Reevaluating Aggregation

Complexity Summer School Essay Submission

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In *The Theory of Moral Sentiments* Adam Smith explains how "Our first ideas of personal beauty and deformity, are drawn from the shape and appearance *of others*, not from our own" [8] (emphasis added). Invoking a Robinson Crusoe example[1], he concludes that such creature would not have the required "mirror" of his fellow-humans to perceive beauty or impropriety. Heidegger posited human existence is always "being-with" others and one's environment, precluding an isolated ego[2]. Individual behavior—and by extension, aggregate phenomena—cannot be fully understood in isolation[3]. This foundational idea challenges traditional approaches in political science and economics, where the study of aggregates often starts from the assumption of the isolated individual. However, how we have conceptualized these aggregates from the isolated-individual-up is something that has long perplexed me. During the program I wish to explore what some have referred to as the "aggregation problem" [2] both as a methodological challenge and a fundamental conceptual issue by applying insights and tools from complexity research to better understand how from interactions aggregate phenomena emerge.

1 Why is this important?

I suspect that the *aggregation problem* in the social sciences is a much more fundamental issue, one that we've overlooked or one whose current approach we've grown comfortable with. During my undergraduate training it was always highlighted that assumptions are not meant to be realistic, but rather useful. Oftentimes (perhaps too many times) professors invoked Jorge Luis Borges's short story *"Del rigor en la ciencia"*[4] as an illustration of why models require simplifying assumptions. What I contend is how most models we explored in either political science or economics merely extend previous models by relaxing assumptions. Those approaches, which I'll refer to inaccurately as "traditional approaches" avoid an adequate inquiry into the role that *interactions* play in the emergence of aggregate phenomena[5]. The reductionism inherent in traditional approaches unintentionally hides from us potential explanations and roads for research.

The phenomena studied by economics, political science and other social sciences are precisely aggregate phenomena arising from complex interactions but that transcend the peculiarities or specificities of its constituent parts. In philosophy this idea is referred to as emergence, an exceedingly functional and crosscutting notion. The typology of emergent phenomena proposed by De Haan [1] suggests that what we are dealing with in these fields is type III emergence or "reflective emergent" phenomena because the "objects [of the system] perceive the emergent behaviour and are able to alter their interactions accordingly" [1]. Simon [7] refers to these objects as elementary subsystems, because any hierarchic system is composed of subsystems that could, in turn, also exhibit a hierarchic structure with, and like so recursively.

Taking a critical stance towards our theoretical practices is a result of a deep worry for the overlooked contingency of our own categories and practices, particularly in economics. But these are historical and dialectical,

[1] He starts the paragraph with "Were it possible that a human creature could grow up to manhood in some solitary place...".

[2] He adds a philosophical take to the german word *Mitsein* or "being-with", as part of his explanation of a relational ontology: "human existence has the character of 'being-with' even if there are no others in one's immediate vicinity" [6].

[3] Some have challenged the view that our world can be understood solely out of the relationships between humans. Other "things" or "objects", in the general sense (ideas, theories), are actors in the sense that they are relevant factors interacting and cocreating social situations in the human world, thus calling this approach Actor-Network-Theory.

[4] In the story Borges describes a map that is so detailed and accurate that it becomes as large as the territory it represents, eventually becoming useless as it is no longer distinguishable from the territory itself.

[5] It's possible that interactions play a negligible role in economic behavior crucial for studying consumption and/or production, but I find it challenging to justify such an assertion, specially after reading about the "network effect" in economics.

and thus must be reexamined in accordance with the changes in society itself,[6] as well as adapt to the changing analytical tools available to us. Listening to peers with which I graduated from my undergraduate economics program justify their choices or explain the behavior of other fellow-humans using marginal costs, the rational choice paradigm or equilibrium intuitions disturbs me profoundly. Inspired in the relational ontology, I feel an obligation to explore an interactional approach in which the environment, typically viewed as a passive object and oftentimes even completely absent in economic models, and the interactions with fellow-humans, are both given the required ontological relevance.

2 Action plan

2.1 In economics

The proof of the existence of a competitive general equilibrium and the mathematical variations and extensions that followed provide a clear example of practitioners assuming the understanding of the aggregate phenomenon, prioritizing formalism over genuine exploration of the phenomenon itself. Modern macroeconomic models built upon microeconomic foundations oftentimes refer to the individual as a (utility-maximizing) household. For some purposes considering an n person household as our elementary subsystem seems reasonable, but (a) How does this "smaller" aggregate behavior of 2 or more individual humans come about? (b) Is it trivial that we can just assume this elementary subsystem as such and not consider it as a higher level hierarchic system in itself? (c) How adequate is a summation (or integration) of utility functions for aggregation of lifetime utilities or welfare of a society in light of emergence? And most importantly, (d) what is an equilibrium in the context of emergent systems like these?

Macroeconomics pretends to understand *aggregate* phenomena, and the connection with the elementary subsystem was incorporating microfoundations. The goal was creating "artificial economic systems that can serve as laboratories in which [...] can be tested out at much lower cost" [4]. Concentrating in the process of aggregation by studying from the ground up how this emergent phenomena comes about is the first item in the agenda in order to answer (a)-(d), and hopefully to construct other laboratories to compare our insights with.

2.2 Political science

Decades of social choice theory that deal with precisely this same challenge of aggregating preferences has brought about a wealth of relevant theoretical results from which we can work on to understand how preferences develop over time. Nonetheless, in my own country as in many others a recent perceived inefficacy of democracy[7] at the expense of legitimacy has driven to the undermine of this very legitimacy. The mission is to *represent* the preferences of the (select and increasingly smaller) electorate. But there are as many political preferences as there are individual humans, and what we learn from a reductionist approach could be enriched from one that incorporates the *dynamics* of preference construction within different groups to which a person belongs: the *process* of aggregation.

Consider a spectrum of aggregation that has on one end a single individual $i = 1, \ldots, N$ (our elementary subsystem) and the entire country of Colombia on another end. (e) How do we go from "Pepito Pérez wants X" to "Colombia wants X"?[8] If representativeness of the constituency were to be on a continuum, (f) how do we characterize the upper and lower limits and *why*? (g) How can we compare theoretically how different democratic arrangements aggregate preferences and under what conditions? Representativeness is the next item on the agenda in order to answer (e)-(g), where studying the aggregation process could provide valuable insights.

3 Case Study

A practical application of our approach could examine the impact of short-term versus long-term rentals by tourists and digital nomads across low-cost cities like Bogotá D.C., Ciudad de México, and Mumbai. This case study aims to contrast these findings with traditional models, highlighting the significance of emergent phenomena in urban settings. How do the individual actions of these newcomers influence a "transition" of the social system? If affected residents modify their political preferences in light of these changes, how could we understand the policy decisions

[6] Paraphrased from H. Marcuse's position regarding the fetishizing of marxian concepts that also need reexamination [5].

[7] At least in the Colombian context, it's a participatory democracy within a presidential system.

[8] I'm not referring to the process of winning an election. Instead, *how* does the current election processes aggregate prefences?

as responding to the common sentiment? Collaborating with Latin American researchers sharing an interest in complexity will leverage Donna Haraway's concept of 'partial perspectives' [3] to deepen our understanding of aggregate phenomena, enriching both our empirical insights and theoretical framework.

Economics Nobel laureates Robert E. Lucas [4] and Friedrich Hayek [9] highlighted the limitations of perfect competition and representative-agent assumptions, emphasizing the role of convenience and measurability in shaping economic theory. Despite two decades of advancements in simulations and network theory, our theoretical frameworks have lagged in incorporating these insights. My goal is to integrate these advances into a nuanced understanding of aggregate phenomena in political and economic behavior, challenging traditional approaches and proposing new principles based on emergent processes.

References

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