On Geniuses and Heroes:
Gilfillan, Schumpeter, and the Eugenic Approach to Inventors and Innovators

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Abstract

Joseph Schumpeter has acknowledged the importance of sociologist Seabury Gilfillan's contributions to the notion of invention and corresponded with him on that topic in the thirties. However, Schumpeter expressed reserved acceptance of Gilfillan's contributions. The aim of this article is to shed light on Schumpeter's ambiguous assessment of Gilfillan's contributions by focusing on the two authors' representations of inventors and innovators. More broadly, this article is intended as a contribution to the prehistory of the economics of invention and innovation. Our contention is that Schumpeter's criticism of Gilfillan's contributions can be explained by Schumpeter adopting a mostly individualistic representation while Gilfillan criticized it. Nevertheless, we show that Schumpeter and Gilfillan criticized the genius and heroic representations of inventors and innovators while – paradoxically – sharing an elitist and eugenicist worldview.

Keywords: Gilfillan; Schumpeter; Invention; Innovation; Eugenics.

JEL codes: B25; B31; 031.

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Introduction

Joseph Schumpeter (1883-1950) was a visiting professor at Harvard University during the academic year 1927-28 and in 1930 before he joined the permanent staff as professor of economics beginning in 1932. In 1911 he published *Theorie der wirtschaftlichen Entwicklung (Theorie)* – revised in 1926(a) and translated into English in 1934 as *The Theory of Economic Development* (*TED*) – and in 1939 the two-volume *Business Cycles - A Theoretical, Historical, and Statistical Analysis of the Capitalist Process* (*Business Cycles*).[2] Among Schumpeter's many contributions to these classics is his distinction between invention (and inventors) and innovation (and innovators) and his argument that only innovations matter from an economic point of view and are a prime cause of business cycles (e.g., Brozen 1951, Ruttan 1959; Parayil 1991; Swedberg 1991a; 1991b).

In *Business Cycles*, Schumpeter acknowledges the importance of the contributions to the notion of invention of the sociologist Seabury Colum Gilfillan (1889-1987), with whom he corresponded in 1934 and 1935.[3] Before we proceed, an important conceptual caveat is in order.

[2] For biographies of Schumpeter, see Allen (1991), McCraw (2007), and Swedberg (1991a; 1991b). For broader studies of Schumpeter's contributions see Andersen (2009; 2011), Arena and Dangel-Hagnauer (2002), März (1991), McKee (1991), and Shionoya (1997).

[3] We refer to the Gilfillan – Schumpeter correspondence as found in Gilfillan's Papers located at Case Western Reserve University, Kelvin Smith Library: Special Collections Research Center – Box 1, Folder 6, Invention. Schumpeter Correspondence. 1934-1937. We have noted in the text that Gilfillan and Schumpeter corresponded from 1934 to 1935 because the latest letter we found in the archives is dated October 23, 1935. Other references to Gilfillan's archives are also taken from the Gilfillan Papers at Case Western Reserve University. The letters from Schumpeter's archives at Harvard reprinted in the volume edited by Hedtke and Swedberg (2000) has two mentions of Gilfillan. The first is a letter from Schumpeter to Gilfillan dated May 18, 1934 in which Schumpeter especially notes that Gilfillan's

In contrast to Schumpeter, Gilfillan does not differentiate between invention and innovation in his contributions and – as we shall examine in further detail – he thus does not distinguish between inventors and innovators. Moreover, Schumpeter's "entrepreneur" can also be called an "innovator" because he is the one carrying out new combinations, that is, innovations (e.g., Elliott 1983, 20; Gick 2002, 92; Hébert and Link 2006, 596; McCraw 2007, 500; Schumpeter (1934) 2012, 78; 1939, 108, 191, 777; Swann 2009, 132).

Gilfillan graduated from the University of Pennsylvania in 1910. He received his MA, titled "Successful Social Prophecy in the Past," in 1920 and his PhD in sociology with a minor in economics supervised by the sociologist Alvan Tenney in 1935, both from Columbia University.[4] In contrast with Schumpeter who was a famous scholar with a stable position at a leading university, Gilfillan always struggled for academic recognition and work opportunities, a condition he blamed on the detrimental effect of the Great Depression which had "decreased the job opportunities for the scientist" (Gilfillan 1970, *xix*). He was acting assistant professor at the University of the South (Sewanee) from 1922 to 1925, and instructor in sociology and economics at Grinnell College from 1925 to 1927. From 1928 to 1929 Gilfillan was curator of Transportation, Communication, and the social science aspects of invention at the Chicago Museum of Science

contributions are for him of the "greatest interest" (Hedtke and Swedberg 2000, 265 – also found in Gilfillan's Papers). The second is in a letter from Schumpeter to MIT economist Rupert Maclaurin that we shall examine later.

[4] Tenney earned his PhD from Columbia University in 1907. Under the direction of Franklin Giddings, he was first appointed at Columbia as Tutor in Statistics and became Assistant Professor in 1911. In his history of Columbia's Sociology Department in the twenties, Wallace (1991) notes that Tenney's supervision of doctoral dissertations was frequently sought, which can explain why Gilfillan turned to him.

and Industry.[5] He taught sociology at Purdue University from 1937 to 1938, was a research associate in sociology at the University of Chicago from 1941 to 1950, and a lecturer at the Department of Sociology at Roosevelt College in 1948.

Following Tenney's advice, Gilfillan made two books out of his doctoral dissertation, both published in 1935 (Gilfillan (1935d) 1970; 1935e). The first one – *The Sociology of Invention* (*Sociology*) – is the theoretical part while the second one – *Inventing the Ship* – is a case study.[6] The necessity of a case study was suggested to Gilfillan by the empirically oriented sociologist William Ogburn – who we shall examine later – and should be understood in the broader context of the development of an empirical and quantitative methodology at Columbia (Wallace 1991). Gilfillan's *Sociology* was published in a reduced and modified form in eight articles between 1934 and 1935 in the *Journal of the Patent Office Society* (*JPOS*) which had Gilfillan's friend Joseph Rossman – more details on him later – as editor from 1931 to 1935 (Regan 2003).[7] In addition, *Inventing the Ship* was published serially under the title "Invention in the History of the Ship" in *Marine News* from August 1928 to March 1929, as a summary in the *Publications of the American Sociological Society* in 1929, and in the *JPOS* in 1930 (Gilfillan 1929; 1930b).[8] Gilfillan's main

[5] The museum was also called the "Rosenwald Industrial Museum" from the philanthropist Julius Rosenwald – a Chicago merchandiser – who financially supported the creation of the museum in the twenties. It was Waldemar Kaempffert, science editor of the *New York Times* from 1927 to 1953 and director of the museum in 1928, who appointed Gilfillan.

[6] The subtitle to *The Sociology of Invention* is "An essay in the social causes, ways and effects of technic invention, especially as demonstrated historicly [*sic*] in the author's Inventing the Ship."

[7] Gifillan's eight articles are Gifillan (1934a; 1934b; 1934c; 1934d; 1934e; 1935a; 1935b; 1935c).

[8] Gilfillan developed his *Sociology of Invention* in his *Supplement to the Sociology of Invention* published in 1971. We have unfortunately not been able to find Gilfillan's publications in *Marine News*.

ideas concerning inventions thus circulated in published form since the end of the twenties. Furthermore, as we have indicated Gilfillan and Schumpeter started corresponding when Gilfillan was about to publish his two books and when Schumpeter was working on *Business Cycles*. In that correspondence, Schumpeter acknowledges that he had read Gilfillan's contributions to the sociology of invention as published in the *JPOS* in 1934-35.[9]

Schumpeter's Assessment of Gilfillan's Contributions

In his autobiography, Gilfillan (1970) notes that he prepared for Schumpeter a list of 500 "socially most important inventions" since 1782 which was nevertheless not published "perhaps because it did not support [Schumpeter's] previous theory of invention as a timing factor in the business cycle" (20). Gilfillan's research for Schumpeter was thus never published (though we found a copy of it in Gilfillan's archives).[10]

Gilfillan and Schumpeter both adopted an "evolutionary" approach – which we shall qualify – and we could have expected that they agreed on their representations of invention (and inventors) and innovation (and innovators). That is, however, not the case. Indeed, Schumpeter expressed reserved acceptance in *Business Cycles* of Gilfillan's contributions without spelling out why.

[9] In a letter to Gilfillan dated June 9, 1935, Schumpeter writes "I perfectly agree, I am happy to say, with all or nearly all your sociology of invention as expounded in the article in the [*JPOS*]" (GP – Box 1, Folder 6, Invention. Schumpeter Correspondence. 1934-1937 – Schumpeter does not precise which of Gilfillan's article in particular he is refereeing to).

[10] We keep the study of Gilfillan's report to Schumpeter for future research.

Schumpeter mentions Gilfillan twice in volume one of *Business Cycles*.[11] First, in Chapter 3 Schumpeter acknowledges that he collaborated with Gilfillan without explaining the nature of that collaboration:

> we *may* accept a theory of invention as presented, for example, by Mr. S. C. Gilfillan in his Sociology of Invention [*sic*] – the present writer, as a matter of fact, *substantially does – and yet adopt another point of view for our purposes*…The writer wishes to acknowledge his obligation, in the matter of invention, to a report made for him by Mr. Gilfillan. (Schumpeter 1939, 85, n. 1 – emphasis added)

We should note that Schumpeter did not elaborate further on the content of his different point of view.[12] Second, Schumpeter mentions Gilfillan in Chapter 6 when he examines the theory of

[11] Schumpeter also mentions Gilfillan in his *History of Economic Analysis* (1954, 787, n. 6).

[12] Schumpeter also cites in that footnote Abbott Usher's 1929 *History of Mechanical Inventions* and Robert K. Merton's 1935 article "Fluctuations in the Rate of Industrial Invention" published in the *Quarterly Journal of Economics*. An economic historian, Usher received a PhD from Harvard in 1910 and became assistant professor of economics at Harvard in 1922 and full professor in 1936. He remained at Harvard until his retirement in 1949. Usher was a close friend of Schumpeter and they supervised the PhD thesis of Elizabeth Boody Firuski, who would become Schumpeter's third wife (McCraw 2007, 237). Usher was familiar with Gilfillan's research as witnessed by his favorable review of Gilfillan's *Inventing the Ship* (Usher 1936). For a comparison of Schumpeter and Usher, see Ruttan (1959; 1961), Schweitzer (1961), and Yagi (2008). Merton joined Harvard in 1932 as a graduate student and defended his PhD thesis on the sociology of science – supervised by Pitrim Sorokin – in 1936. He taught at Harvard until 1938 and joined Columbia in 1941. Merton published a favorable review of Gilfillan's *Sociology* in 1936 in which he notes that it is "by far the most systematic and painstaking work in the field" (Merton 1936, 167). Merton would however criticize the determinist tone of Gilfillan's argument by emphasizing instead the role of serendipity in science (Merton and Barber (2004) 2006, 166). See Dubois (2014) for a study of the Gilfillan-Merton correspondence (from Merton's archives at Columbia) from 1932 to 1976.

continuity (more on that point later) and notes: "Compare also [as with Usher (1929)] S. C. Gilfillan, The Sociology of Invention [*sic*], to which the writer wishes to refer as an excellent introduction to that range of problems…The present writer does not agree with all the results of that work …" (Schumpeter 1939, 227-8, n. 1). One of the objectives of this article is to shed light on the reasons for Schumpeter's ambiguous assessment of Gilfillan's contributions. That starting point shall allow us to examine competing worldviews of inventors and innovators developed in the thirties.

Despite the immense influence of Schumpeter's contributions to the study of invention and innovation and his correspondence with Gilfillan in the thirties, Gilfillan's references to Schumpeter are rare. We have not found any reference to Schumpeter in Gilfillan's two books of 1935. The index of Gilfillan's 1971 book *Supplement* has one mention of Schumpeter in a passage in which Gilfillan cites some contributors to the economics of invention. In the latter, Gilfillan also mentions Yale Brozen, Edwin Mansfield, and Richard Nelson. In addition, at the end of that book, Gilfillan does not mention any of Schumpeter's contributions in his bibliography of what he considers to be relevant contributions. Furthermore, echoing his critical review of Alvin Hansen's 1921 book on business cycles (Gilfillan 1922), in his autobiography Gilfillan retrospectively emphasizes that other factors than innovation should be considered when searching for an explanation of business cycles: "climate, race, natural and transportation resources, size and history, cannot be disregarded" (Gilfillan 1970, 20). In other words, Gilfillan also acknowledged the divergence between his approach and Schumpeter's.

Towards a Prehistory of the Economics of Invention

The relationship between Gilfillan and Schumpeter has not yet been the object of a dedicated study.[13] The aim of this article is to fill that gap by initiating a study of the convergences and divergences between Gilfillan's and Schumpeter's contributions through a comparison of the two authors' representations of inventors and innovators. As we have indicated, this shall shed light on the reasons for Schumpeter's ambiguous assessment of Gilfillan's contributions.

We suggest that this first step in the study of the relationship between Gilfillan and Schumpeter can offer new insights into both – especially Gilfillan who is a lesser known author – and that it can more broadly contribute to what we can call the prehistory of the economics of invention and innovation. We use that latter expression to indicate the period before the institutionalization of the economics of invention as a field of research at the end of the fifties and in the early sixties (e.g., Godin 2010a; 2017; Hounshell 1997; 2000; Mirowski 2011; Mirowski and Sent 2002).[14] Classic contributions at that time are those by Kenneth Arrow (1962) and Nelson (1959a; 1959b) and the publication by the National Bureau of Economic Research of the 1962 volume *The Rate and Direction of Inventive Activity* edited by Nelson (1962). The latter gathered the contributions presented at the conference "Economic and Social Factors Determining the Rate and Direction of Inventive Activity" held at the University of Minnesota on May 12-14th 1960.

[13] Thomas McCraw's 2007 biography of Schumpeter has one mention of Gilfillan in a footnote about a letter Schumpeter sent to Gilfillan in May 18, 1934 (602, n. 28 – the letter is reprinted in Hedkte and Swedberg 2000, 265). Kiichiro Yagi (2008) comes close to examining the links between Gilfillan and Schumpeter. Nevertheless, because he focuses on the Harvard Yard, Yagi devotes little space to Gilfillan and only summarizes the main thesis of the latter's *Sociology.*

[14] Goulven Rubin (2012) has recently used the notion of "prehistory" in his study of Don Patinkin's PhD thesis.

Gilfillan also influenced the economics of invention and innovation developed in the sixties. For instance, Nelson (1959b, 103) considered Gilfillan's *Sociology* as "one of the most interesting studies of invention" and Gilfillan participated at the Minnesota Conference where he commented on Barkev Sanders's article on the issue of the measurement of inventions (Sanders 1962).[15]

We show that Gilfillan assumed a continuous representation of invention leading him to adopt an anti-individualistic approach to inventors. In contrast, Schumpeter adopted a discontinuous approach to invention, in agreement with his individualistic perspective. In addition, we show that Gilfillan and Schumpeter converge on their criticism of the genius and heroic representations of inventors and innovators while – paradoxically – still considering inventors (Gilfillan) and innovators (Schumpeter) as special people with uncommon qualities. We contend that this apparent paradox in Gilfillan's and Schumpeter's contributions can be explained by their elitist and eugenicist worldview.[16]

[15] Sanders entered Columbia in 1926 and received his PhD in Sociology and Statistics there in 1929.

[16] Following the Oxford English Dictionary, we define elitism as "The belief that a society or system should be led by an elite" and elite as "A select group that is superior in terms of ability or qualities to the rest of a group or society" (accessed online February 10, 2017 at https://en.oxforddictionaries.com/definition/elitism; https://en.oxforddictionaries.com/definition/elite). Thomas Leonard (2005, 208) defines eugenics as "a movement to improve human heredity by the social control of human breeding, based on the assumption that differences in human intelligence, character and temperament are largely due to differences in heredity."

1. Conceptual Framework

In this section, we lay out the main conceptual categories that we shall use to compare Gilfillan's and Schumpeter's representations of inventors and innovators. The first distinction we make is between a continuous and a discontinuous representation of invention and innovation. The second distinction – directly stemming from the first one – is between the (mostly) individualistic and the (mostly) non-individualistic representations of inventors and innovators.

1.1. Continuity and Discontinuity

There are two main conceptions of the development of inventions and innovations: a continuous (or incremental or gradualist) one and a discontinuous (or disruptive) one. That distinction is a classic one in the history of science and technology (Basalla 1988; MacLeod 2007), in economic history, and in the economics of technological change (Arthur 2009; David 1991; Mokyr 1990; 2017; Rosenberg 1982; Usher 1929). According to Schumpeter (1939) himself, in the continuous representation:

> every change seems to consist in the accumulation of many small influences and events and comes about precisely by steps so small as to make any exact dating and any sharp distinction of epochs almost meaningless …What is technically called a revolution never can be understood in itself, *i.e.*, without reference to the development that led up to it; it sums up rather than initiates. (227)

In contrast, as is well known, Schumpeter adopted the discontinuous approach. As he put it, "our theory of the mechanism of change stresses discontinuity" (ibid., 226). For Schumpeter,

discontinuity means that "evolution proceeds by successive revolutions, or that there are in the process jerks or jumps which account for many of its features" (ibid., 226).

The continuous approach can be considered as a logical outcome of the evolutionary approach to technological change (Basalla 1988). Indeed, in that representation inventions or innovations build on past developments and are not the *ex nihilo* product of inventors. The evolutionary approach would thus be synonymous with the continuous approach. For that reason, Schumpeter's emphasis on the disruptive and revolutionary nature of innovations which break the regular circular flow of the economy could be considered as opposed to evolutionary principles. Indeed, Schumpeter distinguishes between the static and dynamic approaches and argues that this difference is equal to that between the continuous and the discontinuous:

> *Continuous changes*, which may in time, by *continual* adaptation through innumerable small steps, make a great department store out of a small retail business, come under the "static" analysis. But "static" analysis is not only unable to predict the consequences of *discontinuous changes* in the traditional way of doing things; it can neither explain the occurrence of such productive *revolutions* nor the phenomena which accompany them. It can only investigate the new equilibrium position after the changes have occurred. It is just this occurrence of the "*revolutionary" change* that is our problem, the problem of economic development in a very narrow and formal sense. (62-3 – emphasis added).

Furthermore, Schumpeter has famously stated that the "evolutionary idea is now discredited in our field" (Schumpeter (1934) 2012, 57). We should especially emphasize that Schumpeter did not rely on Darwinian principles nor use biological analogies in his contributions. Nevertheless, as Geoffrey Hodgson (1997) has shown, Schumpeter's "evolutionary" approach should be understood in a broad sense representing his emphasis on dynamics and development.

In contrast to Schumpeter, Gilfillan adopted a continuous approach to the development of inventions and his contributions are filled with biological analogies. For instance, the first principle of his *Sociology* states that: "An invention is an evolution, rather than a series of creations, and much resembles a biologic process" ((1935d) 1970, 15). Moreover, Gilfillan goes as far as assuming a similarity between inventions and biological organisms, noting that "important inventions evolve continuously, *as if biological creatures*, by petty accretions, not by sudden and heroic creation" (Gilfillan 1934b, 307 – emphasis added). In the same vein, Gilfillan applied his continuous representation to his history of the ship, noting that "The ship [was] modified far more by evolution than by revolution – by minor or gradual, even imperceptible changes than by novel large principles" (1934e, 839).

We should finally emphasize that for Gilfillan, the evolutionary nature of inventions is indeed equal to a continuous or a cumulative process (Gilfillan 1934a, 35).

1.2. Sociological Causes and Economic Effects

That first conceptual distinction between continuity and discontinuity could lead to the conclusion that one of the divergences between Gilfillan's and Schumpeter's approaches would be that Gilfillan adopted a continuous representation based on a biological analogy while Schumpeter adopted a discontinuous approach and emphasized the disruptive nature and revolutionary effects of innovations. Some economists and historians of technological change – such as Joel Mokyr (1990) – have more recently searched to combine both the continuous and discontinuous

approaches by importing from evolutionary biology the notion of punctuated equilibria.[17] That notion, developed by Niles Eldredge and Stephen J. Gould (1972; see also Gould 1982) suggests an alternation of periods of radical changes and periods of gradual changes.

We should nevertheless note that *Schumpeter did not consider that his emphasis on discontinuity contradicts the continuous representation*. We should especially note that it is in the context of his discussion of the two continuous and discontinuous approaches that Schumpeter cites Gilfillan in *Business Cycles*. After citing Gilfillan's first principle of invention (which stresses continuity) found in his *Sociology*, Schumpeter notes that: "all that matters just now is to make sure that the reader realizes that absence of incompatibility between the two views [the continuous and discontinuous approaches] referred to in the text" (1939, 227-8, n. 1). For Schumpeter, the difference between the two approaches is of "purpose and method only" (1939, 227). To support that claim, Schumpeter uses two arguments. The first refers to the difference between the micro and macro levels of study. For Schumpeter, discontinuity would pertain to the "microscopic" level while continuity would pertain to the "macroscopic" level:

> the electrification of the household may involve many discontinuities incident to the setting up of new production functions when looked at from the standpoint of individual firms and yet appear, when looked at from other standpoints, as a continuous process proceeding steadily from roots century back…we may characterize this as difference between microscopic and macroscopic points of view: there is little contradiction

[17] Following Richard Goldschmidt's (1940) distinction between micromutations (representing continuous accumulation) and macromutations (representing leaps), Mokyr (1990, 290-291) distinguishes between microinventions (incremental continuous improvements) and macroinventions (technological leaps) and argues that both should be considered.

> between them as there is between calling the contour of a forest discontinuous for some and smooth for other purposes. (Schumpeter 1939, 227)

Schumpeter's second argument can be found in his correspondence with Gilfillan in the thirties and relates to the division of labor between sociology and economics. Adoption of continuity or discontinuity would not depend on the *object* of study but on the *disciplinary perspective* adopted. In a 1935 letter to Gilfillan, Schumpeter notes that innovations:

> …come about *discontinuously in the sense that* they create disturbances or disrupt the even flow of economic life…As *electric energy accumulates continuously to be released discontinuously in lightning, so innovation is released discontinuously however continuous may be the process by which its conditions* [?] *have been built up.* There is, therefore, no contradiction, between *your sociological view* about the process of invention *and my view* about this particular aspect of the process of innovation (which, too, can be looked upon as continuous if we take a sufficiently long-time view). (Question mark is by Gilfillan who made the transcript and emphases are added except the first one)[18]

Two main points should be noted in that quotation.

First, Schumpeter grounds his argument on the *effects* of innovations, acknowledging that their *causes* are continuous. We should note that Gilfillan's primary objects of study were the *social causes* of inventions or innovations and not, like Schumpeter, their *economic effects* (Gilfillan (1935d) 1970, 131). The difference between causes and effects is thus crucial – though rarely acknowledged – when dealing with the issue of the distinction between continuity and discontinuity in the process of invention or innovation.

[18] June 9, 1935. GP – Box 1, Folder 6, Invention. Schumpeter Correspondence. 1934-1937.

Second, as Schumpeter suggests, his argument should be understood in the context of his representation of the relationship between economics and sociology (see also Yagi 2008). Schumpeter's whole research program can be interpreted as a wish to develop a broad-based economic approach which would encompass economic theory, economic history, statistics, and economic sociology (the study of institutions) (see Schumpeter 1926b; Swedberg 1991a; 1991b).[19] However, Schumpeter did not consider the relationship between these subfields as identical in his contributions. In his 1908 *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie* (*DW*, translated into English in 2010 – see Schumpeter and McDaniel 2010), Schumpeter "had tried radically to isolate economics from the rest of social science" (Swedberg 1991b, 32). In *Theorie*, he broadened his scope to other social sciences (ibid.). In *Business Cycles*, in contrast, Schumpeter excluded sociology (ibid., 136). Furthermore, Swedberg (1989, 515) shows that when Schumpeter studied innovators and innovations, he relied on economic *theory*. Hence, Gilfillan's sociological approach conflicted with Schumpeter's focus on economic theory in *Business Cycles*. As Schumpeter put it when contrasting his approach with Usher's and Gilfillan's in a 1944 letter to the MIT economist of technological change Rupert Maclaurin (Backhouse and Maas 2016):

> [Usher and Gilfillan] are interested in the process of the growth of technological knowledge as such *and not at all in the economic and business aspects of actual technological change in industry*. That is why they use a conceptual apparatus different from mine and why they arrive at results which are in appearance though they are not really different from mine. In particular, they stress the continuous growth of technological invention by imperceptible increments, whereas I stress the discontinuous observable in putting new things into business practice. (Schumpeter to Maclaurin, July 17, 1944, in Hedtke and Swedberg 2000, 350 – emphasis added)

[19] Schumpeter borrowed and developed Max Weber's notion of *Sozialökonomik* (Swedberg 1991a; 1991b).

In other words, Schumpeter did not reject the continuous approach *per se* but considered instead that it would be only relevant from a sociological – not an economic – perspective.

1.3. Representations of Inventors and Innovators

Stemming from the opposition between a continuous and a discontinuous approach to the development of inventions and innovations is the issue of the approach to inventors and innovators. We can identify two main representations.

The first representation stems from the continuous approach and is anti-individualistic. It is thus also anti-heroic and anti-genius. That representation is grounded on two main arguments. First, inventors build on the research carried out by their predecessors and thus cannot be considered as solely responsible for their achievements. Second, several inventors develop the same invention at the same time – duplicate inventions – so that none of the inventors considered are necessary to the development of the invention examined (Ogburn and Thomas 1922, 83).[20]

The second representation stems from the discontinuous approach and is individualistic in the sense that it emphasizes that one inventor is responsible for the invention examined – classic examples include Alexander Graham Bell for the telephone or Thomas Edison for the incandescent light bulb. Within the individualistic approach to inventors and innovators are the heroic and genius representations. The online Oxford English Dictionary defines a genius as a person of "exceptional

[20] What Mokyr (1990, 13) calls the "dispensability axiom." Dorothy Swaine Thomas received a BA from Barnard College – which was affiliated with Columbia University and where she was Ogburn's student – in 1922 and a PhD from the London School of Economics in 1924 (for her own recollection, see Thomas 1952). She is most famous among economists for her supervision with Simon Kuznets of the three volumes of *Population Redistribution and Economic Growth, United-States, 1870-1950* (Lee et al. 1957; Kuznets et al. 1960; Eldridge and Thomas 1964).

intellectual or creative power or other natural ability" and a hero as a person who is "admired for their courage, outstanding achievements, or noble qualities."[21] The genius or heroic representations of inventors or innovators have a long history (MacLeod 2007). For instance, we can read as early as the preamble of the patent system enacted in Venice in 1474 that if "provisions were made for the works and devices discovered by *men of great genius*, so that others who may see them could not build them and take the inventor's honor away, more *men would apply their genius*…and build devices of great utility to our commonwealth" (Kaufer 1989, 5 quoted in Mokyr 1990, 79 – emphasis added).

We must emphasize that *a heroic or genius representation is necessarily individualistic whereas the reverse is not true – the individualistic representation does not necessarily lead to heroic or genius representations*. In other words, it is not because one stresses the role played by individuals that one must consider them as heroes or geniuses. As we shall see – in contrast to a widespread belief – Schumpeter's characterization of innovators is a case in point. Figure 1 summarizes our conceptual discussion.

[21] Definitions accessed online (January 6, 2016):

https://en.oxforddictionaries.com/definition/genius

https://en.oxforddictionaries.com/definition/hero

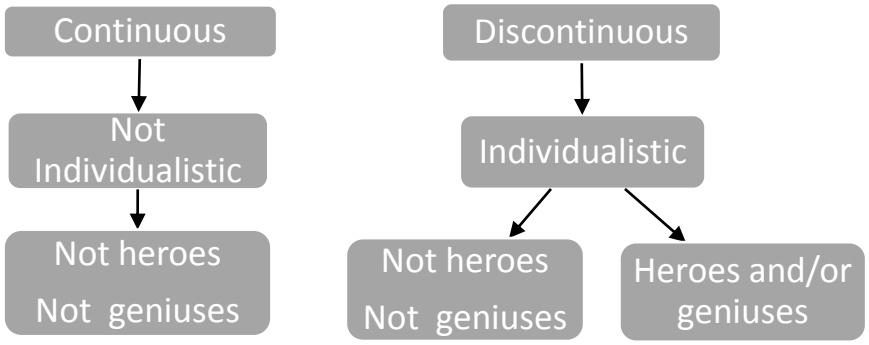

FIGURE 1: Continuous *vs*. discontinuous approaches to invention and innovation and their relationships with representations of inventors and innovators

As with the distinction between the continuous and discontinuous approaches, these two representations of inventors and innovators are not only made by contemporary historians of science and technology but were already familiar to economists in the twenties and thirties.

For instance, in 1926 Ralph Epstein – who received a PhD in economics from Harvard and joined the University of Buffalo that same year – published "Industrial Invention: Heroic, or Systematic?" in the *Quarterly Journal of Economics*.[22] In that article, Epstein identifies three main theories seeking to explain how and by whom inventions come about: the "heroic theory" (237), the "theories of small increments" (244) (the continuous approach), and the "pecuniary motive" (260) (in which "the opportunity for commercial profit [is] the whole *raison d'être* of the exercise of inventive abilities" (261)). We should note that Epstein fails to distinguish between the individualistic-heroic and the individualistic-non-heroic representations, and does not cite

[22] Epstein's doctoral dissertation is titled "Chapters on the Development of the Automobile Industry in the United States."

Schumpeter.[23] It is also noteworthy that Epstein contends that the heroic approach would be mainly adopted by biographers while the incremental representation would be held by "a number of historians, psychologists, and economists" (242). Epstein unfortunately did not spell out the authors he had in mind. We should note that Epstein and Gilfillan corresponded at the end of the twenties. In 1927 Gilfillan sent Epstein his first results on the sociology of invention and the latter responded by noting that Gilfillan's approach receives his "highest approval."[24] This suggests that Epstein favored the continuous representation of invention and opposed the individualistic approach to inventors. We now examine Gilfillan's and Schumpeter's contributions through the lenses of these different representations of inventors and innovators.

2. Gilfillan's Approach to Inventors: Anti-Individualistic, Anti-Heroic, and Ambiguously Anti-Genius

As we noted in the introduction, Gilfillan does not differentiate between inventors and what he calls the "enterprisers" and argues that they share the same qualities: "The inventors are in partnership usually with enterprisers, whose courage, intelligence, business sense and wealth are commonly of importance comparable with that of the inventors themselves" (Gilfillan 1934a, 33). Furthermore, because of his adoption of a continuous approach to inventions, Gilfillan criticizes the individualistic perspective. Indeed, as we have recalled, because in the continuous approach inventions are the product of past developments and the sources of further ones, they cannot be

[23] However, one can find in Epstein's 1926 article Schumpeterian notions or themes such as the idea of invention as "combinations" (260) or the issue of the relationship between competition and innovation.

[24] Gilfillan to Epstein, December 6, 1927 (GP – Box 1, Folder 25, Correspondence 1927-1930) and Epstein to Gilfillan, December 14, 1927 (GP – Box 1, Folder 25, Correspondence 1927-1930).

dated nor assigned to individuals. In addition, the existence of duplicate and equivalent inventions (Ogburn and Thomas 1922; Gilfillan 1935a) testifies that no inventor is ever necessary for their development. As Gilfillan puts it, "to the historian and any social scientist, the progress of invention must appear as quite impersonal" (1934a, 32).

Gilfillan's criticism of the mythology surrounding inventors is most developed in his 1928 *JPOS* article "Who Invented It?" and in his 1935 *Inventing the Ship*. In these two contributions, Gilfillan examines why Robert Fulton was canonized in the US as *the* inventor of the *Clermont* steamboat and criticizes his hero worship. Gilfillan's study of Fulton highlights his continuous approach and its associated anti-individualistic approach to inventors:

> The popular idea…of an invention is a mythologic concept, a personal symbol to account for the origin of something…Fulton was no more the first man to improve the steamboat than he was the last…(Gilfillan 1928, 222-223)

> That foolish question of who invented the steamship we shall certainly not answer by such asininity as "Fulton." We might best reply, as before, that it was never invented, but is still being invented, and has been for centuries, like clothes or modern agriculture. Or we might answer that a "great invention," such as the steamship, has no existence anyway, outside of our habits of speech and thought, which group under a word like steamship or telephone or railway a certain very large and indefinite collection of all the achievements of men's mind since men began. (Gilfillan 1935e, 196)

Gilfillan thus criticizes that an invention or innovation can be ascribed to one individual. For Gilfillan, the individualistic representation has spread through society via the way the history of invention is taught in the first years of school and serves several political functions: "we become patriotic, and hero-worshipers, disinclined to internationalism, Socialism, proletarianism, or materialistic interpretations of history – history was shaped by heroes, not by economic or social

forces" (Gilfillan 1935e, 107). Gilfillan then asks why it was precisely Fulton who was canonized in the US as the inventor of the steamboat and no other (American) inventor. Gilfillan's argument is that Fulton – by making money out of his development of the *Clermont* – attracted other inventors who thereafter considered the steamboat industry as profitable. Hence, Fulton's actual achievement would not be his "invention" but the fact that he "stands at the turning point in steamboat history – before him slow progress, after him rapid" (ibid., 110).

The important point is that even though Gilfillan's study of the mythology of Fulton as the inventor of the steamboat testifies to his criticism of the individualistic and heroic perspectives, it also reveals some ambiguities concerning Gilfillan's approach to geniuses.

We should first note that in the conclusion to his 1928 article Gilfillan notes that "The common idea that the great inventions have been dependent upon the genius of a single man…must now appear erroneous" (225). In the same vein, in his 1929 article Gilfillan argues that "no individual's genius has been necessary to any invention that has had any importance" (201). Meanwhile, Gilfillan had a high esteem for inventors, and in other instances he does characterize them as geniuses. For instance, still in his 1928 contribution, he emphasizes that he does not "mean to disparage Fulton's genius: he was a most brilliant inventor…" (Gilfillan 1928, 218) and that "Technic [*sic*] progress surely owes a great debt to genius" (224). These quotations conflict with Gilfillan's criticism of the genius approach, and thus should not pass unnoticed. As we shall argue and examine later, Gilfillan's ambiguities regarding the genius approach can be explained by his broader eugenic and elitist worldview.

3. Schumpeter's Approach to Innovators: Individualistic, Anti-Heroic, and Ambiguously Anti-Genius

For Schumpeter, because only innovations – as opposed to inventions – lead to economic changes, only innovators have an economic function. This constitutes another divergence with Gilfillan. In addition, as is well known, Schumpeter's emphasis on entrepreneurs as carrying the innovation process stems from his broader methodological individualist approach. Schumpeter introduced the notion of methodological individualism first in German – *methodologische individualismus* – in his 1908 book and then in English in his 1909 article titled "On the Concept of Social Value" published in the *Quarterly Journal of Economics* (Santarelli and Pesciarelli 1990; Swedberg 1991b). Schumpeter did not think of methodological individualism as a universal rule, but as only applying to the domain of pure economics and especially to the theory of the innovator (Hodgson 2007; Swedberg 1991b).[25]

[25] That is not to claim that Schumpeter did not acknowledge the role played by collaborative research – such as that conducted in research labs – in the innovation process. Indeed, it is usually considered that Schumpeter emphasized the innovator as an individual during his European period (roughly, before 1928) and, in contrast, highlighted the increasing bureaucratization of innovation in large firms in his American period (e.g., Frank 1998; Swedberg 1991a; 1991b). For instance, in his 1928 contribution, Schumpeter notes in an oft-quoted passage that in "trustified" capitalism innovation is carried out "within the big units now existing, largely independently of individual persons" (384) and that "Progress becomes 'automatised,' increasingly impersonal and decreasingly a matter of leadership and individual initiative" (385). In the same vein, in *Capitalism, Socialism, and Democracy*, Schumpeter (1942) notes that economic progress "tends to become depersonalized and automatized. Bureau and committee work tends to replace individual action" (133). Nevertheless, As Frank (1998) has argued, that evolution in Schumpeter's work is not a shift in

We should now emphasize what is for us a misreading of Schumpeter's characterization of entrepreneurs. Economists and historians of economics commonly argue that Schumpeter depicted entrepreneurs as heroes or geniuses. We can cite a few examples from well-known sources. Regarding the heroic characterization, Nicholas Kaldor (1954) writes about Schumpeter's "heroic innovating entrepreneurs" (53, see also 71); Walt Rostow (1990) examines Schumpeter's "heroic innovating entrepreneurs" (235), "heroic innovator" (241), and "innovating entrepreneur [as] a kind of Hegelian hero" (246); Ulrich Witt (1992) writes about Schumpeter's "'entrepreneur-hero'" (218, see also 219-20); and Richard Swedberg (1991b) examines "Schumpeter's heroic entrepreneur" (35). We should especially note that we also find the heroic characterization of Schumpeter's entrepreneurs in John Elliott's 1983 Introduction to the *Transaction Edition* of Schumpeter's 1934 *TED*. For Elliott (1983, *xxi*) "The entrepreneur is more of a "heroic" than an "economic" figure" and "Schumpeter's hero is not the competitive market, but the creative, daring entrepreneur…" (ibid., *xxxvi*). Regarding the genius description, Foss, Klein and Bylund (2012) contend that "Schumpeter treats the entrepreneur as an uncaused cause, a pure genius…" (51). Other authors differentiate the notions of hero and genius while adopting one or the other. For example, L. A. O'Donnell (1973) argues that "For Schumpeter…technology improves in a disjointed manner and mainly as a result of the genius of the innovator" (205) while contending that depicting Schumpeter's entrepreneur as a hero would be "less than appropriate" (206).

We argue that the reading of Schumpeter's representation of innovators as heroes or geniuses is contrary to his writings. For instance, in his 1928 article "The Instability of Capitalism,"

Schumpeter's theory but in historical data – which does not call into question Schumpeter's adoption of methodological individualism for the domain of pure economics and the theory of the entrepreneur.

Schumpeter criticizes the heroic characterization of innovators and emphasizes that the distinctive characteristic he attaches to them is leadership:

> *This does not imply any glorification*…economic leadership has…nothing of the glamour some other kinds of leadership have. *Its intellectual implications may be trivial*; wide sympathies, personal appeal, rhetorical sublimation of motives and acts count for little in it; and although not without its romance, it is in the main highly unromantic, so that *any craving for personal hero-worship can hardly hope for satisfaction*... (Schumpeter 1928, 379 n. 1 – emphasis added)

Regarding intellectual faculty and the associated genius approach to entrepreneurs, Schumpeter's writings are more ambiguous but mainly tend to discard that representation too. On the one hand, Schumpeter does describe entrepreneurs as having "super-normal qualities of intellect and will" ((1934) 2012, 82, n. 2). On the other hand, in his 1911 *Theorie* Schumpeter defines the entrepreneur as someone who *acts* and is not afraid of carrying out the new combinations, a process that is, according to Schumpeter, possible "even without particularly brilliant intelligence" (Schumpeter, Becker, and Knudsen 2002, 414). Moreover, in his later contributions, Schumpeter emphasizes that entrepreneurs are defined by their *function* or their will and not by their intellectual faculties. For instance, in his 1928 article, Schumpeter notes that "Successful innovation is…a task *sui generis*. It is a feat not of intellect, but of will" (ibid., 379). Becker and Knudsen (2002; 2003) have shown that from the 1926 second revised edition of *Theorie*, Schumpeter has downplayed the importance he gave to the entrepreneur as a person, offering a more "depersonalized" representation. We should especially note that Schumpeter explicitly criticized the genius representation. For instance, in *TED* Schumpeter emphasizes again that his "analysis of the role of the entrepreneur does not involve any 'glorification' of the

type…We do hold that entrepreneurs *have* an economic function as distinguished from, say, robbers. But *we neither style every entrepreneur a genius* or a benefactor to humanity…" (Schumpeter (1934) 2012, 90, n. 1 – second emphasis added).

Hence, even though Schumpeter adopted an individualist standpoint, he did not use a genius nor a heroic representation of entrepreneurs. Schumpeter's approach to innovators is thus an illustration of a case of individualism which does *not* entail a genius or a heroic representation of innovators.

We have seen that Schumpeter's and Gilfillan's contributions are ambiguous regarding the qualities they attach to inventors and innovators. On the one hand, Schumpeter rejects the heroic and genius representations for a functionalist interpretation of the innovator. On the other hand, he did argue that innovators have higher intellectual faculties. Concerning Gilfillan, his adoption of an evolutionary approach to invention based on a biological analogy leads him to face the issue of having to downplay the role played by individuals while, at the same time, having to acknowledge the fact that it is inventors who invent. As Gilfillan put it ((1935d) 1970, 79), "every fact that bears upon invention…must act upon and thru inventors." Gilfillan's way out of that dilemma was to emphasize the role played by inventors as a "class" and to reject their characterization as "irreplaceable individuals" (ibid.). However, as the historian of technology Lynn White (1968) put it, "a group can conceive nothing which is not first conceived by a person" (quoted in Mokyr 1990, 155, n. 4). Moreover, as we have seen, Gilfillan also had a high esteem for inventors and – as his study of Fulton illustrates – he still sometimes considered them as geniuses.

In other words, even though Gilfillan and Schumpeter both criticized the genius and heroic representations of inventors and innovators, they still could not get rid of the idea that inventors and innovators are special people with uncommon positive qualities. We contend in the next section

that we can explain this tension in the two author's representations of inventors and innovators when we acknowledge their elitist and eugenicist worldviews.

4. The Eugenic Approach to Inventors and Innovators

4.1. Gilfillan on John Dub

Up until the thirties, eugenics constituted the zeitgeist in the US and spread in every aspect of society, including economics (Leonard 2005; 2016; Peart and Levy 2005). Gilfillan was a member of the American Eugenics Society (AES) and is explicit, as early as 1930, about his adoption of an elitist and eugenicist worldview. Moreover, he noted the paradox his adoption of elitism and eugenics leads to regarding his evolutionary epistemology and his representation of inventors:[26]

> To the historian and any social scientist, the progress of invention must appear as quite impersonal. Yet do not conclude that I am a depreciator of brains. I am a pro-aristocrat and a eugenicist. (Gilfillan 1930b, 343)

> In spite of the impersonality of progress, all invention is brought about thru [sic] some sort of inventors, so that its directions, frequency, and efficiency are determined wholly through these men, in proportion to their absolute numbers, intelligence, moral traits, strength of motives for inventing, time free for it, and training and mechanical equipment for it. *So the encouragement of inventors, and also genius and eugenics are needed*. *The*

[26] David McGee (1995) has examined that tension in the sociology of invention developed in the twenties and thirties. Curiously enough, however, McGee never refers to eugenics in his study, despite the importance of that movement at that time and the references made to it by Gilfillan and Ogburn.

> *inventive genius is precious* because he makes hundreds of little inventions, while John Dub makes one or two, or usually none, as my friend Carr's [1929] figures show. (Gilfillan 1930b, 344 – emphasis added)[27]

Furthermore, even though by definition eugenics does not assume or entail racial prejudices, as a matter of fact, eugenics in the US was often associated with racism (Leonard 2005; 2016; Sussman 2014). Gilfillan did express such racial prejudices. In 1930 he published in the *Geographical Review* (1930c) and in a revised form in the *JPOS* (1930a) a critical comment on Mark Jefferson's 1929 article published in the *Geographical Review*. In the latter, Gilfillan notes that to get sound statistics on National inventiveness, it would be "inadvisable to count in the colored population of the United States and the British Dominions, since these people do not figure in invention" (1930a, 261; see also 1930c, 301). Gilfillan thus recommends that in order to get per capita figures the data should be divided by white males only. Finally, Gilfillan even sees a hierarchy among white people and expressed his belief in the superiority of Northern people even inside the US, noting that "The Yankee race, famous for invention, is purer in Maine than in Connecticut…" (ibid.). Gilfillan still forcefully expressed racist prejudices later in his career, as witnessed for instance in his 1969 article "Some Racial Comparisons of Inventiveness" in which

[27] The Carr in the above quotation is Lowell Juilliard Carr. The latter received a PhD from Ann Arbor in 1924 and taught sociology at the University of Michigan from 1921 until his retirement in 1955. In his 1929 article, Carr tries to explain inventors' differences of productivity in terms of patenting activity (see also Carr 1932). Nevertheless, Carr never refers to intelligence or genius in that contribution. Carr shows that the size of the inventor's family is positively correlated with intensity of patenting activity. In *Sociology*, Gilfillan interprets that correlation through the lenses of Huntington's belief that "the greater the man's success in life, the more children he tends to beget" (Gilfillan (1935d) 1970, 80). As we shall see, Huntington was a eugenicist and we suggest that Gilfillan's interpretation of Carr's figures should be understood in the context of Huntington's influence on Gilfillan.

he contended that "retardation which is self-evident in the Negroid stocks cannot easily be explained on grounds of lack of opportunity, or of unfavourable environment" (128). We should also note that Gilfillan published some of hiq articles in *Mankind Quarterly* (Gilfillan 1965b; 1969), a journal which has been characterized as a "cornerstone of the scientific racism establishment" (Kincheloe, Steinberg and Gresson 1997, 39 – see also Mehler 1989; Schaffer 2007).[28]

Even though Gilfillan acknowledged his adoption of eugenics in his own writing, we should examine why he did so through a study of the work of those who influenced him. For that reason, in what follows we examine those we consider as the three main characters who have influenced Gilfillan's worldview on the intertwined – though distinct – notions of elitism, heredity, and eugenics.

The first author who had a crucial influence in shaping Gilfillan's eugenicist worldview was his friend the geographer Ellsworth Huntington (1876-1947). The latter received a MA from Harvard in 1902 and a PhD from Yale in 1909. He was associated with Yale from 1907 to 1945.[29] Huntington's contributions were decisive in developing Gilfillan's interest in – and research on – geography. Gilfillan had read a review of Huntington's book *Civilization and Climate* first

[28] This goes against McGee (1995, 776) who contends that "the sociology of invention had its origins in a revolt against racial theories of evolution." That is not to claim that sociologists of invention in the thirties were racists but to emphasize – as Gilfillan's case illustrates – that there was no unity on such matter in the early sociology of invention.

[29] Huntington was president of the Association of American Geographers in 1923. His presidential address was significantly titled "Geography and Natural Selection: A Preliminary Study of the Origin and Development of Racial Character" (1924a) and was a prologue to his then forthcoming book *The Character of Races* (1924b). See Martin (1973) for a biography of Huntington.

published in 1915 and started working on Huntington's contributions during his first year of sociology at Columbia (Martin 1973, 193; Gilfillan 1970).

In *Civilization and Climate,* Huntington argues that favorable climatic conditions – represented by monthly mean temperature, day to day temperature changes, and humidity – are "causally related" (ibid., 183) with the degree of "civilization" which includes the number of inventions. Following this argument, Huntington contends that the more favorable climatic conditions are observed in the US, southern Canada, Central and Western Europe, and Japan – regions which he argues are also highly "civilized" (Huntington 1915, 142-3 and Chapters 10 and 12).[30] That early encounter with Huntington's research led Gilfillan to write in 1920 one of his first articles entitled "The Coldward Course of Progress." In the latter, Gilfillan follows Huntington's research concerned with climate and argues that there is an inverse relationship between mean annual temperature and leadership in civilization (ibid., 408). In *Sociology*, Gilfillan ((1935d) 1970, 174) notes that this article was "accepted" by Huntington. Moreover, again following his and Huntington's research agenda on the influence of climate on civilization, Gilfillan prepared in 1921 an exhibition titled "Epochs of History Related to Climatic Changes as Recorded by Big Trees" for The Second International Congress of Eugenics in the American Museum of Natural History (Martin 1973, 193). In addition, it was Huntington who asked Gilfillan to work on the history of European political boundaries – research Gilfillan published in 1924 in *Political Science Quarterly*.

[30] For Huntington, climate is not the only factor influencing civilization. In *Civilization and Climate*, he emphasizes that his maps "do not indicate that climate is the only factor in determining the condition of civilization, or even the main one. Far from it. Yet they indicate that it is as essential as any other. Today civilization seems to make great progress only where a stimulating climate exists" (1915, 218). For Huntington factors such as race, education, and "opportunities" also have a role.

Later, it was Huntington who recommended Gilfillan for a position at Grinnell College (Martin 1973, 193).

In the thirties, Huntington became a leading eugenicist and served as president of the American Eugenics Society (AES) from 1934 to 1938.[31] In 1935 he published in conjunction with the directors of the AES *Tomorrow's Children: The Goal of Eugenics*, which aim was to constitute the new "catechism" of eugenics (Huntington and AES 1935, *vii*).[32]

Central to the eugenic rhetoric in the US at that time was the theme of the decline of "native ability" or "race suicide" (Leonard 2005; 2016) – the idea that the "good stock" was progressively displaced by the "unfit" because of wrongheaded social or economic policies. In *Civilization and Climate* Huntington endorsed that rhetoric, contending that "all men are not created equal biologically, and it is the best who are dying out...all this has been said many times by eugenists, but it must be repeated again and again until it is not only believed but acted upon" (1915, 216). Gilfillan also followed that rhetoric, linking his eugenics perspective with what he considered to be a decline in patenting in the US ((1935d) 1970, 109). For Gilfillan, indeed, a possible explanation to that phenomenon lies in a decline of inventiveness brought about by dysgenics policies:

> There is good reason to think that the native ability of the American people has been declining, thru dysgenics, and immigration latterly chiefly of the poorer classes, come mostly for purely economic reasons. It is certain that for several generations past the stupid have been breeding at much higher net rate than those with native

[31] Barry Mehler (1988) examines the history of the American Eugenics Society from 1921 to 1940.

[32] *Tomorrow's Children* was also the title of a movie released in the U.S. in 1934 – directed by Crane Wilbur – which criticized eugenics sterilization policies.

> intelligence, and that as to acquired intelligence, i.e. education and other such advantages, socially transmissible, the distribution of child-raising has been equally perverse. ((1935d) 1970, 112).

In the same vein, Gilfillan endorsed the race suicide rhetoric and cited Huntington and Whitney's 1927 *Builders of America* when examining the issue of how to increase the level of inventive genius. Gilfillan recommended that "the short-pursed masses be more and more thoroly combed for what genius is born among them, if very rapid race-suicide of the intellectual classes, and proliferation of the least successful [Huntington and Whitney 1927], is not to swamp civilization in a sea of jellyfishes" (Gilfillan 1927, 118-9).

The second author who influenced Gilfillan's elitist worldview is Ogburn (1886-1959). The latter received a PhD in sociology from Columbia University in 1912 under the supervision of Franklin Giddings. After positions at Princeton, Reed College, the University of Washington and war services at the National War Labor Board and the US Bureau of Labor Statistics, Ogburn came back to Columbia as a professor of sociology in 1919. In 1927 he moved to the University of Chicago where he became chair of the Department of Sociology until 1951.[33] Ogburn was a very influential scholar. Among many other occupations, he became President of the American Sociological Association in 1929, President of the American Statistical Association in 1931 (and served as editor of its journal from 1920 to 1926), director of research and member of President Hoover's Research Committee on US Social Trends (1929-1933), and was elected first President of the Society for the History of Technology in December 1958.

[33] See Godin (2010b) for a study of Ogburn's contributions and Dubois (2014) for a study of Ogburn's influence in the context of the Gilfillan-Merton correspondence.

Ogburn and Gilfillan first met at the end of the 1910s and became close friends (Gilfillan 1970). Ogburn was already well-known in the twenties for his work on invention (Ogburn and Thomas 1922; Ogburn 1926; 1928; 1929) and later collaborated on such matters with Gilfillan with whom he shared an evolutionary anti-heroic perspective (Ogburn and Gilfillan 1933; Ogburn, Adams, and Gilfillan 1946). In part 4 of the summary of his research published in the *JPOS*, Gilfillan contends that the number of those who can develop an invention is greater than one and notes that it is "assured, as Prof. Ogburn [1922 Part 2 Chap. 5; 1926] has pointed out, by *the normal probability curve which governs the distribution of brains and every other quality known*…" (Gilfillan 1934d, 778–9 – emphasis added).

Ogburn's views on eugenics can be found in his 1921 review of Paul Popenoe and Roswell Hill Johnson's 1918 textbook *Applied Eugenics*.[34] In his review, Ogburn criticizes eugenics not in itself but because it would underemphasize the role of culture in the study of social processes. Indeed, Ogburn did not reject biological arguments *per se* but considered that they should be mixed with cultural ones: "Eugenics cannot be fairly estimated without a generous consideration of the cultural factor" (Ogburn 1921, 535). In his 1922 book revealingly titled *Social Change With Respect to Culture and Original Nature* (Volti 2004), Ogburn emphasizes again that both heredity and social environment should be considered in the explanation of social change (Ogburn 1922, 51). Ogburn supported the idea that there is a "great stability of biological man" (341) while culture would have varied greatly. Ogburn's argument of the stability of biological characteristics stems, on the one hand, from his rejection of Jean-Baptiste Lamarck's thesis of the heritability of acquired

[34] On Popenoe, see Ladd-Taylor (2001).

characteristics and, on the other hand, from his belief that biological mutations are rare.[35] Ogburn's position should in turn be understood in the context of the decreasing influence of Lamarckianism at the turn of the century with the diffusion of August Weissmann's thesis that only the "germ plasm" is transmitted from generations to generations and the revival of Gregor Mendel's laws of heredity.[36] These two developments in biology led to stronger support of the nature side of the nature-nurture debate (Degler 1991). For Ogburn (1922), because biological traits are stable while culture has evolved cumulatively through inventions, the causal factor in explaining social evolution must be culture.[37] For Ogburn indeed, "it is only the phenomena that vary that we term causes" (Ogburn 1926, 226). Ogburn's argument thus goes against eugenics which assumes the

[35] According to Ogburn "The influences of environment are not passed on to the next generation through heredity" (1922, 25-26) or "Acquired characteristics are thought to be so integral a part of an individual as to be hereditary. Indeed it required special research to disprove this" (ibid., 32-33) or "acquired characteristics are not inherited; and this possible source of change is eliminated from consideration" (124).

[36] Ogburn contended that biological traits can, under the influence of culture, change in a lifetime but because acquired characteristics cannot be transmitted, human nature would remain unchanged in the long run.

[37] The influence of the refutation of Lamarckianism on the nature-nurture debate is not clear-cut. Lamarckianism can be considered as leading to a criticism of eugenics. Indeed, the idea that acquired characteristics can be transmitted gave room to the influence of social environment in the "improvement of races." Refutation of Lamarckianism was thus used by eugenicists as a support of strong hereditarianism and as a criticism of the role of culture in social evolution. As Carl Degler put it, "The abandonment of the belief in acquired characters was a stimulus for a eugenics movement" (1991, 24). For others, and most notably Alfred Kroeber (1917) who received his PhD under Boas at Columbia in 1901, refutation of Lamarckianism was used as supporting the idea that the social position of a group is not influenced – through heredity of acquired characteristics – by its past achievements (Degler 1991, 90-93). Culture was in that case considered as the main causal factor. As Hodgson has summed-up, "the validity or otherwise of Lamarckianism thus made no difference to this ideological dispute" ((1999) 2001, 101).

influence of heredity – against culture – on social evolution. Ogburn (1922) summarizes his argument as follows:

> Biological change over the past two thousand years must be exceedingly slight, if it has occurred at all. But the cultural change over the past two thousand years has been extraordinarily great. Therefore there appears to be for this period no correlation between cultural changes and biological changes. Cultural evolution is thus not to be accounted for by biological evolution…The significance of the biological factor for the study of social evolution is thus somewhat more limited than is usually thought. (141-142)

Thus – somewhat paradoxically – Ogburn's emphasis on culture and his skepticism toward eugenics were based on his belief in the existence of the stability of biological traits.

Ogburn applies his emphasis on culture to the issue of "mental ability," noting that it is also the result of both nature and nurture (1922, 81). Nevertheless, he adds that "inventions are the result of inherent natural ability" which would be distributed according to a normal curve with a "few individuals with great ability, a few with very low ability and a great many with ordinary ability" (ibid.). In addition, he notes that (ibid. – emphasis added) "Inventors are found in an upper portion of the curve. They thus have *more inherent ability* than those in a lower portion of the curve. So that in this sense *superior native ability is responsible for inventions*." This testifies to Ogburn's elitism (though we should note that Ogburn also emphasized the crucial role of the cultural context in the development of particular inventions (ibid., 84)).

In his 1926 article "The Great Man Versus Social Forces," Ogburn again emphasizes the interplay of heredity and social environment and focuses on the "frequency of the hereditary

element of greatness" (225).[38] Ogburn yet again argues that inventive ability is distributed according to the normal probability curve and contends that:

> if a biological trait of greatness were measured on a line from the least to the greatest, then the greatness represented by the upper tenth of the line would be possessed by about 1.5 per cent of the population, that is about 1,500 out of 100,000 on the average. And the greatness represented by the upper quarter of the line would be possessed by about 13,000 out of 100,000. (1926, 226)

Even though Ogburn concludes from his figures that "potentialities of greatness are common" (226), that does not preclude that the size of the population concerned with higher qualities is nevertheless *relatively* smaller. We should note – for future reference – that in the above quotation Ogburn contends that qualities are increasing when directing to the right side of the normal distribution. Ogburn adds that invention is the result of mental ability, cultural material, and social valuations. Again, because "inherited abilities of greatness should be plentiful and constant," it would be the cultural elements which would be the leading causes of significant achievements.

Ogburn's contributions were thus archetypal of the nature-nurture debate in the twenties and thirties. We should especially note that at Columbia Ogburn was under the influence of opposing positions in that debate. Giddings was a eugenicist, and as Ogburn put it about his PhD mentor, Giddings searched to explain social changes in terms of the "original nature of man" (Ogburn 1922, 45). Ogburn was also, however, a colleague of the anthropologist Franz Boas. The latter joined Columbia as a lecturer in 1896, became the first professor of anthropology in 1899, and is well known for his criticism of eugenics and racism and his development of cultural determinism (e.g.

[38] Ogburn again contends in this article that "race is notably stable" (226).

Boas 1911; 1912; 1916) – though he still believed in the influence of heredity and the existence of a hierarchy between cultures (Degler 1991). Among Boas' doctoral students was the famous Margaret Mead, who was also Ogburn's student, his assistant as editor of the *Journal of the American Statistical Association*, and his close friend. Ogburn's emphasis on the interplay of heredity and culture is thus representative not only of the debates in the US at that time but also specifically of Columbia's crucial influence in emphasizing the role played by culture. By contrast, in his autobiography Gilfillan (1970) considers Giddings as "the greatest teacher" (*viii*) whereas even though he mentions Boas, he does not characterize him. This suggests that Gilfillan favored Giddings's eugenics approach over Boas emphasis on culture.

For our purpose, we should recall that even though Ogburn did not fully embrace hereditarianism or eugenics, his contributions nevertheless testify to his elitist approach to inventors.

As we have seen, Gilfillan cited Ogburn in order to use the normal curve as a tool for supporting the non-homogenous distribution of inventive talents in the population. Eugenicists commonly used the normal probability distribution and its associated bell-shaped graphic representation as "scientific" tools to classify traits examined in populations (Dudley-Marling and Gurn 2010). It was the Belgian polymath Adolphe Quetelet who is recognized as the first to apply the normal distribution to social issues in the nineteenth century (Quetelet 1835). Quetelet thought that people whose traits were in the average of the distribution – what he called *l'homme moyen* (average man) – represented an ideal while those whose attributes were classified in either side of the distribution consisted in deviations from that ideal. The previous interpretation of the normal distribution changed with Francis Galton who coined the notion of eugenics in his 1883 *Inquiries into Human Faculty and Development*. For Galton, qualities increased from the lower-end to the upper-end of the distribution and the *homme moyen* is thus not an ideal but can instead be perfected

(Desrosières 1998; Hacking 1990). We should thus emphasize that Ogburn and Gilfillan had a Galtonian reading of the normal curve as applied to inventors, testifying further to their elitist worldview.

The third main character who influenced Gilfillan was his friend Joseph Rossman (1899-1972) (Regan 2003). Merton and Barber ((2004) 2006, 166) have characterized Rossman as an "admirer" of Gilfillan, which suggests that the influence was reciprocal. In a 1926 two-part article, Rossman (1926a; 1926b) studied the relationship between intelligence and invention. Rossman (1926a) first examined the correlations between the intelligence of foreigners and the number of US patents granted to them.

We should recall that the tens and twenties were the heydays of contributions to the issue of intelligence measuring in the US (Fancher 1985). Under the presidency and urging of the eugenicist Robert Mearns Yerkes – who received a PhD in psychology from Harvard in 1902 – the American Psychological Association created in 1917 the Committee on the Psychological Examining of Recruits to develop intelligence tests to be applied to US Army recruits during the Great War (Fancher 1985). The Committee included famous American psychologists among which the eugenicist Henry Goddard – who we shall encounter again later – who became in 1906 director of the Psychological Research Laboratory at the Training School for Backward and Feeble-minded Children at Vineland, New Jersey. Yerkes' Committee developed two main tests: The Alpha test, designed for those who could read and write, and the Beta test for the illiterate (Fletcher and Hattie 2011).

In the first part of his 1926 contribution, Rossman (1926a) uses Robert Pintner's 1923 *Intelligence Testing* as well as Galton's contributions in order to support the argument that intelligence is not acquired or subject to the social environment but would be – to the contrary –

innate and hereditary (Rossman 1926a, 519).[39] Moreover, Rossman relies on Alpha tests scores and shows a high positive correlation between them and the numbers of patents granted to foreigners: "The greater the intelligence of the country the larger is [*sic*] the number of patents granted to its citizens" (ibid., 523). Rossman's ethnocentric prejudices were also explicit. For instance, he shows that Americans are the most inventive and concludes from his previous correlation result that they are therefore the "most intelligent group in the world to-day" (ibid., 528). In addition, in a very similar way to Gilfillan's argument on the "coldward course of progress" Rossman contends that it is the Northern – and western – countries which have higher intelligence (ibid., 530-531) and that the number of patents granted to these countries "confirms this fact without a doubt" (ibid., 532). Nevertheless, in contrast with Gilfillan, Rossman does not rely on climate to explain his findings.

In the conclusion to the first part of that article, Rossman also adopts the eugenics race-suicide rhetoric. Indeed, he argues that immigrants from southern and eastern Europe are "undesirable" and that allowing their influx would entail a "gradual lowering of the mentality of our nation and its consequent economic and social decline" (ibid., 534).[40]

Moreover, in 1930 Rossman published "Heredity and Invention" in the *Journal of Heredity*. In the latter, Rossman examined the occupations of the fathers of over seven hundred inventors. He concludes that the inventors he studied "come from a decidedly superior type of stock" (509)

[39] Pintner joined Columbia's Teachers College as professor of education in 1921.

[40] In the second part of his article, Rossman (1926b) examines the relationship between intelligence and inventiveness of US states. Rossman's worldview is not altered by that change in geographical scale, however. Indeed, Rossman concludes that it is the Northern and Western states that are the more intelligent and inventive. See also Rossman's 1928 article "The Correlation of Intelligence and Invention" in which he reaches the same conclusions.

while immediately adding that a better educational environment could explain it. In addition, again relying on army intelligence test scores, he contends that the inventors of his study "are highly intelligent as they come from the upper groups of the population" (ibid.). In addition, Rossman shows that "the nearer the relatives who are inventors, the more the children tend to show inventiveness" (ibid.). As was Ogburn, Rossman is nevertheless careful when explaining these results and emphasizes that both heredity and social environment should be considered.

Rossman's results were republished in his 1931 *The Psychology of the Inventor. A Study of the Patentee.*[41] Gilfillan published a favorable review of the latter in 1932 and considered in his *Sociology* that it was "the *best book* that has yet appeared on the sociology of invention [which] should be possest [*sic*] by every student of the subject" ((1935d) 1970, 166). We should note that, in *Sociology*, Gilfillan emphasizes only the hereditary aspect of Rossman's contributions, noting that "Rossman shows a decided hereditary influence in inventiveness" (ibid., 79). Rossman's and Ogburn's contributions thus share some key features. Indeed, Rossman's position in the thirties can also be considered as a middle way in the debates on the influence of heredity and social environment, and the latter also contended that inventors would be "highly intelligent."

Especially because of the growing influence of the notion of culture, eugenics was already much criticized in the twenties and thirties and would progressively become insulated in academia and society. Gilfillan, who nevertheless never gave up on eugenics, has lamented in his autobiography on that decline of influence:

> Those were the grand old days [the twenties] in Sociology, when it was a science, or an attempt to create one. For in those days, it was perfectly permissible to observe and talk about the differing inborn natures not only of

[41] Due to its success, two editions of Rossman's book were published in 1931.

> individual men, but of their differing groups, social classes and races, and to follow Darwin…Eugenics was then a respectable science, and helper of Sociology…(Gilfillan 1970, *viii*)

5.2. Schumpeter's Eugenic Doubt

Fabrice Dannequin (2012) has shown and examined the influence of Galton's ideas and eugenics on Schumpeter's representation of the innovator. For that reason, we shall devote less space to Schumpeter and focus on the main or different elements.[42]

When he arrived at Harvard, Schumpeter was surrounded by eugenicists (faculty members, administrators, and alumni alike). As Adam Cohen (2016) has shown in his history of eugenics at Harvard, the latter "was more central to American eugenics than any other university. Harvard has, with some justification, been called the 'brain trust' of twentieth-century eugenics…" (48). As one instance, A. Lawrence Lowell, Harvard President from 1909 to 1933 – thus when Schumpeter visited and settled at Harvard – was a fervent eugenicist.

In addition, we should mention the crucial influence on Schumpeter of Frank Taussig. The latter received his PhD from Harvard in 1883 and taught there from 1892 until his retirement in 1935. It was Taussig who invited Schumpeter as a visiting professor at Harvard at the end of the twenties and supported his recruitment in 1932. As is well known, Taussig and Schumpeter were close friends, Schumpeter even living at Taussig's house until he married Elizabeth Boody Firuski in 1937 (McCraw 2007, 153; Swedberg 1991b, 111). We should emphasize that Taussig was

[42] Another trend of literature has drawn a parallel between Schumpeter's and Nietzsche's representations of individuals (Lapied and Swaton 2013; 2014; Reinert and Reinert 2006; Santarelli and Pesciarelli 1990). We contend that, as far as textual evidences from primary sources are concerned, the argument of the influence of eugenics on Schumpeter's thought is better grounded.

familiar with Huntington's research and even urged the latter to write his "Climatic Change and Agricultural Exhaustion as Elements in the Fall of Rome" (Martin 1973, 142) published in 1917 in the *Quarterly Journal of Economics* – which had Taussig as editor from 1889 to 1890 and from 1896 to 1935.[43] Taussig can be considered as a founding father in the study of invention with his 1915 *Inventors and Money Makers* which is a collection of lectures he gave at Brown University. In these lectures, Taussig examines the links between economics and psychology with a focus on inventors and business-men. Taussig adopted an individualistic and genius representation of inventors – at least for the most famous ones – and heavily relied on biographies of inventors which epitomized that representation (MacLeod 2007). Taussig was a eugenicist (Cohen 2016; Leonard 2016). In the second volume of his 1911 *Principles of Economics* – then a classic – Taussig contends that:

> The human race could be immensely improved in quality, and its capacity for happy living immensely increased if those of poor physical and mental endowment were prevented from multiplying…Tho the great broad fact of heredity is unmistakable, the details of the law of inheritance are but dimly known to us, above all in their application to man. More light will come in time from what is called eugenics…" (235)

We can thus conjecture that Taussig influenced Schumpeter's adoption of an individualistic approach to innovators as well as his favorable appraisal of eugenics – to which we now turn. We should first note that we can find evidence of Schumpeter's knowledge of Quetelet's contributions as early as his 1908 *DW*. Indeed, in the latter, Schumpeter uses the expression of *homme moyen* (Schumpeter and McDaniel 2010, 54; see also Santarelli and Pesciarelli 1990) and critically notes

[43] The fall of Rome was the topic of Gilfillan's last book *Rome's Ruin by Lead Poison*, posthumously published in 1990 (see also Gilfillan 1965a; 1965b; 1971; 1990).

that "Sometimes it can be useful to claim that the value functions of different individuals are similar. But we cannot prove that and a finding gotten this way definitely has to be supported by facts" (ibid.).[44] Moreover, Schumpeter explicitly expressed his elitist representation of innovators as early as the first 1911 edition of *Theorie*. In the latter, Schumpeter draws a distinction between the masses and the leaders and argues that the entrepreneurs belong to the last category and are at the top of the "social pyramid" (Schumpeter, Becker, and Knudsen 2002, 415).

Regarding the issue of the hereditary character of intellectual faculties, in his 1927 "Social Classes in an Ethnically Homogeneous Environment" Schumpeter refers favorably in a footnote to classic eugenicist works by Goddard and his 1912 *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness* – a product of Goddard's research at the Training School – as well as to Galton's 1869 *Hereditary Genius* (in Schumpeter, Hoselitz, and Norden (1951) 1966, 179 n. 3). Schumpeter then adds that "We can agree that K. Pearson's pithy statement, 'ability runs in stocks,' is far truer than its opposite, especially since everyday experience confirms it" (ibid., 179 n. 3). The British mathematician and statistician Karl Pearson was a discipline of Galton and a founding father of eugenics. In 1906 he became the director of the Eugenics Record Office – created by Galton in 1904 – and from the death of Galton in 1911 until 1933 he was the first director of the Galton Chair in National Eugenics at the University of London. Schumpeter was in England in 1906-1907 and attended Pearson's lectures in statistics (Swedberg 1991a). That experience certainly was one of Schumpeter's earliest encounters with eugenics since, as Theodore Porter (2004, 279) has shown, at that time "eugenic themes dominated Pearson's public addresses and essays."

[44] Schumpeter also comments on Quetelet's contributions in *History of Economic Analysis* (1954, 525-526).

In addition, in *TED* Schumpeter suggests a classification of human qualities – including intelligence – according to a normal curve, where the most talented are on the skewed upper-end of the distribution and are thus in the minority compared to the masses (Schumpeter (1934) 2012, 81-82, n. 2). Schumpeter thus also adopted a Galtonian reading of the normal curve. Moreover, in a lecture delivered at the Lowell Institute in Boston in 1941, Schumpeter raised some eugenic concerns and – as Gilfillan – embraced the race suicide rhetoric:

> The eugenic doubt I take more seriously…In fact, contraceptives first became widespread in the French society of the regency, then the bourgeoisie, then the upper working class. It was the good stock that was eliminating itself. In England we find that weakminded mothers have about four times as many children as normal mothers. This restricts a nation not only in numbers but also in morals and intelligence. (Schumpeter 1941 in Swedberg 1991c, 377)

Finally, in *History of Economic Analysis* (1954, 790) Schumpeter examines Galton and Pearson together and gives them his highest praise. In addition, as is well known, Schumpeter considered Galton as one of the "three greatest sociologists," the other two being for him Giambattista Vico and Karl Marx (790-1).

To sum-up, elitism and arguments supporting the heredity of the intellectual faculties favorable to invention – mixed in varying degrees with cultural elements – were widespread in the twenties and thirties and can be found in Gilfillan's and Schumpeter's contributions. Our point is that Gilfillan's and Schumpeter's hereditarianism and elitism can be explained by their broader eugenicist worldview. This explains why – *despite their criticism of the genius and heroic approaches* – Gilfillan and Schumpeter still considered inventors (Gilfillan) or innovators (Schumpeter) as leaders or as people with uncommon positive characteristics.

6. Conclusion: In the Shadow of the Entrepreneur

We have initiated a study of the relationship between Gilfillan and Schumpeter through a comparison of their representations of inventors and innovators. We have argued that the two authors converge in their criticism of the heroic and genius representations of inventors and innovators even though their criticism should be qualified because of their elitist and eugenicist worldviews. On the opposing side, we have contended that Schumpeter's representation of the innovator is mostly individualistic while Gilfillan's is mostly anti-individualistic.

Schumpeter's entrepreneur or innovator is much better known that Gilfillan's inventor. We suggest that, beyond the issue of the respective intrinsic merits of Gilfillan's and Schumpeter's perspectives, Schumpeter's approach became more influential because the figure of the entrepreneur rose to prominence in the early twentieth century. As the historian Christine MacLeod has pointed out in her study of the heroic representation of inventors in Victorian England, "between the empire-building entrepreneur, on one side, and the self-important scientist, on the other, by 1914 there was less and less public space for the independent inventor to occupy" (350). It is especially noteworthy that MacLeod uses Schumpeter's 1911 *Theorie* as a symbol of the rising influence of the notion of entrepreneur. Nevertheless, it is difficult to know in which direction the causality runs between, on the one hand, the evolution of the cultural representation of inventors and entrepreneurs and, on the other hand, the influence of Schumpeter's contributions. Without solving that issue, a crude bibliometric procedure can nevertheless support the argument that the entrepreneur did become more influential in economics in the twentieth century. We have collected the number of contributions in which the notion of entrepreneur appears from 1885 to 1950 in the discipline of economics (Jstor data for research – dfr.jstor.org – Februray 2017). In order to correct

for volume effects, we then divided these figures by the number of contributions published in the discipline of economics for each year. We obtain the following graph:

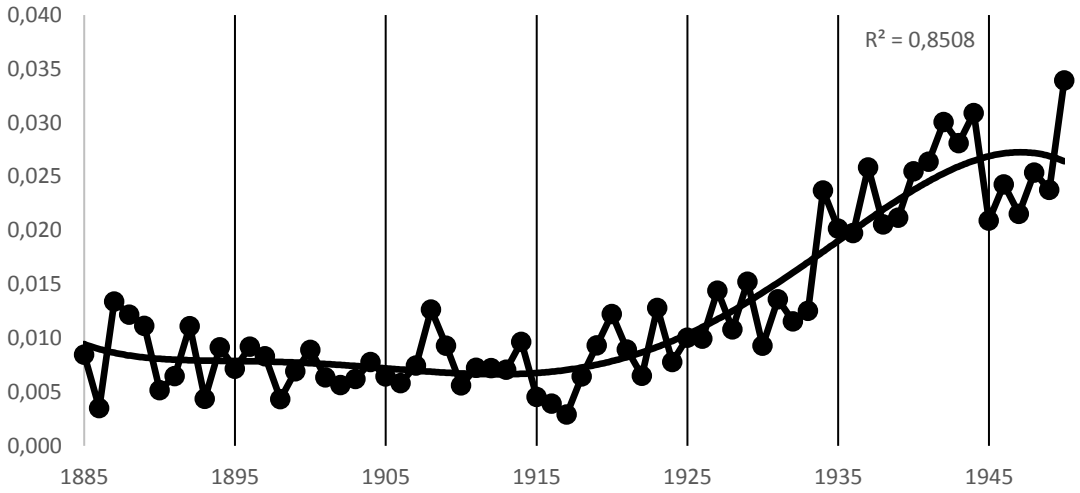

FIGURE 2: Frequency of contributions with "entrepreneur" in the discipline of economics.

MacLeod's periodization of the influence of the notion of entrepreneur is thus confirmed in that case: as the graph shows, the frequency of appearance of the notion of entrepreneur is almost steady from 1885 up until the end of the 1910s when it starts to increase steeply. The entrepreneur is thus mostly a twentieth-century character in economics and has become more influential since the interwar period. As we have suggested, this can shed light on the reasons why Gilfillan's continuous and anti-individualistic approach remained in the shadow of Schumpeter's contributions.

REFERENCES

Allen, Robert. 1991. *Opening Doors: The Life and Work of Joseph Schumpeter*. New Brunswick: Transaction Publishers.

Andersen, Esben. 2009. *Schumpeter's Evolutionary Economics a Theoretical, Historical and Statistical Analysis of the Engine of Capitalism*. New York: Anthem Press.

———. 2011. *Joseph A. Schumpeter: A Theory of Social and Economic Evolution*. New York: Palgrave Macmillan.

Arena, Richard, and Cécile Dangel-Hagnauer. 2002. *The Contribution of Joseph Schumpeter to Economics: Economic Development and Institutional Change*. London: Routledge.

Arrow, Kenneth. 1962. "Economic Welfare and the Allocation of Resources for Invention." In *The Rate and Direction of Inventive Activity*, edited by R. Nelson, 609-26. Princeton, N.J.: National Bureau of Economic Research.

Arthur, Brian. 2009. *The Nature of Technology: What It Is and How It Evolves*. New York: Free Press.

Backhouse, Roger, and Harro Maas. 2016. "Marginalizing Maclaurin: The Attempt to Develop an Economics of Technological Progress at MIT, 1940–50". *History of Political Economy* 48 (3): 423-447.

Basalla, George. 1988. *The Evolution of Technology*. New York: Cambridge University Press.

Becker, Markus, and Thorbjørn Knudsen. 2002. "Schumpeter 1911: Farsighted Visions on Economic Development." *American Journal of Economics and Sociology* 61 (2): 387–403.

———. 2003. "The Entrepreneur at a Crucial Juncture in Schumpeter's Work: Schumpeter's 1928 Handbook Entry Entrepreneur." In *Austrian Economics and Entrepreneurial Studies*, edited

by R. Koppl, J. Birner, and Peter Kurrild-Klitgaard, 199 – 233. Advances in Austrian Economics, Volume 6, Emerald Group Publishing Limited.

Boas, Franz. 1911. *The Mind of Primitive Man*. New York: MacMillan.

———.1912. *Changes in Bodily Form of Descendants of Immigrants.* New York: Columbia University Press.

———.1916. "Eugenics." *Scientific Monthly* 3 (5): 471–478.

Brozen, Yale. 1951. "Invention, Innovation, Imitation". *American Economic Review* 41 (2): 239-257.

Carr, Lowell. 1929. "A Study of 137 Typical Inventors". In *The Rural Community*, edited by the American Sociological Association, 204-6. Chicago: University of Chicago Press.

———.1932. "The Patenting Performance of 1,000 Inventors During Ten Years". *American Journal of Sociology* 37 (4): 569-580.

Cohen, Adam. 2016. "Harvard's Eugenics Era". *Harvard Magazine,* March-April: 48-52.

Dannequin, Fabrice. 2012. "L'influence de l'eugénisme Galtonien dans la pensée de Joseph Alois Schumpeter." *Revue Interventions Économiques. Papers in Political Economy* 46: 1-16.

David, Paul. 1991. "The Hero and the Herd in Technological History: Reflections on Thomas Edison and the Battle of the Systems." In *Favorites of Fortune: Technology, Growth, and Economic Development Since the Industrial Revolution*, edited by P. Higgonet, D. Landes and H. Rosovsky, 72–119. Cambridge, Mass.: Harvard University Press.

Degler, Carl. 1991. *In Search of Human Nature*. Oxford: Oxford University Press.

Desrosières, Alain. 1998. *The Politics of Large Numbers: A History of Statistical Reasoning*. Cambridge, Mass.: Harvard University Press.

Dubois, Michel. 2014. "From Discovery to Invention." *Revue Européenne des Sciences Sociales* 52–2 (2): 7–42.

Dudley-Marling, Curt, and Alex Gurn. 2010. *The Myth of the Normal Curve*. New York: Peter Lang.

Eldredge, Niles, and Stephen Gould. 1972. "'Punctuated Equilibria; an Alternative to Phyletic Gradualism.'" In *Models of Paleobiology,* edited by T. Schopf, 82–115. San Francisco: Freeman, Cooper, & Co.

Eldridge, Hope, and Dorothy Thomas. 1964. *Population Redistribution and Economic Growth, United States, 1870-1950 Vol. 3, Demographic Analyses and Interrelations*. Philadelphia: American Philosophical Society.

Elliott, John. "Introduction to the Transaction Edition". In Schumpeter ((1934) 2012): *vii-lix.*

Epstein, Ralph. 1926. "Industrial Invention: Heroic, or Systematic?" *Quarterly Journal of Economics* 40 (2): 232–72.

Fancher, Raymond. 1985. *The Intelligence Men. Makers of the IQ Controversy*. New York: Norton.

Fletcher, Richard, and John Hattie. 2011. *Intelligence and Intelligence Testing*. London: Routledge.

Foss, Nicolai, Peter Klein, and Per Bylund. 2012. "Entrepreneurship and the Economics of the Firm." In *Handbook on Organisational Entrepreneurship,* edited by D. Hjorth, 49-63. Cheltenham: Edward Elgar Publishing.

Frank, Mark. 1998. "Schumpeter on Entrepreneurs and Innovation: A Reappraisal." *Journal of the History of Economic Thought* 20 (4): 505–516.

Galton, Francis. 1869. *Hereditary Genius: An Inquiry into its Laws and Consequences*. London: Macmillan.

———. 1883. *Inquiries into Human Faculty and Its Development*. New York: Macmillan.

Gick, Wolfgang. 2002. "Schumpeter's and Kirzner's Entrepreneur Reconsidered: Corporate Entrepreneurship, Subjectivism and the Need for a Theory of the Firm". In

Entrepreneurship and the Firm: Austrian Perspectives on Economic Organization, edited by N. Foss and P. Klein, 88-101. Cheltenham: Edward Elgar.

Gilfillan, Seabury. 1920. "The Coldward Course of Progress." *Political Science Quarterly* 35 (3): 393–410.

———. 1922. "Review of Cycles of Prosperity and Depression in the United States, Great Britain and Germany: A Study of Monthly Data, 1902-08 by Alvin Harvey Hansen." *The Sewanee Review* 30 (4): 507–9.

———. 1924. "European Political Boundaries". *Political Science Quarterly* 39 (3): 458-484.

———. 1927. "A Sociological Study of Inventors" *Journal of the Patent Office Society* 10 (3): 115-119.

———. 1928. "Who Invented It." *Journal of the Patent Office Society* 10 (5): 215-225.

———.1929. "Invention in the History of the Ship." *Publications of the American Sociological Society* 23: 200–203.

———. 1930a. "Inventiveness by Nation and State: A Note on Statistical Treatment." *Journal of the Patent Office Society*, 12 (6): 259–267.

———. 1930b. "Invention in the History of the Ship." *Journal of the Patent Office Society*, 12 (8): 341–46.

———. 1930c. "Inventiveness by Nation: A Note on Statistical Treatment." *Geographical Review* 20 (2): 301-304.

———. 1932. "Review." *American Journal of Sociology* 38 (3): 482–84.

———. 1934a. "Social Principles of Invention." *Journal of the Patent Office Society* 16 (1): 30-35.

———. 1934b. "Social Principles of Invention Part II." *Journal of the Patent Office Society* 16 (4): 307-320.

———. 1934c. “Social Principles of Invention Part III.” *Journal of the Patent Office Society* 16 (7): 544-566.

———. 1934d. “Social Principles of Invention Part IV.” *Journal of the Patent Office Society* 16 (10): 769-784.

———. 1934e. “Social Principles of Invention Part V.” *Journal of the Patent Office Society* 16 (11): 832-851.

———. 1935a. “Social Principles of Invention Part VI.” *Journal of the Patent Office Society* 17 (1): 71-81.

———. 1935b. “Social Principles of Invention Part VII.” *Journal of the Patent Office Society* 17 (2): 154-171.

———. 1935c. “Social Principles of Invention Part VIII.” *Journal of the Patent Office Society* 17 (3): 216-236.

———. (1935d) 1970. *The Sociology of Invention*. Cambridge, Mass.: MIT Press (First paperback edition).

———.1935e. *Inventing the Ship*. Chicago: Follett.

———. 1965a. “Lead Poisoning and the Fall of Rome”. *Journal of Occupational and Environmental Medicine* 7 (2): 53-60.

———. 1965b. “Roman Culture and Dysgenic Lead Poisoning”. *Mankind Quarterly* 5 (3): 131-148.

———. 1969. “Some Racial Comparisons of Inventiveness”. *Mankind Quarterly* 9 (3): 120-129.

———. 1970. “An Ugly Duckling’s Swan Song”. *Sociological Abstracts* 18*: i-xl*.

———. 1971. *Supplement to The Sociology of Invention*. San Francisco: San Francisco Press.

———. 1990. *Rome’s Ruin by Lead Poison*. Long Beach: Wenzel Press.

Goddard, Henry. 1912. *The Kallikak Family; a Study in the Heredity of Feeblemindedness.* New York: Macmillan.

Godin, Benoît. 2010a. "'Innovation Studies': The Invention of a Specialty." *Project on the Intellectual History of Innovation Working Paper No. 7*.

———. 2010b. "Innovation without the Word: William F. Ogburn's Contribution to the Study of Technological Innovation." *Minerva* 48 (3): 277–307.

———. 2017. *Models of Innovation. The History of an Idea*. Cambridge, Mass.: MIT Press.

Goldschmidt, Richard. 1940. *The Material Basis of Evolution*. New Haven: Yale University Press.

Gould, Stephen Jay. 1982. "The Meaning of Punctuated Equilibrium and its Role in Validating a Hierarchical Approach to Macroevolution." In *Perspectives on Evolution*, edited by R. Milkman, 83-104. Sunderland: Sinauer Publishing.

Hacking, Ian. 1990. *The Taming of Chance*. Cambridge: Cambridge University Press.

Hansen, Alvin. 1921. *Cycles of Prosperity and Depression in the United States, Great Britain and Germany: a Study of Monthly Data 1902-1908*. Madison: University of Wisconsin Press.

Hébert, Robert, and Albert Link. 2006. "The Entrepreneur as Innovator". *Journal of Technology Transfer* 31 (5): 589-597.

Hedtke, Ulrich, and Richard Swedberg (eds.). 2000. *Joseph A. Schumpeter - Briefe/Letters*. Tubingen: Mohr Siebeck.

Hodgson, Geoffrey. 1997. "The Evolutionary and Non-Darwinian Economics of Joseph Schumpeter." *Journal of Evolutionary Economics* 7 (2): 131–45.

———. (1999) 2001. *Evolution and Institutions. On Evolutionary Economics and the Evolution of Economics*. Cheltenham: Edward Elgar.

Hounshell, David. 1997. "The Cold War, RAND, and the Generation of Knowledge, 1946-1962." *Historical Studies in the Physical and Biological Sciences* 27 (2): 237–67.

———. 2000. “The Medium Is the Message, or How Context Matters: The RAND Corporation Builds an Economics of Innovation, 1946–1962.” In *Systems, Experts, and Computers: The Systems Approach in Management and Engineering, World War II and After*, edited by Agatha C. Hughes and Thomas P. Hughes, 255–310. Cambridge, Mass.: MIT Press.

Huntington, Ellsworth. 1915. *Civilization and Climate*. New Haven: Yale University Press.

———. 1917. “Climatic Change and Agricultural Exhaustion as Elements in the Fall of Rome”. *Quarterly Journal of Economics* 31 (2): 173-208.

———. 1924a. “Geography and Natural Selection: A Preliminary Study of the Origin and Development of Racial Character.” *Annals of the Association of American Geographers* 14 (1): 1–16.

———. 1924b. *The Character of Races as Influenced by Physical Environment, Natural Selection and Historical Development*. New York: C. Scribner’s Sons.

Huntington, Ellsworth, and American Eugenics Society. 1935. *Tomorrow’s Children; the Goal of Eugenics*. New York: Wiley & Sons.

Huntington, Ellsworth, and Leon Whitney. 1927. *The Builders of America*. New York: Morrow.

Jefferson, Mark. 1929. “The Geographic Distribution of Inventiveness.” *Geographical Review* 19 (4): 649–61.

Kaldor, Nicholas. 1954. “The Relation of Economic Growth and Cyclical Fluctuations.” *The Economic Journal* 64 (253): 53–71.

Kaufer, Erich. 1989. *The Economics of the Patent System*. New York: Harwood Academic Publishers.

Kincheloe, Joe, Shirley Steinberg, and Aaron Gresson. 1997. *Measured Lies: The Bell Curve Examined*. New York: St Martin’s Press.

Kroeber, Alfred. 1917. “The Superorganic.” *American Anthropologist* 19 (2): 163–213.

Kuznets, Simon, Ann Miller, and Richard Easterlin. 1960. *Population Redistribution and Economic Growth: United States 1870-1950. Vol. 2 Analyses of Economic Change*. Philadelphia: The American Philosophical Society.

Ladd-Taylor, Molly. 2001. "Eugenics, Sterilisation and Modern Marriage in the USA: The Strange Career of Paul Popenoe." *Gender & History* 13 (2): 298–327.

Lapied, André, and Sophie Swaton. 2013. "L'entrepreneur Schumpétérien est-il surhumain?" *Cahiers d'économie politique/Papers in Political Economy* 2: 183–202.

———. 2014. "Le cycle de la conjoncture chez Schumpeter : éternel retour du même ?" *Revue de philosophie économique* 15 (1): 17–47.

Lee, Everett, Ann Ratner Miller, Carol Brainerd, and Richard Easterlin. 1957. *Population Redistribution and Economic Growth, United States, 1870-1950.* Philadelphia: American Philosophical Society.

Leonard, Thomas. 2005. "Retrospectives: Eugenics and Economics in the Progressive Era." *Journal of Economic Perspectives* 19 (4): 207–24.

———. 2016. *Illiberal Reformers - Race, Eugenics, and American Economics in the Progressive Era*. Princeton: Princeton University Press.

MacLeod, Christine. 2007. *Heroes of Invention: Technology, Liberalism and British Identity, 1750-1914*. New York: Cambridge University Press.

Martin, Geoffrey. 1973. *Ellsworth Huntington: His Life and Thought*. Hamden: Archon Books.

März, Eduard. 1991. *Joseph Schumpeter: Scholar, Teacher, and Politician*. New Haven: Yale University Press.

McCraw, Thomas. 2007. *Prophet of Innovation. Joseph Schumpeter and Creative Destruction*, Cambridge, Mass.: Belknap Press of Harvard University Press.

McGee, David. 1995. “Making up Mind: The Early Sociology of Invention.” *Technology and Culture* 36 (4): 773–801.

McKee, David. 1991. *Schumpeter and the Political Economy of Change*. New York: Praeger.

Mehler, Barry. 1988. *A History of the American Eugenics Society, 1921-1940*. PhD dissertation, University of Illinois. Accessed online March 27, 2017: http://faculty.ferris.edu/ISAR/dissertation.htm

———.1989. “Foundation for Fascism: The New Eugenics Movement in the United States.” *Patterns of Prejudice* 23 (4): 17–25.

Merton, Robert. 1935. “Fluctuations in the Rate of Industrial Invention.” *The Quarterly Journal of Economics*, 49 (3): 454–474.

———. 1936. “Review.” *Isis* 25 (1): 166–67.

Merton, Robert, and Elinor Barber. (2004) 2006. *The Travels and Adventures of Serendipity. A Study in Sociological Semantics and the Sociology of Science*. Princeton: Princeton University Press.

Mirowski, Phillip. 2011. *Science-Mart: Privatizing American Science*. Cambridge, Mass.: Harvard University Press.

Mirowski, Phillip, and Ester-Mirjam Sent. 2002. *Science Bought and Sold: Essays in the Economics of Science*. Chicago: University of Chicago Press.

Mokyr, Joel. 1990. *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press.

———. 2017. *A Culture of Growth: The Origins of the Modern Economy*. Princeton: Princeton University Press.

Nelson, Richard. 1959a. “The Simple Economics of Basic Scientific Research.” *The Journal of Political Economy* 67 (3): 297–306.

———.1959b. “The Economics of Invention: a Survey of the Literature”. *Journal of Business* 32 (2): 101-127.

——— (ed.). 1962. *The Rate and Direction of Inventive Activity*. Princeton: National Bureau of Economic Research.

O’Donnell, L. A. 1973. “Rationalism, Capitalism, and the Entrepreneur: The Views of Veblen and Schumpeter.” *History of Political Economy* 5 (1): 199–214.

Ogburn, William. 1921. “Review of *Applied Eugenics* by Paul Popenoe and Roswell Hill Johnson”. *Political Science Quarterly* 36 (3): 533-535.

———. 1922. *Social Change with Respect to Culture and Original Nature*. New York: Huebsch.

———. 1926. “The Great Man versus Social Forces.” *Social Forces* 5 (2): 225–231.

———. 1928. “Inventions and Discoveries.” *American Journal of Sociology* 34 (1): 25–39.

———. 1929. “Inventions and Discoveries.” *American Journal of Sociology* 34 (6): 984–93.

Ogburn, William, and Seabury Gilfillan. 1933. “The Influence of Invention and Discovery.” In *Recent Social Trends in the United States*, edited by H. Hoover, 122-166. New York: McGraw.

Ogburn, William, and Dorothy Thomas. 1922. “Are Inventions Inevitable? A Note on Social Evolution.” *Political Science Quarterly* 37 (1): 83–98.

Ogburn, William, Jean Adams, and Seabury Gilfillan. 1946. *The Social Effects of Aviation*. New York: Houghton Mifflin Company.

Parayil, Govindan. 1991. “Schumpeter on Invention, Innovation, and Technological Change”. *Journal of the History of Economic Thought* 13 (1): 78-89.

Peart, Sandra, and David Levy. 2005. *The “Vanity of the Philosopher”: From Equality to Hierarchy in Postclassical Economics*. Ann Arbor: University of Michigan Press.

Pintner, Rudolf. 1923. *Intelligence Testing: Methods and Results*. New York: Henry Hold & Company.

Popenoe, Paul, and Roswell Johnson. 1918. *Applied Eugenics*. New York: The Macmillan Company.

Porter, Theodore. 2004. *Karl Pearson: The Scientific Life in a Statistical Age*. Princeton: Princeton University Press.

Quetelet, Adolphe. 1835. *Sur l'homme et le développement de ses facultés ou Essai de physique sociale*. Paris: Bachelier.

Regan, Maura. 2003. "Dr. Joseph Rossman and the Establishment of the Joseph Rossman Memorial Award." *Journal of the Patent and Trademark Office Society* 85: 76-78.

Reinert, Hugo, and Erik Reinert. 2006. "Creative Destruction in Economics: Nietzsche, Sombart, Schumpeter." In *Friedrich Nietzsche (1844–1900): Economy and Society*, edited by J. Backhaus and W. Drechsler, 55–85. New York: Springer.

Rosenberg, Nathan. 1982. *Inside the Black Box: Technology and Economics*. New York: Cambridge University Press.

Rossman, Joseph. 1926a. "The Relation of Intelligence to Invention – Part I". *Journal of the Patent Office Society* 9 (11): 511-534

———. 1926b. "The Relation of Intelligence to Invention – Part II". *Journal of the Patent Office Society* 9 (12): 565-571.

———. "The Correlation of Intelligence and Invention". *Journal of the Patent Office Society* 10 (8): 356-359.

———. 1930. "Heredity and Invention." *Journal of Heredity* 21 (12): 507–12.

———. 1931. *The Psychology of the Inventor: A Study of the Patentee*. Washington: Inventors Publishing Company.

Rostow, Walt. 1990. *Theorists of Economic Growth from David Hume to the Present: With a Perspective on the Next Century*. New York: Oxford University Press.

Rubin, Goulven. 2012. "Don Patinkin's PhD Dissertation as the Prehistory of Disequilibrium Theories." *History of Political Economy* 44 (2): 235–276.

Ruttan, Vernon. 1959. "Usher and Schumpeter on Invention, Innovation, and Technological Change." *Quarterly Journal of Economics* 73 (4): 596–606.

———. 1961. "Usher and Schumpeter on Invention, Innovation and Technological Change: Reply." *Quarterly Journal of Economics* 75 (1): 154–156.

Sanders, Barkev. 1962. "Some Difficulties in Measuring Inventive Activity." In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, edited by Richard Nelson, 53–90. Princeton, N.J.: National Bureau of Economic Research.

Santarelli, Enrico, and Enzo Pesciarelli. 1990. "The Emergence of a Vision: The Development of Schumpeter's Theory of Entrepreneurship." *History of Political Economy* 22 (4): 677–96.

Schaffer, Gavin. 2007. "'Scientific' Racism Again?": Reginald Gates, the *Mankind Quarterly* and the Question of 'Race' in Science after the Second World War." *Journal of American Studies* 41 (2): 253–278.

Schumpeter, Joseph. 1908. *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*. München und Leipzig: Duncker & Humblot.

———. 1911. *Theorie der wirtschaftlichen Entwicklung*. Leipzig: Duncker & Humblot.

———. 1926a. *Theorie der wirtschaftlichen Entwicklung*: *Eine Untersuchung über Unternehmergewinn, Kapital, Kredit, Zins und den Konjunkturzyklus.* München und Leipzig: Duncker & Humblot.

———. 1926b. "Gustav v. Schmoller Und Die Probleme von Heute." *Schmollers Jahrbuch* 50 (3): 337–388.

———. 1927. “Social Classes in an Ethnically Homogeneous Environment”. Reprinted in Schumpeter, Hoselitz, and Norden (1951) 1966.

———. 1928. “The Instability of Capitalism.” *Economic Journal* 38 (151): 361–86.

———. (1934) 2012. *The Theory of Economic Development*. New Brunswick: Transaction Publishers. Sixteenth printing.

———. 1939. *Business Cycles; a Theoretical, Historical, and Statistical Analysis of the Capitalist Process.* New York: McGraw-Hill.

———.1941. “An Economic Interpretation of Our Time: The Lowell Lectures”, In Richard Swedberg (1991c), 339-400.

———.1942. *Capitalism, Socialism, and Democracy*. New York: Harper and Brothers Publisher.

———. 1954. *History of Economic Analysis.* New York: Oxford University Press.

Schumpeter, Joseph, Markus Becker, and Thorbjørn Knudsen. 2002. “New Translations: *Theorie Der Wirtschaftlichen Entwicklung*.” *American Journal of Economics and Sociology* 61 (2): 405–437.

Schumpeter, Joseph, Bert Hoselitz, and Heinz Norden. (1951) 1966. *Imperialism and Social Classes*. New York: Meridian Books.

Schumpeter, Joseph, and Bruce McDaniel. 2010. *The Nature and Essence of Economic Theory*. New Brunswick: Transaction Publishers.

Schweitzer, Paul. 1961. “Usher and Schumpeter on Invention, Innovation and Technological Change: Comment.” *Quarterly Journal of Economics* 75 (1): 152–154.

Shionoya, Yūichi. 1997. *Schumpeter and the Idea of Social Science: A Metatheoretical Study*. New York: Cambridge University Press.

Sussman, Robert. 2014. *The Myth of Race: The Troubling Persistence of an Unscientific Idea*. Cambridge, Mass.: Harvard University Press.

Swann, Peter. 2009. *The Economics of Innovation: An Introduction*. Cheltenham: Edward Elgar.

Swedberg, Richard. 1989. "Joseph A. Schumpeter and the Tradition of Economic Sociology." *Journal of Institutional and Theoretical Economics* 145 (3): 508–24.

———. 1991a. *Schumpeter: A Biography*. Princeton, N.J.: Princeton University Press.

———. 1991b. *Joseph A. Schumpeter: His Life and Work*. Cambridge: Polity Press.

———. (ed.) 1991c. *Joseph A. Schumpeter. The Economics and Sociology of Capitalism*. Princeton, N.J.: Princeton University Press,

Taussig, Frank. 1911. *Principles of Economics. Volume II*. New York: Macmillan.

———. 1915. *Inventors and Money Makers*. New York: Macmillan.

Thomas, Dorothy. 1952. "Experiences in Interdisciplinary Research." *American Sociological Review* 17 (6): 663–669.

Usher, Abbott. 1929. *A History of Mechanical Inventions*. New York: McGraw Hill.

———. 1936. "Review of Inventing the Ship by S. C. Gilfillan." *Isis* 24 (2): 450–53.

Volti, Rudi. 2004. "William F. Ogburn, *Social Change with Respect to Culture and Original Nature*". Technology and Culture 45 (2): 396-405.

Wallace, Robert. 1991. "The Struggle of a Department: Columbia Sociology in the 1920s." *Journal of the History of the Behavioral Sciences* 27 (4): 323–340.

White, Lynn. 1968. *Dynamo and Virgin Reconsidered: Essays in the Dynamism of Western Culture*. Cambridge, Mass.: MIT Press.

Witt, Ulrich. 1992. "Turning Austrian Economics into an Evolutionary Theory." In *Austrian Economics: Tensions and New Directions*, edited by B. Caldwell and S. Boehm, 215–43. New York: Springer

Yagi, Kiichiro. 2008. “Schumpeter in the Harvard Yard: Inventions, Innovations and Growth”. In *Marshall and Schumpeter on Evolution: Economic Sociology of Capitalist Development*, edited byY. Shionoya and T. Nishizawa, 204-222. Cheltenham: Edward Elgar.

ARCHIVAL MATERIALS

The Seabury Colum Gilfillan Papers, Kelvin Smith Library: Special Collections Research Center, Case Western Reserve University.