

At the Root of Change: The History of Social Innovation

Abstract:

This paper introduces a new theory surrounding the process of social innovation using historical case studies. Using the particular example of the lifecycle of the intelligence test over the first half of the twentieth century in the United States, we discuss the hypothesis that the discovery/definition of new social phenomena (naturalistic, constructed, and technological expressions of what we can, ought or will do, that direct or influence behavior) and combination of new and extant phenomena provide the necessary intellectual space and impetus – through glimpses of what could be, seen through the lens of new social phenomena – for the creation of clusters of inventions and innovations. One or more of these innovations, when scaled up or out, can ultimately shift an entire system. This process requires the work of multiple actors, occupying three general roles, the poet, the designer and the debater. Historical data suggests these agents act on both the niche and landscape level, and can travel effectively between them, spotting approaching windows of opportunity to create pathways to their desired adjacent possible, while incubating new social innovations. These observations are based on a comparison of a growing body of historical cases of social innovations.

Frances Westley (fwestley@uwaterloo.ca)

Katharine McGowan (k2mcgowa@uwaterloo.ca)

University Of Waterloo
200 University Ave W
Waterloo, ON
Canada
N2L 3G1

1. Introduction

This paper introduces a new hypothesis that explores the roots and developments of social innovation through comparative historical case studies. Specifically, this paper will introduce the theoretical and methodological framework for this historical discussion, several preliminary trends we have observed, and a more detailed discussion of one specific case, the emergence of the intelligence test, to explore the key dynamics that have emerged in the early stages of research and comparison. These include: new ideas' shift the intellectual landscape, and create the space for novel combinations; the complimentary and compiling efforts of poets, debaters and designers (different roles for agents), and; the importance of agents' functioning at both the niche and landscape level.

Social innovation, unlike technological innovation, is driven in part by the changes in ideas and discourse over time. This paper, as part of a larger project, examines this process: the discovery/definition of new social phenomena (naturalistic, constructed and technological) provide the opportunity for the creation of clusters of inventions and innovations. This opportunity is a glimpse of the adjacent possible – the scope of possible social arrangements one degree removed from current realities (Kaufmann, 2000). These innovations and inventions can ultimately cause an entire system to shift, potentially moving to a place of greater resilience, and rooting those new social phenomena as core ideas in the new iterations of the system in question. The new ideas – new social phenomena (rules about our social, natural and/or technical world) – spark exploration, invention and innovation. Wallerstein (1974) argued truth changes because society changes, but we suggest as new truths emerge and compete for dominance, it creates the space for society to follow suit.

2. Research Methodology

Geoff Mulgan (2006) points to the “radical innovation” origins of much of our current lives. Although Mulgan sees social innovation as a response to modernity's twin pillars, industrialization and urbanization, many radical ideas that shifted society emerged long before the 18th and 19th centuries, some of which are still embedded in our society while others have been displaced in Popper-esque fashion. History allows us to observe patterns and disruptions across multiple scales: “historically we can see what happened” (Byrne, 1998: 26).

This level of holism is the goal of many contemporary studies of resilience and complexity (van der Leeuw et al, 2011) and yet the tension between capturing detail and context and deriving valid conclusions of our examination require a method that allows both for forest and trees. Berks and Folke (1998) argue the characteristics of complex systems *require* case studies. Several excellent studies have employed historical cases in their research into complex systems (Gunderson et al, 1995; Berkes & Folke, 1998; Ommer, 2007; Redman & Foster, 2008; Bures & Kanapaux, 2011). In the raw, history provides a rich resource for those looking to understand social processes, but there is equal risk of over-emphasizing detail, context and specificity, as there is of imposing rigid theory on the messy complexity of human systems; “historical depth is an invaluable aid to understanding problems in the present day, what went wrong, and thus what may be the way to move on productively” (Ommer & Paterson, 2014: 17). In complex systems, information and behaviours do not necessarily scale up neatly or evenly; activity at the micro-level does not simply add up to produce outcomes at the

macro level and one does not explain the other. Hence the benefit of performing multiple cases, with replication in questions and design, to allow cross-case comparison (Yin, 2003). Multiple cases allow the researcher to dig deep into the dynamics of one case, bounded in time and space, but “always considered within the broader concerns of the overarching research question” (Ommer, 2007: 26).

Case Selection. At this stage of our comparative historical project, we have completed case studies on the development of the internet, financial derivatives, the national parks, birth control, the intelligence test, the Dutch East Indian Trading Company, Canada’s Indigenous (Indian) Residential schools, and the Canadian Health Care System.

This is an exploration: were there common mechanisms or trends across disparate disruptive shifts? We began by identifying a significant institutional shift (such as the introduction of a new law). Looking at these discrete moments, we asked what were the goal(s) of this new legislation or institutional change (rather than the result, for instance), and we looked for the windows of opportunity that made this change possible. Therein we looked for new ideas: we considered both the description/discovery of new ideas and the convergences of new and existing ideas and trends, and asked if any of these new ideas constituted a new social phenomenon.

3. Theoretical Framework

Social innovation is of increasing interest in the discourse of wicked problems, limited resources, and ingenuity gaps (Rittel, 1972; Westley, Patton & Zimmerman, 2006; Bason, 2010; Homer-Dixon, 1995). Despite its veneer of novelty, humans have experimented and achieved disruptive, durable change repeatedly – social innovation is a common dynamic of human story. This is especially important from an analytical standpoint, as the number of historical examples increases our pool of social innovations, allowing us to test multiple theories and look for overarching patterns and commonalities across cases. The theoretical framework we employ to compare historical social innovation is composed of three broad categories: the driving force of new (and new combinations of) ideas into the adjacent possible; the compilation of agents’ activities; and the importance of the niche and landscape level.

3.1 New Ideas, Novel Combinations.

Combination is commonly acknowledged as a key mechanism in technological invention, and scientific discovery, and similarly bricolage as a key mechanism of innovation generally (van den End & Kemp, 1999; Becker et al., 2006; Arthur, 2009; Biggs et al., 2010; Thagard, in press). Brian Arthur (2009) suggested new technologies and technological domains emerge as the result of the discovery of new naturalistic phenomena (see below), as well as through the combination of existing technologies within and across domains. Similarly, looking at 100 scientific discoveries and 100 technological innovations, Paul Thagard (in press) sought common features of how individuals involved in those breakthroughs had perceived and/or created novelty. Thagard credited combinations of mental representations as the most common, compelling explanation for the creative process.

This study considers a social dimension of the combinatorial hypothesis of invention. We examine how the emergence of new social phenomena (discrete new ideas about society, nature, technologies, processes and/or the individual) creates the

opportunity for new and/or re-interpretations of social arrangements, and of human behavior, individually or collectively. These new social phenomena allow for glimpses of the “adjacent possible,” the range of alternative social arrangements just beyond the horizon of prevailing practice (Kauffman, 2000; Johnson, 2010). Translating this glimpse into action, agents create new processes, products, programs and eventually policies, all or any of which can produce deep shifts in complex social systems. The exploration of the adjacent possible is a key dynamic of social innovation.

We propose three general categories of social phenomena: naturalistic, constructed, and technological. Naturalistic phenomena are primarily discovered in the realm of science. An example of a new and transformative naturalistic phenomenon was the discovery of the microbial cause of cholera, which replaced the miasma hypothesis, and arose from discrete observations were strengthened through data collection of men such as John Snow (Johnson, 2006). Constructed phenomena are concepts that a discrete group (a culture, a sect, a political group) believes to be true and guides their behavior accordingly. These reflect an earlier sociological concept – the social fact – ideas/rules/beliefs that are real in their effects (if not always strictly tangible or falsifiable), and constrain or direct our activities (Durkheim, 1912; 1968). Technological phenomena consist of individual technologies (a car, a computer, although both are composed on subsidiary technologies) and technology regimes. New technologies can enhance our ability to engage with the natural world, or achieve insights into the workings of our own bodies. Similarly, new technologies or technology regimes such as the internet can affect how we live, and how we interact, organize our economies and affect the flows of power.

3.2 The Heterogeneity of Agency.

The social innovation process is the result the interaction of agency and institutional dynamics (North 1990; McCallum et al., 2009). In our exploration of historical social innovation, we further distinguish agents’ behavior and roles into three categories (adopted from Alex Himelfarb, 2013) – the poet, the designer and the debater. These are agent ‘roles’ (an agent can transition between roles), and the success of a disruptive social innovation relies of the cooperation or compilation of their efforts at specific moments and over time. The poet shapes or expresses the new idea or social phenomenon, the designer converts the phenomena into an innovation (a policy agenda, a program, product, etc), and the debater advocates for either the innovation, the new phenomenon or both.

The debater is the historical systems entrepreneur, who champions an innovation through the system, convening different stakeholders and interests, and “finding the opportunities to leverage innovative ideas for much greater system impact” (Westley, 2013). The roles of designer and poet are not directly translatable to the existing concepts of social entrepreneur as defined or discussed in business or social change literature (Peredo & McLean, 2006; Mair & Marti, 2006; Bornstein, 2007; Gunn & Durkin, 2010; Abu-Saifan, 2012). Perhaps this is a function of the difference in breadth between the concepts. The poet, who first observes and/or describes a new social phenomenon, is not necessarily tied to the social innovation or social change process. Instead, that role falls on the designer, who sees the opportunities created through the adjacent possibles opened through the description of this new phenomenon.

For instance, the early 19th century romantic artists and explorers who first praised the ‘pristine’ and distinctive quality of America’s interior did not themselves decide that large public parks were the appropriate means to protect and share that experience. Their celebration of wilderness was the inspiration for the creation of the first national park at Yosemite during the American Civil War. It took the combined work of men like landscape architect Frederick Law Olmsted (a designer who wrote a manifesto for parks) and businessman-turned environmentalist John Muir (founder of the Sierra Club) to lobby the public and government to create a system of parks open to the entire American population. Poets, designers and debaters built on the work of each other to create disruptive change.

3.3 Scale.

To achieve the sort of broad, lasting change associated with social innovation, that change must cross multiple scales (Westley et al, 2011). Scales are not impermeable layers, but are relevant in the “reflexive relationship whereby action is constrained and enabled by structure, but through reflexive feedback, structures are also changed by agency” (McKay & Tambeau, 2013: 676). Cross-scale cross-case comparison proved initially problematic. Unlike some of the interesting examinations of socio-technical transitions from the DRIFT group using their niche, regime and landscape framework (Geels, 2006; Geels & Schot, 2007), our cases considered highly variant problem domains, geographical domains (regional, national and international) and temporal scales, which made defining a common “regime” or a similar meso-level of analysis difficult across cases. This problem of geographical scale and defining regimes has been remarked elsewhere as well (Smith, Voss & Grin, 2010), although this might in part reflect the broader focus of this study into social innovation (including technological innovations) rather than the specific focus of the socio-technical transition literature. The landscape and niche however proved critical in understanding the movement of ideas to open the adjacent possible.

The landscape was comprised of the “backdrop that sustains society” (Geels & Schot, 2007: 403) ranging from the physical environment to the “political constellations, economic cycles, and broad societal trends” (Westley et al, 2011). Borrowing from the Resilience Alliance’s heuristic discussion of resilience, we describe basins of attraction across the landscape (Walker et al, 2004), deepened by landscape conditions, the collection of resources, and the influence of overarching ‘big ideas’ (such as democracy, capitalism, scientific progressivism) that maintain stable states within that broader landscape. We also identified the importance of historical niches, protective spaces where agents exchange ideas, experiment and explore relative possibilities.

Building on the assertion that a disruptive innovation can trigger the transition of a system from one basin of attraction to another, and that an institutional or systems entrepreneur can also lower the thresholds between proximate basins (Hwang & Christensen, 2007; Westley et al, 2011), we sought historical examples of this dynamic within our cases. What we found was the ability of agents to travel between the niche and landscape level to be able to aid critical transitions and advocate for their particular innovation. In the case of the World Wide Web, we found that designers (frequently programmers) often considered what could be done technologically (working in research institute niches for instance), but also what *should* be done. The latter question was a

landscape-level concern, as designers like Ted Nelson (*The Computer Manifesto*) sought to create an open, egalitarian web, which reflected their political/social values broadly.

Hence, the theoretical framework we develop encompasses both agency and structure, and innovation and exploration as a dynamic thing, both spontaneous and contingent as well as deliberate and thoughtful. We seek to understand not just the conditions that favour disruptive change but the behaviours that encourage it; the important actors and milestones as well as the life cycle of an idea to innovation to disruption to orthodoxy and beyond.

4 The Intelligence Test: an explanatory case

The creation of the intelligence test was a specific solution to a concern about how to arrange people in an emerging modern meritocracy and industrial economy, grounded in the growing faith in scientific progressivism to improve society and individuals. The particular scientific or pseudo-scientific basis for the tests relied on a combination of inheritance, and social Darwinism, as well as new scientific techniques that facilitated repeatable mass testing. There were two poets, Sir Francis Galton (the creator of Social Darwinism) and Alfred Binet, who articulated mental capacity as “intelligence.” The designers however experimented with the potential of testing mental capacity beginning two decades before Binet debuted his test in 1911, and continued to refine Binet’s test for years to come. Two key debaters advanced the idea of testing in America, Henry Herbert Goddard, a psychologist who worked with the “feebleminded”, and Robert Yerkes, a psychologist whose chairmanship of the American Psychological Association (APA) during the First World War allowed him to successfully advocate for testing for all American army recruits. These designers worked in their niche laboratories, and the most successful debaters were able to see the policy implications beyond their lab, and read signals of potential landscape shifts as opportunities to advance the use of the intelligence test.

4.1 New Ideas, New Combinations & Adjacent Possibles.

There were two key new naturalistic phenomena (re)discovered in the 19th century that had foundational effects on education and the treatment of children. First, Darwin’s description of natural selection, that “works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection” (Chitty, 2007: 25). Second was the rediscovery of Mendel’s rules of genetic inheritance, specifically heredity. Could science help build a better society, and validate the extant social hierarchy based on merit and possibility?

If humans were genetically different (eye colour, height, i.e.), some reasoned the same could be said for character, for intelligence and achievement, as well as social problems such as crime and poverty (O’Brien, 2011). Darwin’s second cousin, Francis Galton (a poet for scientific progressivism’s ability to improve society, and rank humanity according to measurable merit), applied natural selection to explain social stratification: those who enjoyed the spoils of society were closer to “perfection” than their lesser fellows (Chitty, 2007; Dudziak, 1986). This ‘Social’ Darwinism mixed scientific-social validation of a class-based society (inequality of situation and opportunity), combining naturalistic and constructed phenomena. So emerged a new adjacent possible: specifically, might heredity and science build a better population? These views defined

the intellectual niche of Eugenics, the science of improving the “quality” of humanity (Chitty, 2007). “Better” meant racial purity, and was usually seen from a middle or upper middle class Protestant perspective, borrowing elements from Malthusian and Darwinian theory (Dudziak, 1986; Zenderland, 1998). Importantly, the originator of social Darwinism, Francis Galton, was deeply passionate about creating data to support his hierarchical social theory, “whenever you can, count” (Herrnstein & Murray, 1994).

If ability could be traced through family lines, then could the same be said of those who found themselves among the dregs of society? Among many concerned with social improvement in the late 19th and early 20th century, a significant threat to public safety and social progress was the “Menace of the Feeble-minded” (Samelson, 1987: 114). If “better” was possible, so too it must be possible to eliminate society’s least desirable, specifically those labeled “feeble-minded.” According to the view, the feeble-minded posed a several-pronged threat (reflecting in part the confused and flexible definition of feeble-mindedness): they were incompetent (and idle) so they did and could not contribute to the economy, collectively and individually they represented a threat to public health and morals as they were liable to commit such sins as “promiscuity, adultery, incest, crime and alcoholism” (Dudziak, 1986: 845; Zenderland, 1998). Thanks to the combination of these social views with the naturalistic phenomena of inheritance, negative behaviours were perceived as the result of bad genes, and therefore fixed more than environmental.

4.2. Innovation(s).

The belief that the differences between people, including ability, character and intelligence, are measurable and determinate, opened up a significant possibility for educators (an adjacent possibility). Progressives had campaigned for decades for technical and scientific expertise in designing, implementing and evaluating public policy (Cravens, 1987). Within this broader debate about the direction and content of the public realm, the education regime in North America and Western Europe was undergoing a fundamental pedagogical shift, from philosophy to psychology (Blanton, 2000; Cravens, 1987). Education had become the state’s purview in many Western countries, and education officials sought to take advantage of the new scientific quantitative measurement methods to effectively and definitively test and stream their student bodies (Chitty, 2007).

To address the concerns of feeble-mindedness in schools, an association of American teachers established special education programs in 1902 as an innovation to tailor education to the limitations or specific needs of a class of students (Zenderland, 1998). But to educate the feeble-minded, there needed to be an effective, reliable method of sorting the student population. Education officials sought to take advantage of the emerging statistical study of human populations (a new technological process), especially the permanent census (Ramsden, 2003). The ability to collect and process large amounts of data about a state’s population informed many aspects of the growing state’s responsibilities, including the management of the classroom. There was competition between different types of tests, and different assumptions of how hereditary intelligence could be measured, but most failed to scale beyond the small niches in which they developed (Sokal, 1987).

The poet (and designer) in the case of the intelligence test was Alfred Binet. Binet devised the first reliable test of children’s cognitive capabilities (based on the twin

assumptions that ability is based on genetic inheritance rather than environmental factors, and that it can be mapped systematically over time) to distinguish the mentally incapable from those failing for environmental, rather than genetic reasons (Chitty, 2007; Zenderland, 1998). Instead of looking for physical or behavioral cues for mental capacity (previously the dominant means of, the tester should look to cognitive capacity alone – hence the concept of intelligence, itself a new naturalistic phenomenon that rooted his innovation of testing for Intelligence Quotient (I.Q.) (Zenderland, 1998). Those children whom the test “objectively” indicated were “feeble-minded” could be institutionalized, a separation believed to be for the best interest of themselves and society generally (Blanton, 2000: 1016).

4.3 Scaling towards a Tipping Point & Mass Adoption.

In this case, one key debater for the intelligence test, and intelligence as a naturalistic phenomenon was Henry Herbert Goddard. Goddard was a psychology, Director of Research at the Vineland Training School for Feeble-minded Girls and Boys in New Jersey, a niche that allowed him to experiment with different tests. Goddard was perpetual advocate for intelligence testing and the role of psychology in education, successfully shifted the narrative of feeble-mindedness in America to a question of intelligence (Zenderland, 1998). Goddard advocated for the theory that “feeble-mindedness” was the result of intelligence (or lack thereof), and a simple test could differentiate these children from the broader class. He was able to convince American doctors working in institutions for the feeble-minded to “redefine mental deficiency in terms of intelligence” (Zenderland, 1998: 104). Goddard’s advocacy work broadcast Binet’s ideas and processes linked with I.Q., and achieved medical and institutional legitimacy for intelligence tests (Zenderland, 1987).

At first, the solution to “feeble-mindedness” was institutional segregation. Advocates believed that a good institution could even train the “feeble-minded” to “go out into the world and support themselves,” but that would only be allowed once surgical techniques allowed for safe sterilization of the “feeble-minded” to remove “the terrible danger of procreation” (Zenderland, 1998: 181-182; Dudziak, 1986). If “feeble-mindedness” was inherited, then removing any question of genetic transmission could remove the major threat the “feeble-minded” posed to society.

4.4 Disruptions, Social Shifts.

The intelligence test quickly facilitated another form of social control on the “feeble-minded.” Specifically new medical technology allowed for safe sterilization of those deemed feeble-minded. Beginning with Indiana in 1907, 28 states introduced compulsory sterilization laws (although it was not until the case of Carrie Buck in 1925 than any of these laws were upheld at the state supreme court level) (Dudziak, 1986). Mass testing also validated racial assumptions about the hierarchy of races. Binet explicitly did not want his test to be used to rank people beyond separating those who fell below a certain floor and could benefit little from conventional education (Blanton, 2000). Once the process was available however, it was quickly seized on to differentiate people based on intelligence and race.

4.4.1 A Deep Dive. The intelligence test’s ultimate success in America relied on the successful complimentary activities and intentional cooperation of several well-

placed individuals and emergent professional associations. The context in which these individuals functioned is equally important – American academia and bureaucracy during a time of crisis – the First World War – for which the United States Army seemed to have been relatively poorly prepared (despite the fact the war was nearly three years old when the Americans joined on Easter, 1917). The Army decision-makers searched for tools (people and processes as well as technology) that could facilitate their war effort, from soup to nuts – they needed to recruit, dress, train and equip an Expeditionary Force for overseas service for a war already in progress.

The creation of a citizen army – soldiers picked from a workforce that spanned from industry, to agriculture and white-collar work – created significant opportunities for the emergent profession of psychology. Over the late 19th and early 20th century, psychology developed as a discipline of academic inquiry and an outward-looking consultative profession, in which the role of testing was introduced early, although not without controversy. The American Psychological Association (APA) was founded in 1892, in which the Committee on Physical and Mental Tests was created three years later (Watson, 1953). G. Stanley Hall was one of testing's (along with Freudian theories and psychology generally) chief "propagandists," and he was exceptionally well-placed to advocate for the tool in psychology: Hall was president of Clark University, worked at Johns Hopkins, held weekly clinics at the Bay View Hospital, and both taught and demonstrated for psychiatrists at the Worcester State Hospital (Watson, 1953). Among Hall's students were both Goddard and Lewis Terman (Watson, 1953).

Terman (another designer in this story) adopted Binet's test beyond children in 1916. Terman shifted the test's focus away from simply providing a marker below which children were 'feeble-minded,' and instead the test could be used to rank its takers across a wide spectrum of capacity (Hegarty, 2007; Porter, 2009). This modification, the Stanford-Binet test, facilitated the tests' passage through a key window of opportunity, thanks almost exclusively to Robert Yerkes, perhaps the key debater in the adoption of the intelligence test. Yerkes believed science could validate and inform a merit-based hierarchy of people based on their ability/potential contribution to the economy (Kevles, 1968). Prior to the war, Yerkes established an internship program at the psychiatric institution for adults at the Boston Psychopathic Hospital (Watson, 1954), furthered the cause of psychology as an applicable profession addressing America's current social problems.

America joined the Allies in the First World War in 1917, and needed to raise a large (and largely civilian) army quickly. Walter Dill Scott, an applied psychologist from the Carnegie Institute of Technology, approach military officials with a plan to create a test that would match civilian skills with military tasks (Keene, 1994). Army officials enthusiastically embraced Scott's project, only to grow increasingly frustrated as the process moved slowly, and their needs for men grew (Keene, 1994). Yerkes similarly saw the war as an opportunity for psychology and intelligence tests to demonstrate their utility in evaluating human potential quickly and efficiently. After the war, Yerkes' official history of the test reflected this interest in the professionalization and legitimization effects of the war: "in common with the other and more exact sciences, psychology demonstrated its preparedness for wholly unexpected practical demands and responsibilities" (1921: v).

The sequence of events that brought psychology into the American war effort was rapid, and seemingly serendipitous, yet this partnership was the product of luck and intentionality multiplying across networks. Although the other Allies (and of course by extension the Central powers as well) had been at war since the summer of 1914), the United States joined the Allies officially in April. This paper will not address the myriad reasons why America did not join the war earlier, or why the country joined specifically in April, but a quick chronology highlights Yerkes' phenomenal debater/systems-level entrepreneurial actions. President Woodrow Wilson addressed the Congress on 2 April to detail the German atrocities that, cumulatively, now demanded America's action; both the Senate and the House had voted for war by the 5th (Good Friday), and on the 6th Wilson signed the war resolution (Harries & Harries, 1997). That same day, the APA's experimental psychologists were gathered in Cambridge, Mass., where Yerkes and his colleagues, including a Captain W.S. Bowen who taught military science and tactics at Harvard, formed a session "for discussion of the relations of psychology for national defense" (Yerkes, 1921: 7). The attendees agreed to collect information about extant uses of psychology for military purposes, specifically in Canada, who had joined the war automatically in 1914 as a colony of Britain. A quick trip to Montreal and Southern Ontario convinced Yerkes of "the urgent desirability of the application of psychological methods in the selection of recruits and in the study of incapacitated soldiers" (Yerkes, 1921: 8). Whether this was a self-fulfilling confirmation of a committed believer or the dispassionate analysis of a scientifically objective observer is largely irrelevant – Yerkes had the proof he needed to defend the utility of the test.

Yerkes was the APA's president, and prior to his trip to Canada, he penned a letter to the associations' members that rallied his colleagues to the common purpose he perceived for their profession. In that letter, placed before the APA on the 7th, Yerkes declared it was "desirable that psychologists of the country act unitedly in the interests of defense," and in a combination of patriotic spirit and practical considerations, "we should act at once as a professional group as well as individually" (Yerkes, 1921: 7). Although this may seem exceptionally prescient and public spirited, Yerkes (and Scott and others) can be understood as part of a larger phenomenon of Dollar-a-Year men, professionals who offered their expertise and service to the federal government to help the war effort. The war coincided with a period of increased professionalization and industrialization in America (and beyond), and many private companies and individuals offered themselves to the cause (although not all for the negligible annual salary of a dollar) (Harries & Harries, 1997). The hard line between soft war profiteering and patriotism can sometimes be difficult to draw definitively.

On 14 April, Yerkes and his colleagues met with the Chairman of the National Research Council at a conference in Philadelphia; this encounter led to an invitation for Yerkes to attend the NRC's semi-annual meeting in Washington on the 19th. Through that meeting, and a special meeting of the APA two days later, members organized a committee specifically focused on psychology (and even more finely tuned military psychological work) within the NRC (Yerkes, 1921; Keene, 1994). Yerkes' pitch was simple; mass testing could effectively distinguish the thousands of incoming recruits according to their intellectual capacity, and ultimately soldierly possibility, to get "the right man to the right job" (Keene, 1994: 240). It was a tool rooted in modern science to respond to a very modern, or at least immediate problem.

The APA's plan quickly traveled through the linked scientific and military bureaucracy in Washington. After the NRC received the report in early May, they referred it to their chairman of the committee on medicine and hygiene, Dr. Victor Vaughan, who liked the plan and submitted it to the Surgeon-General of the Army (Yerkes, 1921; Pintner, 1926). Unlike Scott and his comparison of civilian and military skill sets, Yerkes and the APA created an example mass test for intelligence in advance, assuming the authority and availability associated with a finished product. The test deeply impressed the Army's General Staff, who approved a trial mass test (Keene, 1994; Keyles, 1968).

Throughout May 1917, Terman gathered fellow psychologists at Goddard's Vineland School to refine their testing process for the army (Keene, 1994). In reflection, Pinter celebrated this intensive work: "it is a splendid example of what co-operative research can do with the right motive or stimulus" (420). The Committee on Provision for the Feebleminded offered the psychologists \$500 (later \$700) to fund their work (Yerkes, 1921). The test had to be easy to implement quickly (the goal was to run the test within a week of a recruit's arrival in camp), and to clearly facilitate the army's personnel requirements of placing many men in the appropriate jobs *quickly*. Psychologists developed 400 practice exams, which the participant psychologists tested on marines of officer cadets throughout June, and the military financed a second mass test of 4000 soldiers in July. These trials eventually informed the creation of two tests officially rolled out over the winter of 1917-1918, labeled 'Alpha' and 'Beta,' for which the Surgeon General created the Division of Psychology within the Medical Department (Yerkes, 1921).

At least one reflective officer doubted whether there was a certain degree of intelligence required to become cannon fodder, and it proved difficult for higher levels of command to ensure their juniors actually used test results, but such thoughts did not impede military psychologists' mission creep, eventually working in half a dozen military departments (Keene, 1994; Yerkes, 1921). Over the course of the war, 1.75 million of the United States' 4 million recruits took intelligence tests at one of four divisional cantonments' Psychological Testing building (both building and test were frequently introduced after significant opposition from individual commanders) (Keene, 1994).

Although this process was not without problems¹ (Blanton, 2000; Pinter, 1926), tests on this massive scale validated both the test, and the concept behind it - intelligence. In 1919, the *Lancet* declared "Intelligence, of course, is only one of the factors in military efficiency, but it is probably the most important single factor," and thanks to the war, intelligence tests had given "clear indications of their future value in the work of human selection and vocational training" (539). Yerkes felt similarly laudatory, arguing in his official history of the Alpha and Beta tests that "the place of scientific tools in the Army personnel system was firmly established by the time of the Armistice...which have had an important effect upon the progress of comparable civilian work" (Yerkes, 1921: 129-130)

The rush of tests during the war may not have resulted in many privates being raised to officers (as Terman and others had argued they would), the war was a proof of

¹ Terman's results reflect that we tested for level of education more than capability, and his own racial assumptions. The latter were also clearly demonstrated in his hope to reduce the number of children born to non-white Americans.

process, that testing could be done on a mass scale, and produce results in which the testers had confidence (Watson, 1953). Simultaneously, Goddard introduced internships for consulting psychologists at his Vineland school, further reinforcing tests' role in psychology as new entrants were trained at this centre of Binet-based testing (Watson, 1953).

The link between eugenics and race is Nazi Germany, but it is hardly the only example. Perhaps the most instructive case is the mass I.Q. testing Texas used to affirm their belief in a hierarchy of racial intelligence (Blanton, 2000). Clyde Chitty (2007) argues that the link between fixed intelligence and class are reflected in the differentiation of academic and vocational education: “we need to *educate* the middle class but merely to *train* the working class” (1). Alternatively, although credible accusations of racism and classism remain, tests of intellectual capacity opened up educational opportunities for lower-income children beginning in the 1950s (Blanton, 2000).

5 Conclusion

The story of the intelligence test is not a celebratory one, but it was certainly an attempt to better serve the marginalized (in this case “serve” must be interpreted with the lens of the time), and build a more resilient society through scientific-social partnerships. It was the big ideas of scientific progressivism, and especially intelligence that created the opportunity, the possibility of a test for ability (and inheritance for sterilization based on the tests). Poets created and described this opening to the adjacent possible, designers created tests that could bring the current reality into line with that future, and debaters made the necessary connections (political, medical and institutional/educational) to bring the intelligence test from its niche in labs and small-scale schools to become a key element of the meritocracy in pre-war America. The history of social innovation offers us a glimpse of process, of agency and perspective, indeed the entire lifecycle of the innovation process.

Works Cited

- “Intelligence Test.” *The Lancet* 9 September 1919, p. 539
- Arthur, W. Brian. (2009) *The Nature of Technology: What It Is and How it Evolves*. New York: Free Press.
- Becker, Markus, Thorbjorn Knudsen & James March. (2006) “Schumpeter, Winter and the sources of novelty.” *Industrial and Corporate Change* vol. 15, pp. 353-371.
- Berkes, F. & C. Folke, eds. (1998) *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. New York: Cambridge University Press, 1998.
- Biggs, R. F. Westley & S. Carpenter. (2010) “Navigating the back loop: fostering social innovation and transformation in ecosystem management.” *Ecology and Society* Vol. 15. No. 2, pp 9.
- Blanton, Carlos Kevin. (2000) “They Cannot Master Abstractions, but They Can Often Be Made Efficient Workers’: Race and Class in the Intelligence Testing of Mexican Americans and African Americans in Texas during the 1920s.” *Social Science Quarterly* vol. 81 no. 4 (December), pp.1014-1026.
- Byrne, David S. (1998). *Complexity Theory and the Social Sciences: An Introduction*. London: Routledge.
- Chitty, Clyde. (2007) *Eugenics, Race and Intelligence in Education*. London: Continuum.
- Cravens, Hamilton. (1987) “Applied Science and Public Policy: The Ohio Bureau of Juvenile Research and the Problem of Juvenile Delinquency, 1913-1930.” in Michael Sokal, (ed.) *Psychological Testing and American Society, 1890-1920*. New Brunswick: Rutgers University Press.
- Dudziak, Mary. (1986) “Oliver Wendell Holmes as a Eugenics Reformer: Rhetoric in the Writing of Constitutional Law.” *Iowa Law Review* vol. 71 pp. 833-867.
- Geels, Frank. (2006) “the hygienic transition from cesspools to sewer systems (1840-1930): The dynamics of regime transformation.” *Research Policy* vol. 35, pp. 1069-1082.
- Geels, Frank & Johan Schot. (2007) “Typology of sociotechnical transition pathways.” *Research Policy* vol. 36, pp. 399-417.
- Gunderson, Lance & C.S. Holling.(2002) *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington: Island Press.

- Hegarty, Peter. (2007). "From Genius Inverts to Gendered Intelligence: Lewis Terman & the Power of the Norm." *History of Psychology* vol. 10 no. 2 pp. 132-155.
- Herrstein, Richard & Charles Murray. (1994). *The Bell Curve: Intelligence and Class Structure in American Life*. New York: Free Press.
- Himelfarb, Alex. (2013) "The Means Test: How We Measure Success" Blog Entry at afhimelfarb.wordpress.com/2013/01/03/the-mean-test/ 3 January.
- Johnson, Steven. (2006). *The Ghost Map: The Story of London's most terrifying epidemic – and how it changed science, cities, and the modern world*. New York: Riverhead Books.
- (2010) *Where Good Ideas Come From: The Natural History of Innovation*. New York: Penguin.
- Kauffman, Stuart. (2000) *Investigations*. Oxford: Oxford University Press.
- Keene, Jennifer Diane. (1994) "Intelligence & Morale in the Army of a Democracy: The Genesis of Military Psychology During the First World War." *Military Psychology* vol. 6 no. 4 pp. 235-253.
- Kevles, David. (1968) "Testing the Army's Intelligence: Psychologists and the Military in World War I." *The Journal of American History* vol. 55 no.3 (December) pp. 565-581.
- Kingdon, John. (2003) *Agendas, Alternatives, and Public Policies*. 2nd Ed. New York: Longman.
- Kuhn, Thomas. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Maree, M. & S. Mertens. (2011) "The limits of economic value in measuring the performance of social innovation." In A. Nicholls & A. Murdock (eds.) *Social innovation: blurring boundaries to reconfigure markets*. New York: Palgrave Macmillan.
- MacCallum, D, F. Moulaert, J. Hillier & S. Vicari Haddock. (2009) *Social Innovation and Territorial Development*. Aldershot, UK: Ashgate.
- Mulgan, Geoff. (2006) "The Process of Social Innovation." *Innovations* (Spring) pp. 145-162
- O'Brien, Gerald. (2011) "Eugenics, Genetics, and the Minority Group Model of Disabilities: Implications for Social Work Advocacy." *Social Work* vol. 56 no.4 (October) pp. 347-354.

- Ommer, Rosemary. (2007) *Coasts Under Stress: Restructuring and Social-Ecological Health*. Montreal: McGill-Queen's University Press.
- Ommer, Rosemary & Barbara Paterson. (2014) "Conclusions: Reframing the Possibilities for Natural and Social Science Dialogue on the Economic History of Natural Resources." *Ecology and Society* vol. 19 no. 1 pp. 17-21.
- Pinter, Rudolph. (1926) "Intelligence Tests." *Psychological Bulletin* vol. 23 no.7 pp. 366-381.
- Porter, Theodore. (2009). "Measurement & Meritocracy: An Intellectual History of IQ." *Modern Intellectual History* vol. 6 no. 3 pp. 637-644.
- Ramsden, Edmund. (2003) "Social Demography and Eugenics in the Interwar United States." *Population and Development Review* vol. 29 no.4 (December) pp. 547-593.
- Samelson, Frank. (1987) "Was Early Mental Testing: (a) Racist Inspired, (b) Objective Science, (c) A Technology for Democracy, (d) The Origin of the Multiple Choice Exams, (e) None of the Above? (Mark the RIGHT Answer)." In Micheal Sokal, (ed.) *Psychological Testing and American Society, 1980-1930*. New Brunswick: Rutgers University Press.
- Smith, Adrian, Jan-Peter Voss & John Grin. (2010) "Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges." *Research Policy* vol. 39 no .4 pp. 435-448.
- Sokal, Michael. (1987) "James McKeen Cattell and Mental Anthropometry: Nineteenth-Century Science and Reform and the Origins of Psychological Testing." in Michael Sokal, (ed.) *Psychological Testing and American Society, 1890-1930*. New Brunswick: Rutgers University Press.
- Thagard, Paul. (forthcoming) "Creative Combination of Representation: Scientific Discovery and Technological Innovation." In R. Proctor & E.J. Capaldi (eds.) *Psychology of Science*. Oxford: Oxford University Press.
- Watson, Robert. (1953) "a Brief History of Clinical Psychology." *Psychological Bulletin* vol. 50 no. 5 pp. 321-346.
- Westley, Frances. (2013) "Social Innovation and Resilience: How One Enhances the Other." *Stanford Social Innovation Review* (Summer), pp. 6-8.
- Westley, Frances, Per Olsson, Carl Folke, Thomas Homer-Dixon, Harrie Vredenburg, Derk Loorbach, John Thompson, Ma^ons Nilsson, Eric Lambin, Jan Sendzimir, Banny Banerjee, Victor Galaz, Sander van der Leeuw. (2011) "Tipping Toward Sustainability." *AMBIO* vol. 40 pp. 719–738.

- Westley, Frances, Brenda Zimmerman & Michael Quinn Patton. (2006) *Getting to Maybe: How the World is Changing*. Toronto: Random House.
- Yerkes, R. M. ed. (1921) *Psychological Examining in the United States Army. Memoirs of the National Academy of Science*. Vol. 15. Washington, D.C.: Surgeon General's Office & Division of Psychology.
- Yin, R. (2003) *Case Study Research: Design and Methods*. 3rd Edition. Thousand Oaks, New York: Sage Publications.
- Zenderland, Leila. (1998) *Measuring Minds: Henry Herbert Goddard and the Origins of American Intelligence Testing*. Cambridge: Cambridge University Press.
- Zenderland, Leila. (1987) "The Debate over Diagnosis: Henry Herbert Goddard and the Medical Acceptance of Intelligence Testing." In Michael Sokal (ed.) *Psychological Testing and American Society, 189-1930*. New Brunswick: Rutgers University Press.