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A Reply to Flaminio Squazzoni's Comment

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Abstract

Graham Room's reply to Flaminio Squazzoni's comment on his essay "The Empirical Investigation of Non-Linear Dynamics in the Social World. Ontology, Methodology and Data", published in *Sociologica*, 14(1), 2020.

Keywords: Non-linear dynamics; co-evolving systems; autocatalytic sets; patents and technological innovation; contingent historical change.

It is not uncommon for scholars to read a review of their work — perhaps by an anonymous referee for a journal — and to feel aggrieved that the reviewer has simply not understood the work in question. Of course, often this is because the author has failed to present the argument with sufficient clarity — the review on second reading can therefore be a force for good, prompting the author to reformulate the argument to better effect. It is nevertheless a pleasure to read a response such as that by Flaminio Squazzoni (2020), which goes straight to the central arguments of the article in question (Room, 2020), and then poses some fundamental and searching questions.

A full response would require a much longer piece than this — and would indeed require an extended period of consideration. My comments here are therefore no more than a first step in that process. Squazzoni in his closing paragraph expresses his wish to understand more fully my theoretical agenda; but in reality, he is helping me clarify that agenda for myself! That of course is what academic collaboration and criticism should be all about.

There are five main questions that Squazzoni poses.

First, he challenges the "bio-social evolutionary divide" that he finds in my article.

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> *We are not the only "manipulative", "experimental" purposive species, as the evolutionary key includes different mechanisms for gene-environment interactions in various species (...) Not only does purposiveness have its counterparts in non-human species (e.g., Sapolski, 2017); so do power, competition, positional advantages and status hierarchies, which are prevalent in many species (Wrangham, 2019). (...) Recent research confirms that we humans have* **only** *scaled up these mechanisms thanks to the co-evolution of brain and social structures, while biological and social evolution are deeply, jointly intertwined via the link between social environment and genetic selection* (Squazzoni, 2020, p. 196; emphasis added).

The key word here is "only" — if humans have "scaled up" these mechanisms, is the difference just a matter of degree, or is it so large that it entails a massive qualitative change?

Odling-Smee is one of the evolutionary biologists who highlight the way that non-human species actively re-shape or "engineer" their abiotic environment, adapting it so as to buffer and moderate its selective pressures (Odling-Smee, Laland, & Feldmann, 2003). This is what he calls "niche construction". But is it "purposeful"? I stand with Marx on this: "*A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality*" (*Capital*, Vol 1, 1867).

Odling-Smee goes on to contrast the genetically encoded information inherited by each new generation, as to how organisms can successfully operate within different selective environments (this includes human beings of course); and the *cultural* transmission of such information, among humans uniquely. This is a massive qualitative difference. For social scientists, such cultural mechanisms are moreover drenched in the contested exercise of positional advantage and power and they must be analysed as such. Any "evolutionary" account of human societies that lacks a clear conceptualisation of power at its heart is, for me at least, inherently and fundamentally unsatisfactory.

Indeed, it is with the exercise of power that Squazzoni's ***second*** challenge is then concerned — exercised in particular by social actors involved in the patent process which I have taken as my empirical example. He accepts in principle my account of the processes of technological innovation and institutional change that are underway, but he wonders how power would be theorised here and how it would be empirically manifested.

Figure 7 in my paper displays the four quadrants of the workflow that I distinguish within the patent process. In each quadrant the actors in question — inventors on the one hand, national and global patent officers on the other — are faced with a set of tasks within a specific institutional regime; at completion the fruits of their work pass on to the next quadrant in the sequence. However, the lone inventor is in reality a rarity. Inventors typically sit within large corporations — or within small start-up companies, whose dream is to be bought up by such corporations. It is these corporations that gather intelligence as to emerging trends in technology; it is they that decide on the direction of corporate R&D investment and also then play a big part in shaping public R&D; it is they who decide which patents to buy up and shelve, lest their own market dominance is compromised.

Implicitly if not explicitly, WIPO (the global patent authority) displays in its annual updates the range of newly emerging technologies that are coming on stream; but it is the corporations that dispose of investment funds that decide which of these technologies will be privileged in the coming years. Fossil fuel industries may thereby be given a longer life; new green technologies may struggle to find a market; government subsidies may be key to the new

balance that is struck. That in turn will leave its mark on the range of inventions for which patents are sought: a mark of the exercise of such corporate power. How far such marks can be exploited for research purposes remains to be seen.

Squazzoni turns ***thirdly*** to my treatment of time. He is content that this fully embraces the dominant paradigm of time and dynamics, as a sequence of changes and innovations in a world in constant flux. Nevertheless, he wants equal attention to persistence and continuity — and, he might have added, path dependency, as discussed for example in the literature on historical institutionalism (Pierson, 2004).

Squazzoni also likes the distinction between "slow" and "fast" dynamics as presented by Jain and Krishna. He comments however that "time is internal to social processes and can be slow or fast, depending on their duration and constructive rhythm" (2020, p. 197). What this all suggests is that alongside the well-developed literature on complex landscapes, there is a paper to be written on complex "timescapes": what Prigogine describes as the "timing of space" (Prigogine & Stengers, 1984, p. 17). I am currently working on just such a paper.

Still in relation to my treatment of time, Squazzoni asks how typical is the timescale embedded within the patent process. The formally recorded events involved in patent registration and classification may obscure more than they reveal about the temporal dynamics that underpin them. Squazzoni is obviously right in this. The annual calendar that I capture in my four quadrants may indeed prove deceptively neat for rigorous scientific research, even if WIPO has been able to impose it on the world of technological invention; and the researcher must recognise that the real world of invention embodies a much more complicated blending of processes and calendars. Whenever we make use of databases constructed for administrative purposes we must consider carefully the limits to their use for our research purposes and we must cross-check against other forms of evidence. We should not fear to be methodologically adventurous; but we must make a clear assessment of the risks and limitations.

Squazzoni asks ***fourthly*** how typical the patent process is of other processes of innovation. I have after all offered the contingent historical model as an exemplar for empirical research on the dynamics of innovation; it is reasonable to ask what adaptations would be needed, to apply it to other empirical fields. Squazzoni takes as his counter-example a database of proverbs and maxims, to examine the evolution of a culture over time. Social actors can exploit the available fund of proverbs and maxims and re-purpose them, for example in political communication, while also leaving them to persist over time. Absent however are the institutional classifications and semantic ontologies of the patent system, with their "scheduled times" or "regular events". Also absent is any centralised institution, in charge of the selection and classification of meanings.

As scientists, we make sense of the world around us by decomposing and disentangling it into manageable chunks — but also then noticing the ways in which the chunks interact. In this way we follow Einstein's maxim to "make things as simple as possible — but no simpler". Political and business leaders follow the same principle in the world of practical affairs. Systems of imperative coordination order masses of citizens into a limited range of tasks, an administrative division of labour that allows large-scale complex tasks to be completed. The analysis of such systems was of course central to the sociology of Max Weber. He also however recognised that such imperative coordination involves the exercise of power and that this is always contestable.

The patent system, seemingly so neat, regular and efficient, is one such system of imperative coordination. It provides us with one "toy model" for viewing large scale processes — in this case, the registration and facilitation of invention. There are close parallels — see for example

Zuboff's account of "surveillance capitalism" and the extraction of "behavioural surplus", but with the exercise of power far more visible (Zuboff, 2019, Ch. 2). It may however be that the example I give of the patent system is most useful not by itself, but alongside a number of other such toy models, for analysing patterns of innovation within different institutional settings. Squazzoni's example of proverbs and maxims might possibly serve as one of those additional models.

Squazzoni turns ***fifthly*** to the question of noise. The Jain and Krishna model on which I build incorporates the randomness of the Darwinian selection mechanism. Squazzoni asks how the recognition of purposeful and agile agency will affect this — whether such agency generates the *diversity* upon which the selection mechanisms of (social) evolution can act, or should instead be seen as a source of purposeful *order*.

We might first recall the contrast that Darwin himself draws between natural and artificial selection. He describes the pigeon breeders and horticulturalists (Darwin, 1859, Ch. 1) who looked out for novel characteristics in the offspring of each new generation, which would give them an advantage in new markets. I describe such purposeful search and selection as the "arts of civilisation" (Bronowski, 1981, Chs. 2–4). Such purposeful agency is informed by the breeder's imagination of the markets that will become available, but also by the power at his disposal to bring new breeds to that market faster and more effectively than his rivals (think similarly of the current race to produce a vaccine for the C-virus). Markets are however not just *discovered*, they are also *made*, and that too depends on the power as well as the imagination of those who compete. Furthermore, markets are not just *made*, they also then *interact*, and in ways that cannot be entirely foreseen. In short therefore, purposeful and agile agency both selects from within diversity, and is to this extent a source of order, and also sets new interactions in motion, and is thus a source of novel diversity.

To conclude: In his opening paragraph Squazzoni sets the whole discussion in the topical context of the COVID-19 pandemic. He wonders how far the framework I have offered could be useful in examining the non-linear dynamics involved in such social situations of crisis. The current emergency requires us to understand the virus itself and its biological evolution but also the "adaptive decisions, behavioural zigzags, unpredictability and uncertainty that prevail in public decisions and social behaviour at all levels". I would add that it also however requires us to consider the economic and political interests upon which these developments impinge and the exercise of power by those affected. Our task as social scientists is not only to explain the non-linear dynamics of the interacting biological, technological and social systems amidst which we live, but also to expose the alternative futures which may be available and the terms on which collective choices among those futures are playing out.

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