Keystone Practices to Enable Smart Cities to Flourish

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This paper draws on the notion of creative urban ecologies as a way to characterize a thriving 'smart' city both in terms of the technology and data in use and also in terms of the city's capacity to learn and adapt. What does it take for a city and her inhabitants to remain resilient in the face of challenges like climate change or disease outbreaks? How does a global city use data effectively to deal with situations where information will inevitably remain incomplete, uncertain and dynamic? How can and should data serve the ultimate end goal of urban well-being? Drawing on the author's own engagements with creative information practices, data ethics and trust-building strategies, the paper presents a human-centred approach to 'smart city' initiatives. Creating smarter cities calls upon us to work with a complex and ever-evolving mix of people within a built environment constructed upon an existing ecosystem using ever 'smarter' technologies. Thriving in and adapting to change in such contexts involves a capacity for imaginative problem solving and problem finding as much as it involves technical know-how. The paper offers a framework for building resilience into the fabric of an urban ecology, introducing four critical operating principles, and closes by speculating how supporting five keystone practices can create a city that is 'smart', sustainable and compassionate.

Keywords: *Data ethics, trust-building, codesign, creative ecology, community building, resilience, urban ecology*

INTRODUCTION

During the Australian spring and summer of 2019-2020, horrific bushfires swept across the country, laying bare both ecological and urban vulnerabilities. More than 12.6 million hectares burnt, with thirty-three human lives lost, over one billion animals killed and 11.3 million Australians affected by smoke.

While metropolitan Sydney was spared from the most cataclysmic of the firestorms, the fallout of smoke, haze, and ash shrouded the city and surrounding communities for weeks on end, leading to this region having some of the worst air quality on the planet during that period. And as the summer heat persisted, water catchments already strained by years of drought were stretched further by the fire

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crisis and communities found themselves facing severe water restrictions. In the aftermath of the fires, drought and economic impact, the resilience of both the community and the land was already apparent. Before the cleanup could be completed or government authorities could finalise their review of the social, economic and ecological fallout of the firestorms of that long, hot summer, there was a new enemy to fight along new battlefronts with the declaration of the COVID-19 global pandemic and the establishment of stringent limitations on human movements, including state and international border closures and quarantine requirements.

Both crises, in their own way, confront the city of Sydney and her residents with situations that extend beyond the reach of existing understandings and contemporary experience. Firefronts on the fringes of Sydney during bushfire season were nothing new, but the scale of these most recent fires had made the behaviour of outbreaks harder to model. Sydney had also experienced quarantine conditions before – the city's historic Quarantine Station remains a very visible reminder of how the city used physical barriers and social distancing to tackle the Spanish Influenza outbreak of 1918. But, one hundred years later, with jet aircraft rather than troopships the main potential risk of disease to the city, the scale of this current pandemic confronts us at a new quickfire pace in the modern, technologically-enabled ways of a global city like Sydney. And even though data technologies are being deployed in rapid-fire fashion to aid in the fight against this disease, the technical and political concerns with contact tracing apps, for instance, provide us with cautionary tales as more of the data technologies we have come to associate with 'smart cities' are brought on line.

Even without such dramatic shocks to the city's rhythms as might be caused by events like a disease outbreak or bushfire, residents of cities like Sydney experience a range of chronic stresses such as personal safety, affordable housing and transport congestion challenging their resilience. As the world continues to deal with the ongoing challenge of a global pandemic and concerns about climate change, the erosion of public trust accompanying these crises appears to be accelerating calls for fresh thinking about ways cities like Sydney can effectively use data to prepare for and stave off similar crises in the future. In early 2020, the dial of the Society for Atomic Scientists' Doomsday Clock was moved closer than ever before to the symbolic midnight "doomsday" hour, entering into the realm of the two-minute warning, "...when danger is high and the margin for error low". In a statement explaining the reasons for their decision released 23 January 2020, the editor of the Bulletin wrote:

> "Humanity continues to face two simultaneous existential dangers—nuclear war and climate change—that are compounded by a threat multiplier, cyber-enabled information warfare, that undercuts society's ability to respond. The international security situation is dire, not just because these threats exist, but because world leaders have allowed the international political infrastructure for managing them to erode."

It was time, the announcement went on to say, for new, creative responses:

> "If decision makers continue to fail to act—pretending that being inside two minutes is no more urgent than the preceding period—citizens around the world should rightfully echo the words of climate activist Greta Thunberg and ask: 'How dare you?'
>
> Public engagement and civic action are needed and needed urgently" (Mecklin, 2020: *Statement from the President and CEO – Inside the two-minute warning*).

We hear much about how building up our individual and collective resilience can see us through the uncertainty of such events; how innovation and creativity can help us respond successfully to the challenges we face. As a data ethicist AND a Sydney resident myself, these events compel me to speculate about the conditions needed to enable a modern, data-informed city to flourish in the midst of such crises.

This essay is the product of that reflection, focusing on ways that insight from my own engagements with creative information practices, data ethics and trust-building strategies might contribute to 'smart city' initiatives, enabling resilient, sustainable and compassionate urban communities. Having spent many years examining the anthropology of ideas and conditions that can kickstart individual and collective creativity, I have long been intrigued by the dynamic relationship between creativity, risk and uncertainty. As an educator in the information and data science domains, I have integrated that creative-analytic focus on information and data ethics. And as an advocate for social justice, I design training to raise awareness about the issues of data justice and to help data professionals respond to public concerns related to the deployment and use of data sharing platforms. What does it take for a modern city (and her inhabitants) to remain resilient in the face of challenges like climate change or disease outbreaks? How does a global city use data effectively to deal with situations where information will inevitably remain incomplete, uncertain and dynamic? How can and should data serve the ultimate end goal of urban well-being?

A SMART CITY AS A CREATIVE INFORMATION ECOLOGY: AN ECOLOGICAL VIEW OF THE CITY AS A HUMAN-TECHNOLOGY PARTNERSHIP

What does it mean to be a 'smart city'? For the purpose of this essay, I draw on the following broad definition from the August 2020 Roadmap produced by Standards Australia where

> "In its simplest form, it is generally defined in terms of a city's goals enabled by data and technology. These goals should ultimately be about improving the lives of citizens. In the context of Australian cities, they may include sustainability, resilience, liveability, productivity and workability. The emphasis and specifics may vary from city to city. From a city's perspective, advances in data and technology have unlocked new, more cost-effective and produc-

> tive ways for 'cities' to undertake existing tasks. But the Smart City impact goes far beyond just 'doing things better.' Data and technology have enabled very innovative solutions to existing and emerging problems, and importantly, provided opportunities to innovate highly novel products and services." (Standards Australia, 2020: 9)

Many smart city initiatives are connected to efforts that address the social resilience, health and wellbeing of a community.

Alongside the development of data technologies to deploy in our cities, there is growing concern about what might be getting overlooked in the process (see for instance Green, 2019a; OECD, 2020). Creating smarter cities calls upon us to work with a complex and ever-evolving mix of people within a built environment constructed upon an existing ecosystem using ever 'smarter' technologies. Thriving in and adapting to change in such contexts involves a capacity for imaginative problem solving and problem finding as much as it involves technical know-how. Despite all the benefits likely to emerge for cities from increased application of data technologies, there are inevitable (and critical) data limitations that must give us pause as we continue to expand the deployment of smart city technologies. Human experience remains richer than what can be codified within any AI or data technologies at our disposal. The thesis proposed here is that a resilient smart city is one where human as well as machine intelligence is maximised. This argument is premised on a belief that preparing for unknown futures in a technology-infused society requires human agility and experimentation.

Florida's (2001; 2012) discussion of the creative class as an economic force for this century is very appropriate here:

> "It was the rise of this new class and of creativity as an economic force that was the underlying factor powering so many of the seemingly unrelated and epiphenomenal trends we had been witnessing; from advent of whole new industries and businesses, to changes in the way we lived, worked, and consumed, extending even into the rhythms, patterns, desires, and expectations that governed our daily lives" (Florida, 2012: Preface).

It is also important to appreciate that Florida's notion of a creative class was about more than supporting a privileged sector of society:

> "The key thesis of my argument is as simple as it is basic: Every human being is creative. That the Creative Class enjoys vast privileges is true, but to acknowledge that fact is not to endorse it. The essential task before us is to unleash the creative energies, talent, and potential of everyone else—to build a society that acknowledges and nurtures the innate creativity of each and every human being" (Florida, 2012: Preface).

The creative hubs and innovation centres so commonplace in our cities seem to confirm Florida's depiction of tech-entrepreneurs favouring urban living over suburbia. In many countries, reports commissioned to enable governments and workforces to better manage transition from work in traditional sectors to the creative and cultural sector (e.g., European Commission, 2010; Green &Hannon, 2007; Hill, 2020; Newbigin, 2010; Pratt, 2012; Tims & Wright, 2007; Wright et al.,

2009) seem to extend Florida's thesis to the building of creative cities. And current discourses of the 'smart city' seem to extend that vision of creativity and innovation even further (e.g., Ministry for Housing & Urban Affairs, 2020; OECD, 2020; Standards Australia, 2020).

Descriptions of this kind of urban landscape depict an environment capable of enabling a culture of creative cooperation in the midst of dynamic information and knowledge network transformations. Thus, the framework I use to examine data technologies in the urban landscape builds on the *information ecology* construct of Nardi & O'Day (1999), the wider notion of the *creative ecology* envisioned by Howkins (2009) and Florida's (2012) discussion of the *creative class*. Succeeding in the information-intensive environments characterised by a smart city means cultivating a sustainable creative ecology capable of supporting and nurturing agile engagements with all of the interconnecting parts of such spaces.

An ecological perspective with its accompanying language of interdependencies, diversity, networks and mixing zones seems a very apt way to describe the complexity of any modern city. Howkins defines creative ecology

> "...as a niche where diverse individuals express themselves in a systemic and adaptive way, using ideas to produce new ideas and where others support this endeavour even if they don't understand it" (2009: 11-12).

Howkins suggests the strength of such ecology lies in the relationships rather than the infrastructure and the continual learning and creating of meaning taking place. His holistic approach builds on Bateson's ecology of mind, Naess's ecology of wisdom and explorations of urban ecologies and network ecologies. Howkins identifies four aspects of ecological thinking relevant for creativity and innovation: diversity, change, learning and adaptation (Howkins, 2009: 45). Drawing on this work, an ecological perspective of the city provides a holistic appreciation of habitats and interdependencies that allow species (or ideas) to thrive, which in turn enriches an awareness of the self in that space.

Like Howkins (2009), Nardi & O'Day (1999) draw attention to the power of the ecology metaphor as part of a more systemic understanding of the way people work in sociotechnical contexts. Their depiction of the informational space as an ecosystem draws attention to the interdependencies, networks and complexities when people work with information and informative artefacts. Because the data technologies associated with smart city initiatives are designed with the intention to *inform* people, practice and policy, it seems very appropriate to consider the smart city as an information ecology.

Thinking of the smart city as both a creative *and* an information ecology sensitises us to its character as a diverse and adaptive community with complex information flows generated by both human and material components. Creativity, generally associated with the generation of new ideas, is a natural part of this ecological perspective on adaptation and learning. For Bateson, the word 'idea' is synonymous with the word 'difference'. So in defining information as "a difference which makes a

difference" (Bateson, 1987: 459), he ties the generation of ideas to information at a fundamental level. I would argue that creativity is not the end, but rather the means for accomplishing our goals, whatever they may be. Like information, creativity is an enabler. If a smart city is to be capable of responding to change and complexity, it must also be a sustainable creative ecology capable of supporting and nurturing agile engagements with all the information generated in such a data-intensive context.

ENABLING HUMAN CAPABILITIES ALONGSIDE GROWING MACHINE INTELLIGENCE

Cautionary tales about overlooking the human side of technological change are not a new phenomenon. The Doomsday Clock referred to in the introduction to this essay, for instance, traces its origins back to a time when the Cold War's threat of nuclear catastrophe loomed large in the minds of politicians and the public. It was an era shaped by two relatively new technologies: computational technologies and nuclear power. Vannevar Bush is often credited with being one of the first visionaries to imagine what a hyper-connected world would look like. Passages of his 1945 essay *As We May Think* – written in the dawning of a nuclear age that saw the Second World War transform into Cold War – offer evocative descriptions of situations where machine intelligence could address the limitations of human actions:

> "There may be millions of fine thoughts, and the account of the experience on which they are based, all encased within stone walls of acceptable architectural form; but if the scholar can get at only one a week by diligent search, his syntheses are not likely to keep up with the current scene" (Bush, 1945, Part 5).

Achieving faster, better information access, he surmised, was critical for humanity's future.

Like the frightening world of the early Cold War era of the time of that essay, today's pressing concerns about global security and safety seem to call out for better, more efficient and more effective access to information about our surroundings if we are to solve many of the world's urgent problems. And yet, even then, amidst his envisioning of machines that could support our thinking, Bush cautioned against any assumption about total reliance on them for all our thinking:

> "Much needs to occur, however, between the collection of data and observations, the extraction of parallel material from the existing record, and the final insertion of new material into the general body of the common record. For mature thought there is no mechanical substitute" (Bush, 1945, Part 3).

For me, such imaginings of technology augmenting human cognitive activity point to the need to hold on to and nurture the creative, inventive qualities of the human mind even as we design machines that can support and extend our thinking.

There is another cautionary tale to draw from past imaginings about technologically-enabled futures that appears very appropriate to the deployment of data technologies in our cities. Speaking at a 1984 conference at which thought leaders

and educators gathered to discuss a "Brave New World" of technological change precipitated by the growing availability of computational technologies, Barry Jones (Australia's Minister for Science at that time) expresses his concern about disparities in the growth of machine intelligence and human intelligence:

> "Machines are doubling their intellectual capacity every few years, but people are not. If artificial intelligence outstrips human intelligence, if technology is smarter than its displaced human equivalent, then the power of the people who own the machines will be expanded to an almost unimaginable degree. What are the implications for our political system?
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> "In Australia, the current generation of managers grew up before the technological revolution. They do not fully understand its significance — and have an instinctive anxiety that if the number of Indians is reduced, fewer chiefs will be needed as well. When the existing technology is used at full capacity, or when new generations of managers arrive on the scene, the impact may be enormous unless we adopt appropriate social responses. It is time to examine the implications." (Jones, 1984: 19-20).

It is not hard to imagine this statement's applicability to contemporary discussions about the deployment of automated technologies and other data innovations within smart city initiatives, drawing attention to social and ethical consequences and deployment in line with the public interest (e.g., Green, 2019b; OECD, 2020).

These two historical visions of human-machine futures serve to remind us of the perennial nature of the sociotechnical and ethical concerns associated with human-machine partnerships. In the midst of our current discussions about data integration in the modern city, they also serve to remind us that there is something innately human and constant about striving to overcome the challenges of our time.

To flourish in a 'smart city' I therefore contend takes more than a mastery of particular tools or systems. As the data technologies deployed in our cities grow smarter, it will be equally important to ensure that processes are in place to ensure that we continue to nurture the human capacity for learning, wonderment, experimentation, risk-taking and creativity. Through the co-mingling of creative literacies and technical literacies, we can more effectively engage with data in the unexpected and often exponentially changing ways it will confront us in the dynamic setting of a smart city. When we give ourselves permission to imagine and adapt our thinking beyond the information given, we will learn to make best use of all the data created, collected and analysed through 'smart city' technologies. In short, there is a need for artful as well as skilful engagements with all the information these processes produce. And finally, if ALL residents of a city are to reap the rewards of 'smart' tools (rather than simply those who own those tools), then we must nurture a culture of creative cooperation and lifelong learning for all inhabitants of our cities.

THE ROLE OF UNCERTAINTY AND RISK FOR BUILDING INDIVIDUAL AND COLLECTIVE RESILIENCE

Another rich conceptual area of value for this discussion concerns the role played by exposure to risk and uncertainties in relation to both resilience and creativity. In this section I will point briefly to some key findings from my earlier explorations of this relationship that are of particular value for enabling the culture of creative cooperation that can support a city's strategic deployment of data technologies.

In Anderson (2006; 2013) I illustrate how working through uncertainty can be a mediating strategy for knowledge generation, portraying experts thriving in their information landscapes because they had developed capacities to not only manage uncertainty but to embrace it. Uncertainty is often associated with risk, fear and danger. It is, however, a natural experience within the process of information seeking and meaning making. Furthermore, the perception and strategic use of uncertainty can be both a positive and negative influence on our behaviour.

Uncertainty impacts the whole self, and while it is not always a positive experience, my scholarly (and personal) investigations into the anthropology of uncertainty have helped me to come closer to understanding how uncertainty can be an enabler in some situations, but an obstacle in others. Ultimately this led me to dive deeper into uncertainty and risk in terms of the role they play in human behaviour – starting with an exploration of the role in terms of individual behaviour before looking at the wider implications for us as families and communities. I grew particularly fascinated by the productive contribution that working with and through risk and uncertainty can have in our lives, encapsulating what I'd learnt into a depiction of four phases states contributing to creativity and innovation (Anderson, 2013). When we can learn to manage our reaction to uncertainty and develop a tolerance for the discomfort it can cause in such instances, we put ourselves in a better position to build on the positive effects and mitigate some of the potential pitfalls. When we allow ourselves the space to be creative and inventive in our worlds, new insight emerges to enable us to handle the complexities we face.

Before exploring these productive capacities further, it is important to recognize that there are risks and uncertain situations that seem to have little creative potential. Risks to family security (e.g., job loss, housing concerns), to health (e.g., disease outbreaks, surgery, illness), or to personal security (e.g., crime, terrorism) are examples that many of us can appreciate. However, even in such circumstances, individual judgments vary with regard to where to draw the line in terms of threats to our security and acceptable risks. A review of research into terrorism threats, for instance, found great variance in terms of the perception of risk and potential terrorism threats within different communities at different points in time (Maguen et. al, 2008). Perception is a powerful determinant when it comes to developing a tolerance of risk and uncertainty in society collectively and in our own lives. My own exploration of the risk landscapes of childhood in relation to mobile phone use and

cyberbullying points to the detrimental impact of framing the child as a victimised consumer and privileging the perspective of the parent/teacher (Anderson, 2010). There is a powerful social element at play in the way we approach risk. Boholm (2015) supports the view that risk and uncertainty are extremely contextual. Her work also helps us understand how public talk of economic and political uncertainty and a generalised aversion to risk can shape our personal perception.

Wallerstein (1998), an historical social scientist who has written extensively about change and dynamics in global systems, has something to contribute to this exploration of uncertainty and its role in human experience. His observations about human social systems in periods of transition suggest that fear and panic kick in when we perceive our situation to be precarious, individually and collectively. This fear can be brought on by the major impact that seemingly small inputs can have on our stability (Wallerstein, 1998: 320). The cascading effect of the sub-prime credit crisis earlier this century, job losses accompanying digitisation and automation strategies and our current global trust deficit all seem to confirm his assessment. In such times it can be difficult to find a balance between desirable and undesirable uncertainty that we can live with, but it is helpful to remember that in times of upheaval, creativity and risk taking can become tools for moving from old ways into the new ones necessitated by change. Wallerstein's words at the end of the 20th ring as true today as they did then:

> "If we were certain of the future, there could be no moral compulsion to do anything. We would be free to indulge in every passion and pursue every egoism, since all actions fall within the certainty that has been ordained. If everything is uncertain, then the future is open to creativity, not merely human creativity but the creativity of all nature. It is open to possibility and, therefore, to a better world" (Wallerstein, 1998: 322).

When we do not know, we must imagine.

Emotionally, intellectually and physically, humans need some form of risk and uncertainty for motivation, interest, excitement and intellectual curiosity – all of which are ingredients for innovation, creativity and imagination. Not knowing can often motivate us and compel us forward. However, too much 'not knowing' can overwhelm and cause us distress. At such a point, an individual might be said to be experiencing undesirable uncertainty, unproductive or negative, associated with frustration, information overload and risks beyond the tolerable. My own research on uncertainty (Anderson, 2006) has shown that positive and negative forms (as experienced at any one moment) are inextricably intertwined but one key to working through any kind of uncertainty is developing a tolerance for it. In fact, it seems that desirable uncertainty appears to emerge through the interplay between positive and negative forms in our individual practices. Thus, working with and through the uncertainties that we experience plays a critical role in creative, innovative activity.

In the ever evolving circumstances characteristic of the creative information ecology of the city, a body of research like that explored in this section suggests that tolerating uncertainty can serve a critical function for information discovery and

use. Furthermore, building a tolerance for uncertainties warrants support in the design of our cities and the data systems we develop to deploy in them. The holistic experience of both the positive and negative forms of uncertainty shape our ability to tolerate challenging encounters. And because productive and unproductive forms are closely bound to one another in any given situation, there is an intricacy to this positive-negative relationship to suggest that they are not easily uncoupled from one another. Acknowledging this complex positive-negative blend has implications for system design and for the training of our data specialists within such systems.

The demand for workers possessing such transformative capacity to effectively engage with exponential increases of information and the uncertainty characteristic of shifting knowledge landscapes is particularly acute in data-intensive environments where possessing the analytic skills one needs to manipulate data is not enough. More than a decade ago when the challenges of the digital economy sparked reports about the challenges to education, Adams (2006) and Moyle (2010), for instance, already suggested that flourishing in these new environments does not necessarily involve a mastery of particular tools or systems, but rather a capacity for lifelong learning, experimentation and risk-taking. To derive the meaningful insights that transform data into information takes creativity and curiosity (see for instance Parmar et al., 2014).

Learning to tolerate uncertainties not only supports our creative capacities as individuals and as a community; it also plays a big part in our individual and collective resilience. Creativity and resilience are both complex, process-oriented phenomena that appear closely intertwined. Both resilience and creativity are often described in terms of bendiness, elasticity and flexibility. A resilient person is one who demonstrates an ability to bounce back and perform what Masten & Powell (2003) refer to as "ordinary magic". Luthar et al. (2000), for instance, frame resilience as a dynamic, developmental and progressive adaptation to vulnerabilities and adversities. In experiencing and learning from adversity, new strengths emerge – and possibly new vulnerabilities as well. Creative adaptation, which Meneely & Portillo (2005) connect to agility and flexible thinking, is theoretically very close to the flexibility associated with resilience. Metzl & Morrell (2008) posit creativity as an inherent predictor and facilitator of resilience. Wolin & Wolin (2010) depict creativity as one of the seven types of resilience in their resilience mandala. It also figures strongly in Robinson's (2010) adaptive resilience cycle.

Amabile (1998), through her research on creativity in organisational contexts, posits creative thinking as a confluence of different kinds of thinking and doing. She asserts that creativity is a function of three components: creative thinking skills, expertise and motivation (1998: 78-9). Her work suggests that nurturing creativity does not involve choosing one or the other of these components, but rather nurturing creative capacities through different ways of thinking and being in context.

Thus, applying imagination, we could argue, is a necessary skill for any professional. When discussing the power of creativity, Sir Ken Robinson offers an evocative perspective on the difference between imagination and creativity:

> "Imagination is not the same as creativity. Creativity takes the process of imagination to another level. My definition of creativity is 'the process of having original ideas that have value.' Imagination can be entirely internal. You could be imaginative all day long without anyone noticing. But you never say that someone was creative if that person never did anything. To be creative you actually have to do something. It involves putting your imagination to work to make something new, to come up with new solutions to problems, even to think of new problems or questions.
>
> "You can think of creativity as applied imagination" (Robinson, 2009: 67).

Applied imagination is one way to frame the tension between applying standards (such as those associated with effective deployment of data technologies in a smart city initiative) and breaking away from those standards in response to new and uncharted challenges in a given context.

Beyond enhancing our collective ability to be comfortable with uncertainty, building resilience into the fabric of such a creative information ecology helps a city (and its inhabitants) to productively engage with risk and adversity. Building the resilience to handle these complexities requires agility in all that we do, whether working on a task, with other people or technologies and handling information. Working effectively in hyper-coordinated and information-intensive landscapes inevitably involves working well with both people and technologies. It also goes hand-in-hand with learning to be at one's inventive and agile best. Critically, nurturing a creative information ecology extends beyond individual practice and learning. It flourishes through practice and in community as learners develop their individual and collective creative capacities. The agility born from shared experimentation and reformation enhances our collective capacities for skilfully handling and generating useful data.

An ecological perspective in which the focus is on understanding how and where resilience occurs is very evident in process-oriented discussions of Deakin Crick et al. (2013), Keye & Pidgeon (2013), Luthar et al. (2000), Masten & Powell (2003), Meneely & Portillo (2005), and Robinson (2010). Resilience is not something one can measure directly. Instead, as Luthar et al. (2000) assert, it is inferred by the presence of both significant risk factors and competency indicators. Through engaging with risk, a capacity for resilience can emerge. Similarly, through practice and making sense of experience and past knowledge, our inventiveness is nurtured. Csikszentmihalyi (1996: 28) speaks of "the work of creativity." Metzl & Morrell (2008) draw on this transformative view of creativity as recognition of the role it can play as an agent of potential change within the process of resiliency. These theoretical connections between resilience, creativity and uncertainty suggest that engagements with creative processes and reality-based situations calling for adaptive solutions can promote the resilient agency needed in challenging workworlds.

Meneely & Portillo (2005) assert that an individual exhibiting adaptable thinking is also likely to possess the flexibility necessary to design and potentially transform their domain with original and imaginative solutions.

Nurturing resilience is acknowledged as a critical component for effective learning, with strong evidence of the influence resilient dispositions can have on organisational and individual creativity and innovative problem solving (e.g., Deakin Crick & Goldspink, 2014; Keye & Pidgeon, 2013; Robinson, 2010; Howkins, 2009). This notion of learning power posits the learner's engagement with information and knowledge within a framework of human-learning principles and the dynamics of complex adaptive systems. Awareness of one's own learning power is but the starting point, as the true power emerges when this self-awareness is converted into strategies one applies to the acquisition and production of new knowledge (Deakin Crick et al., 2013). Within this learning power framework, developing one's creative capacities and critical curiosity contributes to a learner's resilient agency (Deakin Crick & Goldspink, 2014). Learning is how we adapt, even if it means we have to take the risk of learning from mistakes.

Adaptive behaviour is a cornerstone of Howkins (2009) creative ecology, so this perspective on resilience connects very strongly with his depiction of "… a network of habitats where people change, learn and adapt." Taking this ecological view has a profound impact on the way we engage with ideas and established facts in all areas of human understanding, and our efforts to navigate the tenuous lines between certainties-uncertainties and creativity-control. In ecological terms, resilience enables one to thrive no matter what changes occur to the system. The dynamism and complexity of any urban landscape requires that we foster our abilities to be creative, innovative, anticipatory and imaginative about any situation that might emerge, especially in relation to data collected as a representation of that landscape.

SMART DATA USE IN A CREATIVE INFORMATION ECOLOGY: OPERATING PRINCIPLES FOR FLOURISHING

Building on the theoretical understandings presented in the previous sections of this essay, a resilient city has the capacity to recover quickly from challenges, continuously learning in the face of uncertainty and fluidity of knowledge. This working understanding forms the basis for four critical operating principles that I believe can enable a smart city to flourish.

1: Data is never complete, information never certain, but action is still required.

As the experiences of the Australian bushfires of 2019-2020 and the COVID19 pandemic remind us, data can never tell the full story. Accounts about the fire behaviour and the limits of data modelling in light of an unprecedented crisis, for

instance, confirmed what many firefighters already knew: that responding to a fire with sufficient speed and efficacy in spite of incomplete information calls on personal experience, i.e., to develop an intuitive understanding of fire, as well as data. As discussed in earlier sections of this essay, the human capacity for imaginative problem solving and problem finding must be nurtured alongside technical know-how. David Levy wrote:

> "We would seem, then, to be losing the time 'to look and to think' at the very moment we have produced extraordinary tools for investigating the world and ourselves and for sharing our findings" (Levy, 2007: 238).

I have echoed Levy's comments in my own work (Anderson, 2011; 2013), digging deeper into the role that intuition, insight and serendipity play in idea generation and scholarship. Alongside the data technologies we build to augment our ways of seeing and being in the world, we need to ensure we are also nurturing all aspects of human intelligence. We must keep the human in our technology design as we design and deploy machines that can support and extend our thinking.

2: Indecision in light of the indeterminacy of information is a threat to the resilience of an urban ecology.

Navigating risk landscapes is critical for the developmental processes described in the resilience frameworks of Luthar et al. (2000) and Metzl & Morrell (2008). We learn by doing. And we can, ironically, learn a lot more sometimes from mistakes than we can by succeeding at the first attempt. Failing at something can also be a precursor to innovation and new ideas when those experiences of failure are framed as opportunities for learning. Matson's (1990) "Intelligent Fast Failure" is an example of a technique that seeks to naturalise the practice. Robinson (2010) asserts that organisations with the strongest adaptive resilience tend to see risk as integral. That the Society of Atomic Scientists referred to indecision as a threat to humanity in their April 2020 Statement about the COVID Crisis (Bulletin Science and Security Board, 2020) signals that we are losing this necessary human ability to sit in and respond to uncertainty and indeterminacy. That announcement also noted that there is a risk in overestimating humankind's ability to control the escalation of a crisis. Perhaps the increasing datafication of our world has led us into a false sense of security about the capacity of data and technology to 'know' our world and help us to make the 'right' decision.

3. Communal Wellbeing should drive the ethics of the system.

To build a resilient culture, I have argued, we need to find ways to individually and collectively engage with risk and adversity. Good governance frameworks are enabling stewarding all data assets and overseeing outcomes in line with the core values of the community. Such a framework provides the assurances of safety and security necessary to enable a community to sit (more) comfortable in uncertainties.

It is therefore critically important that the welfare of the most vulnerable members of any community are looked after and that multi-stakeholder perspectives figure in the governance of any data deployments. The principles of Indigenous Data Governance (IDG) offer guidance that can be applied to the welfare of the city, particularly by alerting us to the powerful controls that data can exert on the most vulnerable sectors of a community. As Carroll et al. (2019) articulate in their exploration of IDG:

> "Indigenous data governance can thus be described as a reciprocal relationship between data for governance and governance of data. The first is a matter of quality, relevance, and access: can Native nations obtain the data they need for governance? The second is a matter of ownership and control: can Native nations manage, protect, and use that data?" (Carroll et al, 2019: 5).

Similarly, data governance in service of urban communities should enable the collection and use of accurate, relevant, and timely data for policy and decision-making, where terms, conditions and relevancy are collectively and dynamically determined. If we allow the wellbeing of a city and her inhabitants – as is so often cited as the motivation for the deployment of data technologies, and to determine the ethics of the system – then it follows that the governance of that system (and its constituent technologies and data) should be in the service of a community's "foundational capacity" (Carroll et al, 2019) to make and implement strategic decisions about their affairs.

4. Design WITH the city rather than FOR the city.

Building on Boholm's (2015) discussion of risk in my work I argue that one of the best ways to navigate uncertainty and risk is through open and honest sharing within trusted relationships that can support your learning and growing. Governments and leaders have a moral and social obligation to reassure the public about their management of data and analytics processes by using controls, processes and standards, providing greater transparency about the way data is used, and articulating the value of any of the resulting systems and technologies they put in place (see for example discussion in OECD, 2017; Standards Australia, 2020). Approaching the governance framework for the data collected by and about the city and her inhabitants in a manner described in the previous section can go some way to building such trust. Overseeing the data on behalf of a community, however, is insufficient on its own. Participatory approaches that get the community involved in the design process from start to finish are powerful tools for building trust into the network.

Increasingly citizens will expect to be involved in the design of the processes by which data about them is collected and used. In their 2017 article for *The Conversation*, Cooray and colleagues assert that

> "In future, citizens will want to drive new ways of interacting with and consuming city services by being actively involved. Therefore, providers of these services need to enable the public to contribute and create more individual-

ised solutions in a citizen-friendly way" (Cooray et al., 2017).

The Benton Report released earlier this year (Riedl, 2020) echoes these concerns, providing examples of smart city co-building and ethical test beds involving community input.

Jer Thorp's 2016 *Medium* post reflects on a particular situation in which big data analysis was so removed from the high school students purportedly represented in that data that a cascading set of errors resulted in mislabelling with potentially detrimental consequences. As he sets the scene for his discussion of ways to 'turn the data around' he observes:

> "It's a world that flows in one direction: data comes from us, but it rarely returns to us. The systems that we've created are designed to be unidirectional: data is gathered from people, it's processed by an assembly line of algorithmic machinery, and spit out to an audience of different people — surveillors and investors and academics and data scientists. Data is not collected for high school students, but for people who want to know how high school students feel. This new data reality is *from* us, but it isn't *for* us" (Thorp, 2016).

If we want to build data systems that respect the citizens from whom the data is sourced, we should be taking into account the wellbeing of people from whom the data is taken in the first place and create public, shared data spaces. Public value and public inclusion need to be foregrounded to mitigate the risk of reiterating – or worse still, amplifying – inequities and distrust in the design of government services.

CLOSING THOUGHTS: KEYSTONES ENABLING A SMART CITY TO THRIVE

As discussed in earlier sections of this paper, applying an ecological perspective to our discussion of a smart city draws attention to sociotechnical interdependencies, complexity and ever evolving networks of action. And, as I have asserted in the previous section, respecting all members of that urban ecology as first-class citizens means designing smart city technologies WITH the city's inhabitants and not simply seeking to design with their welfare in mind. Staying with this ecological perspective, I close this essay with reflection on some practices that we can put in place to set us up for success as flourishing, creative, learning, compassionate cities capable of harnessing the full productive potential of data technologies.

Within any ecology, it is also possible to identify keystone species. Like the keystone at the apex of a masonry arch, the strength and security of keystone species shapes the overall health of the ecosystem; and **trust** is a keystone for building and maintaining a flourishing modern city.

Global communications firm Edelman has been studying trust for twenty years, sharing their findings through the Edelman Trust Barometer and ongoing global surveys. Their 2020 findings on trust in business, government, media and NGOs reveal an erosion of trust in all four sectors, which Edelman attributes to

"...people's fears about the future and their role in it, which are a wake-up call for our institutions to embrace a new way of effectively building trust: balancing competence with ethical behavior". (https://www.edelman.com/trustbarometer)

As my own explorations in this matter have shown, there is a link between vulnerability, uncertainty and trust. Trust is what allows us to move beyond doubt and into a more productive and positive engagement with the unknowns of our worlds – in the present and in our possible futures. We are more likely to tolerate the uncertainty of any situation we face when we have a sense of trust about the people or setting involved. In the early stages of the declaration of the global COVID-19 pandemic, consulting firm McKinsey made similar observations:

> "In crises, the state plays an essential and expanded role, protecting people and organizing the response. This power shift transforms long-held expectations about the roles of individuals and institutions" (Craven et al., 2020).

In light of this erosion of trust, they argue, a rethinking of the social contract is taking place. These comments are consistent with the observations presented earlier in this essay about the growing demand for digital inclusion and socially-responsible technology. In line with this concern, I propose five Keystone Practices for creating this critical climate of trust:

- Community
- Civility
- Communication
- Connection
- Commitment

The notion of **Community** has permeated this essay. An urban ecology is by very definition a communal entity. If we are to preserve and protect the fragile ecology of our modern cities as we look to data and technology to help us tackle the wicked problems of our time, the complexity of all these constituent parts needs to be front of mind. **Civility** involves showing mutual respect and empathic understanding. Alongside the erosion of trust we are witnessing a rise in hate-speech and efforts to shut down opposing viewpoints. As noted earlier about the perception of risk and tolerance of uncertainty, in the midst of our contemporary uncertainties, such behaviours are detrimental. It is increasingly recognised that listening shows leadership. One does not need to agree with another's point-of-view to listen to their concerns. Ensuring there are platforms for civil discourse where ALL members of a community listen to and learn from the concerns and fears of others is a keystone practice. Following on from civility, **Communication** that is consistent and honestly presents not only what is known, but what is not known (aka: uncertain). For a government or the leadership of a city, for instance, practicing open, honest and consistent communication about reasons for taking specific actions contributes to the transparency about the decisions undertaken for and on behalf of citizens. Furthermore, communication must run both ways – which returns us to the value of listening and seeking out the views of others. **Connection** points to deeper un-

derstanding about and appreciation of the complexities of our world, and to the role that intuitive understandings play in our individual and collective sensemaking, connecting to the world around us. Indigenous knowledge perspectives speak about grounding in country (locality). Such principles for country-centred design grounded in the deeply abiding practices of first nation peoples is not only a way to pay respect to the land and her inhabitants but also to sensitise us to forms of evidence that extend beyond what might be directly visible at any point in time. **Commitment** points to the need for professionalism. Linking back to the discussion about the role that competence plays in trust building, as data professionals we need to nurture social and technical competencies; creative and analytic; communal and individual. Building on the earlier point about civility, it involves patience and persistence, as well as listening. Consequently, there must be a commitment to communication in line with the mechanisms for feedback Thorp (2016) describes.

Supporting these six keystone facets of an urban ecology can create a city that is 'smart', sustainable and compassionate. Reflecting on recent displays of leadership, New Zealand Prime Minister Jacinda Ardern's landslide re-election victory in October 2020 points to growing appreciation for empathic and inclusive leadership displaying these qualities. Thus, the keystones presented here for building the trusted partnerships are necessary to create the 'smart city' data technology and urban data ecology.

NOTES

1. See https://www.abc.net.au/news/science/2020-03-05/bushfire-crisis-five-big-numbers/12007716.
2. See news reports of the scale of the firestorms such as: https://www.abc.net.au/news/2020-01-03/scientific-modelling-not-coping-with-current-bushfires/11839356.
3. Story about returning WW1 soldiers placed into quarantine in Manly: https://www.dailytelegraph.com.au/newslocal/manly-daily/troops-returned-from-hell-of-war-to-the-flu-terror-and-snakeinfested-quarantine/news-story/f7ad25b6c0fa40c98058f76d2a63126e.
4. The Editor of the Bulletin provides the following explanation of the Doomsday Clock's origins: "Founded in 1945 by University of Chicago scientists who had helped develop the first atomic weapons in the Manhattan Project, the Bulletin of the Atomic Scientists created the Doomsday Clock two years later, using the imagery of apocalypse (midnight) and the contemporary idiom of nuclear explosion (countdown to zero) to convey threats to humanity and the planet. The decision to move (or to leave in place) the minute hand of the Doomsday Clock is made every year by the Bulletin's Science and Security Board in consultation with its Board of Sponsors, which includes 13 Nobel

laureates. The Clock has become a universally recognized indicator of the world's vulnerability to catastrophe from nuclear weapons, climate change, and disruptive technologies in other domains." https://thebulletin.org/doomsday-clock/current-time/#full-statement.

5. The term creativity is not formally defined in this paper but falls within the scope of discussion within the Adelphi Charter (Royal Society, 2006) and the creative ecology portrayed by Howkins (2009: 9), who contends that creativity 'can be described but not defined and indeed has always been conditional'.
6. See for instance press releases here: https://smart-cities.com.au; http://smartcities.gov.in/content; https://israelsmartcities.org; https://www.transportation.gov/smartcity.
7. See: http://playnpause.org for a brief encapsulation of these four phases states.
8. See for instance https://www.abc.net.au/news/2020-01-03/scientific-modelling-not-coping-with-current-bushfires/11839356.
   https://www.abc.net.au/news/2020-03-17/coronavirus-cases-data-reveals-how-covid-19-spreads-in-australia/12060704.
9. See for instance: https://www.smh.com.au/national/is-jacinda-ardern-the-world-s-most-effective-leader-20200507-p54qp7.html; https://www.aljazeera.com/news/2020/11/2/jacinda-ardern-names-incredibly-diverse-new-zealand-cabinet.

REFERENCES

Adams, K. (2006) The sources of innovation and creativity: A paper commissioned by the National Centre on Education and the Economy for the New Commission on the Skills of the American Workforce. September 2005. Retrieved from http://www.fpspi.org/pdf/innovcreativity.pdf.

Amabile, T. M. (1998) How to kill creativity (cover story). *Harvard Business Review*, **76**(5): 76-87.

Anderson, T.D. (2006) Uncertainty in action: Observing information seeking within the creative processes of scholarly research. *Information Research*, 12(1) paper 283. Available at http://InformationR.net/ir/12-1/paper283.html.

-----. (2010) Mobile design: Giving voice to children and young people. In: Donald, S. H., Anderson, T. D., & Spry, D. (Eds.). *Youth, society and mobile media in Asia*. London: Routledge. 135-151.

-----. (2011) Beyond eureka moments: Supporting the invisible work of creativity and innovation. *Information Research*. 16(1) paper 471. http://InformationR.net/ir/16-1/paper471.html.

-----. (2013) The 4Ps of innovation culture: Conceptions of creatively engaging with

information. *Information Research*, 18(3) paper C28. Available: http://www.informationr.net/ir/18-3/colis/paperC28.html.

Bateson, G. (1987) *Steps to an Ecology of Mind*. Northvale, NJ & London: Jason Aronson.

Boholm, A. (2015) *Anthropology and Risk*. London: Routledge.

Bulletin Science and Security Board (April 15, 2020) "COVID-19 and the Doomsday Clock: Observations on managing global risk", Available: https://thebulletin.org/2020/04/covid-19-and-the-doomsday-clock-observations-on-managing-global-risk/

Bush, V. (1945, July) As we may think, The Atlantic Monthly, 176(7), 641-649. Retrieved from http://www.theatlantic.com/magazine/archive/1969/12/as-we-may-think/3881/

Carroll, S. R., Rodriguez-Lonebear, D., & Martinez, A. (2019) Indigenous Data Governance: Strategies from United States Native Nations. *Data Science Journal*, 18(1), 31. DOI: http://doi.org/10.5334/dsj-2019-03

Cooray, M., Duus, R., & Bundgaard, L. (2017, Aug 23) Technology is not Enough to Create Connected Cities – Here's why. https://theconversation.com/technology-is-not-enough-to-create-connected-cities-heres-why-82740

Craven, M., Mysore, M., Singhai, S., Willson, M. (2020) McKinsey COVID-19: Briefing note #5, April 13, 2020, https://www.mckinsey.com/business-functions/risk/our-insights/covid-19-implications-for-business

Csikszentmihalyi, M. (1996) *Flow and the Psychology of Discovery and Invention*. Harper Perennial, New York.

Deakin Crick, R. & Goldspink, C. (2014) Learner dispositions, self-theories and student engagement. *British Journal of Educational Studies*, 62:1: 19-35.

Deakin Crick, R., Haigney, D., Huang, S., Coburn, T. & Goldspink, C. (2013) Learning power in the workplace: The effective lifelong learning inventory and its reliability and validity and implications for learning and development. *The International Journal of Human Resource Management*, 24:11, 2255-2272.

European Commission. (2010) Unlocking the potential of cultural and creative industries. Green Paper, Brussels, COM(2010)183. Retrieved from http://ec.europa.eu/culture/our-policy-development/doc/GreenPaper_creative_industries_en.pdf.

Florida, R. (2001) *The Rise of the Creative Class*. New York: Basic Books.

-----. (2012) *The Rise of the Creative Class, Revisited,* New York: Basic Books.

Green, B. (2019a) Cities are not technology problems: What smart cities companies get wrong. *Metropolis*, 4 March 2019. Available: https://www.metropolismag.

com/cities/ben-green-smart-enough-city/

-----. (2019b) *The Smart Enough City: Putting Technology in its Place to Reclaim Our Urban Future.* Boston: The MIT Press.

Green, H. & Hannon, C. (2007) Their space: Education for a digital generation [Pamphlet] Retrieved from http://www.demos.co.uk/files/Their%20space%20-%20web.pdf.

Hill, Adrian V (ed.) (2020) *Foundries of the Future: A Guide to 21st Century Cities of Making*. With contributions by: Ben Croxford, Teresa Domenech, Birgit Hausleitner, Adrian Vickery Hill, Han Meyer, Alexandre Orban, Víctor Muñoz Sanz, Fabio Vanin and Josie Warden. Delft. TU Delft Open, 2020.

Howkins, J. (2009) *Creative Ecologies: Where Thinking is a Proper Job*. St. Lucia, Queensland: University of Queensland Press.

Jones, B. (1984) Facing the brave new world: Will the sleepers wake in time?" In Randell, S. (ed.). *The Human Face of Technological Change: Theme Papers from the Silver Jubilee Conference of the Australian College of Education* (25th, Australian Capital Territory, Canberra, May 5-9, 1984). Carlton VIC: Australian College of Education. pp. 13-20. ISBN 0909587329.

Keye, M. D., & Pidgeon, A. M. (2013) Investigation of the relationship between resilience, mindfulness, and academic self-efficacy. *Open Journal of Social Sciences*, *1*(06): 1-4.

Levy, D. M. (2007) No time to think: Reflections on information technology and contemplative scholarship. *Ethics and Information Technology*, *9*(4): 237-249.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000) The construct of resilience: A critical evaluation and guidelines for future work. *Child development*, *71*(3): 543-562.

Maguen, S., Papa, A., & Litz, B. T. (2008) Coping with the threat of terrorism: A review. *Anxiety, Stress & Coping*, 21(1): 15-35.

Masten, A. S., & Powell, J. L. (2003) A resilience framework for research, policy, and practice. In S.S. Luthar (Ed.) *Resilience and vulnerability: Adaptation in the Context of Childhood Adversities* New York: Cambridge University Press, 1-25.

Matson, J. V. (1990) Failure as part of the success equation. *The Journal of Creative Behavior*, *24*(4): 275-278.

Mecklin, John (Editor) (2020) Closer than Ever: It is 100 seconds to midnight. 2020 Doomsday Clock Statement, Science and Security Board Bulletin of the Atomic Scientists Editor, John Mecklin. https://thebulletin.org/wp-content/uploads/2020/01/2020-Doomsday-Clock-statement.pdf;https://thebulletin.

org/doomsday-clock/current-time

Meneely, J., & Portillo, M. (2005) The adaptable mind in design: Relating personality, cognitive style, and creative performance. *Creativity Research Journal*, *17*(2-3): 155-166.

Metzl, E. S., & Morrell, M. A. (2008) The role of creativity in models of resilience: Theoretical exploration and practical applications. *Journal of Creativity in Mental Health*, *3*(3): 303-318.

Ministry of Housing & Urban Affairs, Government of India (2020) Climate Smart Cities Assessment Framework 2.0, Available https://smartnet.niua.org/csc/assets/pdf/CSCAF_2_Booklet.pdf

Moyle, K. (2010) *Building innovation: Learning with technologies*. *Australian Education Review*, Number 56. Retrieved from http://research.acer.edu.au/aer/10.

Nardi, B. & O'Day, L. (1999) *Information Ecologies: Using Technology with Heart*. Cambridge, MA: MIT Press.

Newbigin, J. (2010) The Creative Economy: An Introductory Guide. British Council's Creative And Cultural Economy Series, London: British Council. Available. https://creativeconomy.britishcouncil.org/media/uploads/files/English_GuideToolkit_30_withCoverLR.pdf

OECD (2017) *Embracing Innovation in Government Global Trends.* World Government SummitDubai, United Arab Emirates, 12-14 February 2017 Available:https://www.oecd.org/gov/innovative-government/embracing-innovation-in-government.pdf

----- (2020) *Smart Cities and Inclusive Growth*. Building on the outcomes of the 1st OECD Roundtable on Smart Cities and Inclusive Growth. Available: https://www.oecd.org/cfe/cities/OECD_Policy_Paper_Smart_Cities_and_Inclusive_Growth.pdf

Parmar, R., Mackenzie, I., Cohn, D., & Gann, D. (2014) The New Patterns of Innovation. *Harvard Business Review*, *92*(1-2), 86-95.

Pratt, A. C. (2012) A world turned upside down: The creative economy, cities and the new austerity. In: A. Beauclair & E. Mitchell (Eds), *Smart, Creative, Sustainable, Inclusive: Territorial Development Strategies in the Age of Austerity*,. Brighton: Regional Studies Association, 13-19.

Riedl, Denise Linn (June 2020) *Toward Inclusive Urban Technology*. Evanston, IL: Benton Institute for Broadband & Society. https://www.benton.org/publications/inclusive-urban-tech

Robinson, K. (2009) *The Element (written with Lou Aronica)*. London: Penguin.

Robinson, M. (2010) *Making adaptive resilience real*. Arts Council, England. Available http://www.artscouncil.org.uk/media/uploads/making_adaptive_resilience_real.pdf.

Royal Society for the Encouragement of Arts Manufactures & Commerce (RSA) (2006) *Promoting Innovation and rewarding creativity: A Balanced Intellectual Property Framework for the Digital Age*. London: RSA.

Standards Australia (2020) Smart Cities Standards Roadmap, available: https://www.standards.org.au/getmedia/bfe42f98-011e-4798-8fa5-5b70c8a2a6bd/SA_Smart_Cities_Roadmap.pdf.aspx)

Tims, C. & Wright, S. (2007) *So What Do You Do? A New Question for Policy in the Creative Sector*. London: Demos. Retrieved 30 September, 2013 from http://creative-blueprint.co.uk/library/item/so-what-do-you-do.

Thorpe, J, (2016, 19 Nov) Turning Data Around, Medium, Available: https://medium.com/memo-random/turning-data-around-7acea1f7479c

Wallerstein, I. (1998) Uncertainty and creativity. *The American Behavioral Scientist*, 42(3): 320-322.

Wolin, S. J., & Wolin, S. (2010) *The Resilient Self: How Survivors of Troubled Families Rise Above Adversity*. New York: Villard.

Wright, S., Newbigin, J., Kieffer, J., Holden, J. & Bewick, T. (Eds) (2009) After the Crunch, Creative & Cultural Skills and Counterpoint, British Council Think Tank. Retrieved from:http://creativeconomy.britishcouncil.org/media/uploads/resources/russia-projects-creative-economy-after-the-crunch.pdf.