establishment. This degree of trust then persisted at Board level, in spite of significant challenges encountered along the way, and potential obstacles have on a number of occasions been circumnavigated (often through informal engagement between Board members). The sense of common purpose remains intact, and operational difficulties are overcome. To use the term invoked in the first case study, the *regulative discourse* operating in this context has so far proved resilient.

- The personnel of the observatory has included individuals who could be described as ‘cognitive connectives’, or individuals whose intellectual backgrounds entailed a view across multiple fields of study, or whose work experience included city administration, civil society or university workplaces. In one way or another, these were individuals who were already known

to the respective stakeholders in the partnership, or were recognised as good-faith participants in post-apartheid reconstruction. Without sacrificing the implication of independence or autonomy, these were individuals with the intellectual background and maturity to be trusted with a politically and academically sensitive project. Moreover, they brought with them their respective networks that reached into political circles, offices of the city administration, civil society organisations and university departments. The observatory became a nodal point for networks of cognitive exchange that could underpin or contribute to the more formal research programmes of the initiative. A wider grouping of specialists is associated with the project as an advisory structure, and the project recruits additional specialist research contributions as required. As time has passed, the staff complement of the project has expanded to better address the research themes and the public information commitments.

In conclusion, key insights for transdisciplinary initiatives more generally would include:

1°) *A seemingly resilient regulative discourse is encoded in a set of framing arrangements for the initiative, and the maintenance and review of the project is entrusted to a formal governing structure* (the observatory Board) that meets periodically, both formally and informally, when necessary. Relationships between key Board members are sufficiently trusting for informal avenues of problem-solving to precede formal Board ratification.

2°) *A cognitive community of specialists, conversant with the intellectual terrains required for urban studies, is gathered in a purpose-designed organisational vehicle, tasked with driving long-term research programmes.* The dedicated investment of specialist expertise, pursuing the themes consistently over time, enables wide and nuanced knowledge to be accumulated about the region. This knowledge, as well as the growing reputation of the project and its network of partners and advisors, enable it to provide both well-informed short-term responses to quick-turn-around demands from the City-region Administration as well as deeply-nuanced insights and policy advice derived from multi-dimensional longitudinal research.

Put differently, the boundary-spanning problematic of the first case study had implications for both *external brokerage* (across the various stakeholders) and *internal brokerage* (especially across internal divisions within the institutions—university and city), and the case study illustrated where brokerage seemed strong and where it faltered. In the second case study, the *inaugurating* external brokerage gives rise to a structured and codified vehicle for *ongoing* brokerage—the observatory Board—which provides a compelling platform for periodic review and maintenance of the connective discourse. The Board, over time, acquires a repertoire of procedures, formal and informal, for resolving disputes and difficulties, and promises a measure of stability and predictability for the partnership. While in the first case study, the tensions between the political leadership and the public service bureaucracy in the City Administration played a significant role in interrupting the initiative, in the second case study the formal structure and long-term establishment of the regional observatory means that any such internal tensions within the city region administration are less likely to disrupt the systematic work programmes of the project. Whereas in the first case study, the horizontal compact between the partner institutions could be degraded or ended simply by neglect from one party, in the second case study, such neglect would come to the attention of the governance systems of the respective institutions, with attendant issues of accountability.

The internal brokerage problem of the first case study is resolved in the second case study by constituting a dedicated structure with purpose-recruited expert personnel. The resources of the unit can provide undivided attention to the project, without having to counter the ‘gravitational pull’ of home structures that participants in the first case study needed to contend with (i.e. their existing academic commitments and accountabilities). Relations with collaborators beyond the observatory structure can now be regulated by contract, rather than only the normative pull of the original mobilising logic.

As noted earlier, these case studies are deliberately contrastive and serve to illustrate a number of considerations related to how transdisciplinarity might be considered and approached into the future. I shall deal with these in turn.

Connective cognition

To begin, how do we understand the boundaries that needed to be overcome for the collaboration achieved in the Street Traders case study? It is because institutions like universities on the one hand, and city administrations on the other hand are constituted for quite distinct societal purposes—the one is predicated on the production and distribution of knowledge and learning, the other must fulfil a regulative function across multiple spheres of society. As such, each has divergent normative frameworks and performative priorities governing everyday behaviour; they have differing governance systems and differing decision-making rhythms. Individuals socialised into these respective institutions take on particular identity inflections (*habitus*, in Bourdieu's terms), which come in time subtly to distinguish them from each other. The brokerage task entailed in agreeing on a shared project must include calculations on both sides about how the priorities and rhythms of the respective institutions must continue to be served while this *designedly disruptive* exercise is inserted into their respective patterns of institutional life. In the case of the university, academics had to be gathered together, to be persuaded that a transcendent mission was at hand, sufficiently compelling for individuals to consider adjusting existing full teaching and research commitments and accommodating a new, unplanned demand within already-pressured lives. The university was fortunate to be able to recruit a highly-skilled project director in the form of a professional practitioner already intimately associated with the questions at hand, who was able immediately to take on the full-time central role of co-ordinating the part-time contributions of senior experienced academics from varying fields of study. Money had immediately been made available by the City Authority for the task, and so the time of all participants was readily contracted.

In other words, relatively unique conditions existed within the university for a nimble, quick-turn-around assemblage of well-informed expertise that could be directed at the problematic. This was highly fortuitous, rather than any planned capacity. Rapid-response problem-solving is *not* part of the normal repertoire of universities, which are predicated instead on the steady rhythms of teaching semesters and systematic research projects that follow established methodological norms. The set of activities that constituted this project thus occupied a kind of discrepant liminal space in the university, championed by one university executive, and provided temporary home, intellectual direction and generous indulgence by senior professors in urban planning. This constituted the hastily-constructed and somewhat tenuous platform for the multi-disciplinary, multi-actor knowledge exchange between academic scholars and the other stakeholders in the site of study.

By contrast, similar makeshift manoeuvres seemed not to happen in the same way in the city administration to provide the personnel and conditions for the knowledge exchange. Instead, continuing levels of mistrust, predicated on a number of perceived risks, meant city officials were disinclined to provide informed input to the project (as the street traders had been persuaded to do). A more detailed study of the dynamics at work in that context might have revealed a series of conditionalities and pathologies informing the reluctance to participate, but these will need to the subject of another study (see for example Benit-Gbaffou, 2015).

In short, even for a short-term, rapid-response exercise of this nature, distinct interventions have to be made into the normal routines and rhythms of institutions to enable cross-boundary knowledge-exchanges to occur, and even more so if the knowledge was to be configured into innovations in organisational life, perhaps even requiring a number of organisations to reconfigure their performative patterns to accommodate a new set of practices designed to give rise to alternative outcomes. Thus, short-term, informal initiatives of this nature are inherently vulnerable to the levels of investment by

the partners, always at the risk of fitful, partial participation or even withdrawal. Institutional departments have only limited tolerance for their members defecting to a special project, and participants will quickly succumb again to the gravity of designated institutional orbits.

However, this is not to rule out rapid response formations as a necessary and legitimate strategy in the face of an urgent, unanticipated question: such needs are likely to persist. Instead, institutions like universities and city administrations should anticipate this and make provision for exercises of this nature as an expected and normal part of the organisational repertoire. This could include some general principles to support legitimate participation, successful follow-through, strong liaison with knowledge partners, and formal systems to consider what new learning is relevant for the organisation and which should be absorbed into its systems. In other words, the aberrant and unforeseen eventualities need to be as carefully managed and exploited for their value as the planned and predictable patterns of organisations.

By contrast, the City Region project illustrates more formal approaches to managing the tensions of boundaries. There is an effort to stabilise compromises and accommodations, and to provide a degree of organisational reliability as a platform for what is acknowledged at the outset as a *long-term* project. This represents a *fundamentally different stance* towards knowledge—particularly the complex forms of knowledge needed to inform complex questions. This acknowledges that the forms of knowledge that will enable us to steer our social futures is inherently multi-dimensional across a number of axes: it draws on multiple disciplines, it emerges from multiple standpoints, it is dependent on context, it emerges (and indeed changes) over time and needs to be accumulated over time (co-created between partners), and it might take on a different character when rubbed up against similar knowledge generated elsewhere on the globe. Indeed this knowledge can be partly codified in texts, given expression in concrete design, but in its most lively and usable form, it is embedded in *people*, in both explicit and intuitive forms, and finds most generative and innovative expression when these people work together.

Under these circumstances, and given the wide fronts on which we need to achieve better steerage of the future, there is a compelling argument for transdisciplinary work to be given more formal platforms, predicated on long-term knowledge projects, and which are geared to bring together both specialised scholars and experienced practitioners, both the highly-qualified, and those who hold deep knowledge from the streets, the fields, and the *banlieues*. It makes sense for these structures to be located in (or associated with) universities, the traditional knowledge engines of society, but not necessarily. They should be constituted and located in ways that enable their distinctive transdisciplinary purposes to be pursued, sometimes on the peripheries of universities where they are not constrained by the necessary rhythms and distinctions of normal academic life, but are similarly protected from political, religious or commercial interests. They need to be established with a strong commitment to the long-term knowledge project, but committed to reflexivity, which requires that, as the thematic object of study evolves (as it will), so the project and its modalities of enquiry will adapt accordingly. Transdisciplinary knowledge is *inherently emergent*, and the provision that we make to pursue it must honour this character.

Needless to say, far-sighted examples of this nature are already in place in one form or another, like the Oxford Martin School, but examples like this, and the regional observatory case study above, have arisen under distinctive circumstances, and these are relevant if we are to take seriously not only the vitality of transdisciplinary knowledge, but also the sustainability of universities into the future. The next section of this paper develops this idea further.

Longitudinal cognition

In essence, if we are to take seriously the fact that, firstly, the challenge of sustainability more broadly has taken on an unprecedented urgency, that secondly we require a quantum leap in the kind

of knowledge required to address this, and that this knowledge arises from *connective cognition*, a form of collective societal learning that is emergent over time, where deepening insight has the effect of provoking fresh questions, then we must confront the fact that this has consequences for the pre-eminent knowledge institutions of society. The implication, I believe, is that universities need to be configured much more deliberately for long-term investment in particular thematic knowledge areas that, we know already, are critical for the achievement of sustainability into the future. In Africa, for example, there is a powerful need for deep transdisciplinary, multi-partner research to be conducted in multiple contexts into the issues of livelihoods and socio-economic inequality; the future of the extractive industries and their associated distributive regimes; the re-industrialisation of the continent's economy and the growth of intra-continental trade; the governance systems of the continent; the patterns of migration, xenophobia and intergroup violence; gender violence and homophobia; and the distinctive health challenges of transforming and post-conflict societies, to name just some of the most critical. Although Africa is forecast as the site of strong growth into the future, there is little or no collective capability available to guide this growth in directions that address the continent's legacy of deep inequality. Not the multi-lateral organisations that straddle the various regional economic groupings, nor the African Union itself, nor the universities of the continent, have any capability to generate *informed collective views* on the issues noted above, certainly not in any way that would enable evidence-based measures to guide the future of the continent. Although I have noted these as critical sustainability challenges for Africa, they each have their counterparts in virtually all corners of the globe: these are concerns that are planetary in their reach and implications, but with only isolated pockets of capacity for concerted research and innovation directed at addressing these.

The only certain way of constituting these cognitive resources is for deep, long-term investments in the kinds of transdisciplinary capacity outlined earlier. These must be established with the diverse resources needed to address the complex questions at hand, and on a time-scale that will permit the accumulation of expertise and insight needed. It is these secure configurations with long time-horizons that will be best equipped to respond to the urgent demands for quick turn-around rapid-response situations that will inevitably be a common feature of our unpredictable future. This is one of the ways in which we equip ourselves for resilience, in the face of the precariousness that increasingly characterises the future of global society.

Our public universities, however, are increasingly ill-equipped to take on this qualitative shift in their third mission.[8] The escalating demands to widen participation (a virtuous goal) is accompanied by shrinking *per capita* support from the public purse, and the regimes of measurement and audit have tended to draw research productivity away from the inherently more expensive boundary-spanning modalities (see Alan Harding,[9] *et al*, for a succinct overview). Institutions are increasingly relying on third-stream income,[10] but this is often clearly ear-marked for sharply-defined projects and is short-term in duration. At best, universities are able to advance particular subject fields in partnership with philanthropic foundations, but the danger is that some institutions, or fields of study, become what

8 The first two missions are teaching and research. The 'third mission' varies widely across institutions and over time, but usually implies the ways in which universities engage with societal needs outside the walls of the academy.

9 Alan Harding, Alan Scott, Stephen Laske, & Christian Burtscher (eds.), *Bright Satanic Mills: Universities, Regional Development and the Knowledge Economy*, Burlington, Ashgate, 2007.

10 'Third stream income' refers to revenue sources other than public purse subsidy and student fee income, and might include contract revenue, grants and donations, accruals from investments, etc.

Leihy and Salazar[11] have called 'grifters', institutions whose directions are swayed by opportunistic dependency on external resourcing contingencies. What is required is a significant reconceptualization of the role of universities in shaping the future of human society, where the 'third mission' is galvanised into much more *systemically-focused* preoccupation with the problematics of global and local sustainability. We have moved beyond the era where this dimension of university life can be the half-hearted domain of voluntary 'community engagement' and well-meaning 'service learning', undertaken almost entirely at the whim of occasional and passing enthusiasms. Instead, this zone of academia (what Burton Clark a long time ago called the 'entrepreneurial periphery') needs to be the trusted site where the institutions of society invest in the knowledge project of the future. This site needs to be understood as deeply *reciprocal*, moving away from the uni-directional view that knowledge flows *out of* universities *towards* society in the form of fresh graduates and research output. Instead, the reciprocity is reflected in the multi-partner participation as much as in its multi-disciplinary character, and that the knowledge and financial flows *into* the platforms are in turn reciprocated by the quality of insight that is generated *out of* them. In the second case study above, so well-pleased is the city-region government with the cognitive output of the regional observatory that the funding is to be increased, while other parties (smaller municipalities and opposition political parties) are also adding investments, mostly to deepen the granularity of insight available for their constituencies. Good quality information, that enables insight and informed decision-making, is a valuable commodity, attracting investment. In the case of the 'third mission zone', we require now serious consortia of investors (government, industry and civil society) to join with higher education to create the powerful transdisciplinary platforms that will sharpen our gaze onto the present and the future, and assist us to steer it innovatively and with rather greater wisdom than before. In short, what is needed is a revised social contract with wider society.

This kind of transformation will not happen without the emergence of far-sighted leadership, capable of seeing the need, and influential enough to direct societal resources to these longer-term ends. Such leadership tends to be rare, with powerful figures instead distracted with the short-termist preoccupations of quarterly shareholder returns, or the need to ensure re-election. Universities themselves need to contribute to a societal climate conducive to sober leaderly reflection on our collective future, through the production and publication of clear-sighted perspectives to this end. Goddard, *et al*[12] have provided a compelling account of how leadership in an urban context needs to take on a different character, with leaders from the university and the city working together on key challenges: "to lead the city, not just to lead in the city". This is a view of leadership as a capacity that is necessarily distributed and sourced from various quarters, and accumulates around deepening shared vision and mutual trust. Indeed, knowledge, insight and transformative leadership seem inseparable. Since many universities still cherish the 'public good' ideal, and continue generally to stand apart from business and political interests, there is a strong argument to be made for the academy to take the lead in providing a good-faith platform to assemble the civic leadership required in, for example, a particular urban context. The serious and popular media need also to become strong civil society allies in generating the view in the public sphere that the project of connective cognition is an overwhelming priority, and that astute minds from all quarters need to find common cause in how this is to be founded, funded and defended for the common good.

11 Peodair Leihy and Jose Salazar, "Institutional, Regional and Market Identity in Chilean Public Regional Universities," *Universities and Regional Development: A Critical Assessment of Tensions and Contradictions*, ed. Rómulo Pinheiro, Paul Benneworth and Glen Jones, London, Routledge, 2012, p. 141-160.

12 John Goddard, Louise Kempton and Paul Vallance, "The Civic University: Connecting the Global and the Local," *Universities, Cities and Regions: Loci for Knowledge and Innovation Creation, op. cit.*, p. 59.

Global cognition

Much of the thrust of this argument has focused on the necessity for powerful social learning (connective cognition that enables innovative futures) to be constituted by multiple participants situated in relation to one another in a distinct context. This is for the distinctiveness of context to grasped in all its nuance, so as to enable a sufficiently informed approach to intervening productively in that milieu. This needs to include the participation of key stakeholders who are persuaded of the value of the enterprise and the integrity of its process.

There is equally, however, an imperative for this social learning to seek out global dimensions, not least because there are few complex local problems that are not replicated in counterparts internationally. Indeed, many concerns confronting us locally may indeed have their origins elsewhere, and we realise that full transdisciplinarity must come to terms with global flows and forces in order to penetrate causes and effects, interests and entitlements, resistances and remedies.

Naturally, scholars have been intimately networked globally for centuries, and disciplinary dialogue, contestation and affirmation have long required an international character for their credibility. Indeed, many sociologists have remarked that the affiliations of academics are often much more deeply loyal to a dispersed global network of fellow specialists in the intellectual field than they are to the concrete institution that provides their salary (see for example Burton Clark,[13] and Tony Becher & Paul Trowler).[14] This is quite appropriate; academic identities are predicated on deep intellectual commitments that are profoundly normative and enduring, and as such mark out shared 'territories' more surely than any campus perimeter. However, these global networks of disciplinary solidarities are seldom multi-disciplinary in character (as any supervisor of an innovative multi-disciplinary postgraduate thesis quickly finds out at examination time) and even more rarely are they transdisciplinary. This presents challenges for the conventional means of validation in the world of scholarship (Guggenheim).[15] But as Sabine Hark[16] has noted, for transdisciplinarity to be rooted in more rigorous procedures and find increasingly distilled principles, it needs to find stronger institutionalising modalities, rather than seeking to avoid them, even though we may not find these modalities in the conventional architecture of university disciplines.

For the kind of global perspective that is needed for the large-scale complex problems, or the challenges that find comparable form in varying contexts, it seems inescapable that the kind of platform we have designed for city-level urban learning needs to be replicated in strategic points around the globe, as seems appropriate for whichever avenue of enquiry is at hand. In other words, we need global networks of transdisciplinary 'centres of cognition', predicated on common questions and themes, and committed to increasingly systematic exchange of methodologies, insights and personnel, in order to achieve a transcendent multi-perspectival view that has global breadth of vision, and can

13 Burton Clark, *The Academic Life: Small Worlds Different Words*, Princeton, NJ, Carnegie Foundation for the Advancement of Teaching, 1987.

14 Thomas Becher & Paul Trowler, *Academic Tribes and Territories: Intellectual Enquiry and the Cultures of Disciplines*, Second Edition, Buckingham, Society for Research into Higher Education, and Open UP, 2001.

15 Michael Guggenheim, "Undisciplined Research: the Proceduralisation of Quality Control in Transdisciplinary Projects," *Science and Public Policy* 33.6 (2006), p. 411-421.

16 Sabine Hark, "Transreflections: Transformations of Knowledge—Intersectional Feminisms—Transdisciplinary Alliances." Or "Transreflektionen, Transformation von Wissenschaft—intersektionaler Feminismus—transdiziplinaerer Beziehungssinn," *Wieder die Gleichheitsrhetorik, Soziologische Analzsen—theoretische Interventionen*, ed. Gerline Malli, Susanne Sackl-Sharif, Münster, Westfälisches Dampfboot, 2014.

command global credibility and commonality of purpose. Expressed slightly differently, David Singh Grewal[17] has suggested that we need to establish epistemic communities with the intellectual resources to re-articulate global dilemmas in terms that enable these to be addressed differently from before. Indeed, as Grewal has argued (following Charles Taylor and Arjun Appadurai), the task before us is to achieve cognitive convergence across these epistemic communities to enable new social imaginaries that configure societal and economic relations for increasingly sustainable futures.

Inevitably, as insight deepens and methodologies mature—and as the problems we address morph and mutate—so we will need to be self-reflexive and adaptive in turn, reforming our modalities of learning in response to—and as part of—the human condition.

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