

# Social Emergence and Unpredictability

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**Abstract:** I analyse arguments for social emergentism based on the notion of unpredictability. After examining and ultimately rejecting weak emergentism as relevant theoretical counterpart to reductionism, I discuss three arguments asserting that social phenomena should be considered strongly emergent as they are in-principle unpredictable. The main results are a clearer understanding of the premises underlying an emergentist case for unpredictability and that none of the discussed arguments succeeds when confronted with the actual practice of contemporary social science. This conclusion contributes to a deeper understanding of the concept of unpredictability and the prospects of a theory of emergence in social science.

**Keywords:** Philosophy of social science; prediction; reductionism; emergentism; deterministic chaos.

## 1. Introduction

There is a long-standing debate concerning the meaning, the viability and the merits of different form of individualism and holism in the social sciences. In recent years, this debate has often been framed in terms of reduction and emergence: Are there social phenomena or systems – such as groups, nation states or organisations – with emergent features (i.e. properties, behaviours, dynamics)? And if so, are these features irreducible *or* ultimately reducible to the level of individuals (in some sense of the term ‘reduction’)?

Discussions on social emergence in the philosophy of the social sciences have so far focused predominantly on the possibility of emergent causal powers. These discussions already started with Karl Marx (1844, 1858; Marx & Engels, 1846), Emil Durkheim (1964[1895]) and Gabriel Tarde (1899) and are ongoing (cf. Greve, 2015; Sawyer, 2005; Zahle & Collin, 2014). While some authors argue for the existence of autonomous causal powers of social systems, others have denied this or attempted to reconcile reductionist and emergentist approaches in the social sciences (Elder-Vass, 2010, 2014a, 2014b; Greve, 2010; Sawyer, 2002, 2003, 2005; Wahlberg, 2014a, 2014b; Zahle & Kaidesoja, 2019). In this paper, I take a different path and attempt to shed light on a lesser-discussed aspect of social emergence. I discuss arguments for emergentism that are based on the idea that certain social phenomena are in a strong sense *unpredictable*. This focus on unpredictability is motivated precisely by the (surprising) fact that this type of emergence – although a tenet of classic emergentism, (in particular in Lloyd Morgan, 1927; cf. Klee, 1984; Stephan, 2002) – has as of yet not received any in-depth treatment

in the philosophy of the social sciences. By focussing on the question of the unpredictability of emergent social phenomena, I want to change this, thereby enriching the discussion in the philosophy of the social sciences and contributing to a more differentiated understanding of the premises underlying an emergentist case for unpredictability.

A central aim of this paper is to contribute to a better view of the discursive landscape on social emergence and to encourage philosophers of the social sciences and theory-oriented social scientists to not only address questions of causality in the context of the emergence discussion. In particular, arguments for the in-principle unpredictability of social phenomena deserve more attention and should be explored in more depth. As I will show, however, a more in-depth exploration of these can ultimately not be purely conceptual, but will also need to address questions of the empirical corroboration of (alleged) barriers to predictability.

I proceed as follows. In section 2, I distinguish weak and strong emergence. Subsequently (section 3), I explore the notion of unpredictability with a view to two varieties of *weak* social emergence and ultimately reject weak emergentism as a fruitful theoretical counterpart to reductionism in the social sciences. In section 4, I assess three arguments that have been put forward to defend the idea that certain social phenomena are in-principle unpredictable and will therefore need to be considered *strongly* emergent. I will discuss the intransparency of social systems (4.1), deterministic chaos (4.2) and the

epistemic disconnectedness of sociological micro-macro-laws (4.3) as possible foundations for in-principle unpredictability. The main findings of my discussion will be that none of the arguments are successful, which becomes clear when the arguments are confronted with the actual practices and state of contemporary social science. In the concluding section, I briefly sketch some implications of my findings for the broader discussion about emergentism and unpredictability in the philosophy of the social sciences.

## 2. Weak vs. strong emergence

The core motivation for social emergentism is to develop a position that can reconcile two basic intuitions about social reality. First, social reality is realised by individual agents and depends on their actions and interrelations with each other and material reality (Epstein, 2007; List & Spiekermann, 2013). Second, social phenomena display some kind of novelty or autonomy. The goal to reconcile these intuitions is, of course, a general trademark of emergentism, as aptly stated in the *Stanford Encyclopedia of Philosophy* article on emergent properties:

“The general notion of *emergence* is meant to conjoin these twin characteristics of dependence and autonomy. It mediates between extreme forms of *dualism*, which reject the micro-dependence of some entities, and *reductionism*, which rejects macro-autonomy” (O’Connor, 2021).

This notion of emergence stands in the tradition of the *British Emergentism* of the 1920s and motivated several authors to develop a view of *life* as emergent phenomenon and to think about *mind* as having emergent properties as well (Alexander, 1966[1920]; Broad, 1980[1925]; Lloyd Morgan, 1927, 1929; see McLaughlin 1992). The latter motivation was later taken up by authors in neuroscience and philosophy of mind (Chalmers, 2006; Sperry, 1969, 1986). The central aim in all of these cases is to reconcile the ideas that some higher level phenomenon (life/mind) is realised by its micro-structure (cells/brain) and that it nevertheless possesses a kind of qualitative novelty and/or autonomy, e.g. in terms of novel configurational forces (i.e. forces that results from the specific organisation or relatedness of a system and can change the course of events, see Lloyd Morgan, 1927, p. 16ff).

The key question, of course, is what exactly “some kind of qualitative novelty and/or autonomy” is supposed to mean in these cases. In the debate on emergentism, there are two standard answers to this question, pointing to the crucial distinction between weak and strong emergence. Before I go into this, however, it is important to emphasise a feature that both positions have in common. I do this because there is some confusion in the discussion about this which has at times led to framing the very idea of strong emergence as antinaturalistic or dubious. Weak and strong emergentism are united by their commitment to *metaphysical monism*. This is a key characteristic of emergentism, which sees itself as a position that opposes forms of substance dualism, e.g. soul/body dualism, the existence of a Hegelian “Volksgeist” or strong vitalist positions (O’Connor,

2021). Emergence of any kind of higher level phenomena or properties always implies their ontological *dependence* on the lower level, meaning that there are no fundamentally different kinds of substances or ontological realms involved (Hoyningen-Huene, 1985; Kirchhoff, 2014).

The main difference between the two positions revolves around the question of irreducibility. According to strong emergentism, there are certain higher level systemic features (i.e. properties, behaviours, dynamics) – of chemical compounds, living entities, the mind, social systems – that are *in-principle* irreducible, i.e. they cannot be explained, deduced or predicted from knowledge about the lower level due to the way the world is organised. Weak emergentism, on the other hand, sees any irreducibility as stemming *only* from limitation in our knowledge. Although certain higher-level systemic properties may be difficult to explain, deduce or predict from the lower level of the system, this difficulty is seen as a pragmatic barrier and ultimately transient (Hoyningen-Huene, 2007; Stephan, 2002). The clash between both positions therefore revolves around questions of explanatory, deductive and predictive reducibility. To what extent can emergent phenomena be deduced or predicted from knowledge about the lower level that gives rise to them? Is it possible to fully explain emergent properties by providing reductive descriptions that make their occurrence transparent to us?<sup>1</sup> It is these questions that are at the core of the dispute, within which I aim to focus on issues of predictability.

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<sup>1</sup> See the seminal discussion in Kim (1999), which explores the close connection between reducibility, predictability and explainability in emergentism in more detail.

It is worth pointing out that strong emergence is sometimes called ‘ontological’ emergence and weak emergence described as ‘epistemological’ or ‘epistemic’. I think this terminology can easily mislead as it can be understood as a contradiction to the above statement that metaphysical monism is a *shared* assumption of both positions. I want to emphasise, therefore, that the term ‘ontological’ is referring to something else when used in this context. It means that strong emergence is characterised by a fundamental irreducibility that results from the way the world is constituted and, if true, would have to be accepted as a “brute empirical fact” (Alexander, 1966[1920], p. 46). So the idea is that although an emergent phenomenon or property of a system is ontological dependent on its realising micro-structure it adds a *genuinely new feature to the setup of the world*, for instance a novel property (such as consciousness) or force, which is the reason for the in-principle epistemological irreducibility – hence strong emergentism has ontological *and* epistemological aspects. However, this does not introduce a new substance or novel ontological realm; i.e. ontological novelty is understood within a metaphysically monistic framework. In the case of weakly emergentist positions, on the other hand, irreducibility is understood as *only relative to our epistemic state* and can be overcome, in principle, by expanding the knowledge about the lower level that gives rise to higher order phenomena or properties.

It will be helpful to say a few more things about the reading of strong emergence that is presupposed here (and is in line with the tradition of *British Emergentism*) in more

detail. Strongly emergent features can be understood as dependent (on their micro-structure) and fundamental (aspects of reality) at the same time. This tension has sometimes been labelled as conceptual incoherent. However, Barnes (2012) shows that this is not so, given that fundamental things are not necessarily among the basic building blocks of the universe. Shoemaker (2002) develops an argument for strong emergentism along these lines, based on the idea that there could be micro-latens properties that only become manifest in specific configurations that give rise then to new fundamental properties. In this paper, I assume that this is the best possible reading of strong emergentism (cf. O'Connor, 2021; Wilson, 2005) without defending this position in detail.<sup>2</sup> I am aware that there are alternative views that seek to dissolve the difference between dualism and emergence, e.g. by asserting that strong ‘ontological’ emergence would have to give up the dependence from the micro-level (Elder-Vass, 2010, p. 32; Guay & Sartenaer, 2016; Silberstein & McGeever, 1999). In my view, these positions have the disadvantage of missing the crux of emergentism as formulated above, i.e. to provide an intermediate position between reductionism and dualism.<sup>3</sup> Accordingly, the claim that it is necessary to “abandon ontological dependence” is often merely attributed to strong emergentist positions, rather than being actively justified by their proponents. This is unsurprising, as most strong emergentists actually strive to reconcile ontological dependence with a meaningful form of novelty and/or autonomy. While this

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<sup>2</sup> See, e.g., Bedau & Humphreys, 2008; Kim, 1998 and Stephan, 2007 for elaborate discussions clarifying the concept of strong emergence.

<sup>3</sup> This is also the reason why I do not adopt the matrix with combinations of weak/strong and ontological/epistemological emergence in Guay & Sartenaer, 2016.



reconciliation may be exceedingly difficult—some might argue: impossible—it is clear that a solution cannot simply involve abandoning ontological dependence altogether.

Note, however, that the ontological dependence relation should not be understood too statically, as the evolution of a system over time and the unfolding of specific processes building on each other may be relevant for the emergence of specific properties (Kirchhoff, 2014). In the social sciences in particular, social systems which seems identical may give rise to different macro-properties if their development and their histories differ in relevant respects.<sup>4</sup>

### **3 Weak emergentism**

In the discussion about the unpredictability of social phenomena, both weak and strong emergence play a role. In this section, I will first turn to weak emergentism. My aim is to make clear that this form of social emergence, although widespread, is not decisive for the relevant controversy in the philosophy of the social sciences. Furthermore, this will serve to clarify what it takes to be in-principle unpredictable in the social sciences, thereby preparing the ground for the discussion of strong emergentism in section 4.

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<sup>4</sup> See the seminal paper by Currie (1984) arguing for a form of “diachronic supervenience relation” and discussing further complexities regarding the contextuality of higher-level social properties.

### 3.1 Unpredictability and weak social emergence

As stated above, most discussions about emergentism in the philosophy of the social sciences have focussed on (structural or downward) causation, e.g. group pressure and societal coercion, and the question whether these are examples of strongly emergent causal powers or not. An important reason for this is that the unpredictability of social phenomena (or their properties) is often seen as a mere consequence of the extreme complexity of the social world and our epistemic limitations and thus as weakly emergent – which is less interesting from an *epistemological* point of view. Weakly emergent properties may come as a surprise because they were not expected from our knowledge of the micro-structure of a social system and they might *appear* to be irreducible because they do not obviously result from the interactions at the micro-level, but, at the end of the day, they *are* compatible with a reductionist approach. To reiterate, the key point here is that any kind of unpredictability of weakly emergent properties is only relative to our current state of knowledge and/or methodological limitations. That is to say that, in principle, this kind of unpredictability *can* be overcome by expanding our knowledge and/or improving our methods – even though this may be extremely difficult and hardly feasible for pragmatic reasons.

This is less interesting from an epistemological point of view and not controversial because reductionists in the social sciences, most notably methodological individualists, *acknowledge* the existence of weakly emergent properties of complex social phenomena (say political movements) and pragmatic problems in predicting these (Demeulenaere,

2011; Greve, 2015). This concession of transient or pragmatic unpredictability does not contradict the reductionist research programme, for the latter aims precisely to achieve greater predictive success regarding weakly emergent phenomena by overcoming these problems. The term ‘greater predictive success’ must be understood in relative terms here. It is meant to refer to the possibility of roughly predicting the development of a social system and its properties with a certain probability. No one in the philosophy of the social sciences assumes that the social sciences will be able to predict, in high resolution, what exactly a social group or organisation will do on any given day, etc. (I will come back to this important caveat below). The punch line is that the challenges for (roughly) predicting weakly emergent phenomena are *not* in-principle insurmountable.

### 3.2 Unpredictability and moderately weak social emergence

There are, however, also weakly emergent phenomena that seem to be more challenging – and more relevant for the epistemological reductionism vs. antireductionism debate, especially in relation to the social sciences. Consider Humphreys' (2013) discussion (based on the work of Mark Bedau) of Schelling models in the *Encyclopedia of Philosophy and the Social Sciences*.<sup>5</sup> Schelling models are agent-based models for the study of distribution patterns on a (grid) map. They make the assumption that there are two types of agents (type A and type B), each of which has the preference not to have too many agents of

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<sup>5</sup> I assume that many readers will be familiar with Schelling models. Here is a link to a free online version, in case you are not: <http://nifty.stanford.edu/2014/mccown-schelling-model-segregation/> [accessed 09 October 2025].

the other type in the immediate neighbourhood (say no more than 70% of agents of the other type). It then shows, using simple rules of behaviour for these agents, how a randomly distributed arrangement of different agents on a grid map consistently results in a segregation into homogeneous neighbourhoods of type A and type B. This segregation is interesting and surprising in view of the only slightly pronounced preference for avoiding too many neighbours of the other type. More importantly, Schelling segregation patterns cannot be deduced as “there is no simple correspondence of individual incentive to collective results” (Schelling, 1971, p. 143). In these (and similar) cases, we can only predict the outcome of a certain development, a certain macro-pattern, by *simulating* the systems we want to predict (Bedau, 1997). Although the laws of micro-interaction in Schelling models are very simple, the underlying complexity and context-dependence of interactions is so high that it is impossible to predict the emerging macro-pattern *directly*, by way of deduction from knowledge about the initial conditions of the system and the laws governing the micro-behaviour. It is cases like these that Bedau calls weakly emergent. Since I use the term in a broader sense (see above), I will consider these cases as special instances of weak social emergence, namely cases of *moderately weak social emergence*.

Predicting moderately weak emergent phenomena through simulation is nevertheless possible, since we can “crawl the causal web” (Bedau, 2008) of the micro-interactions that give rise to the macro-patterns of interest. It is possible to do this in compressed time with the help of computers. This fact is absolutely key for understanding to what

extent moderately weak emergent properties like these are (un)predictable. Although predictions of this type are “computationally incompressible” (Humphreys, 2008) in the sense that there is no simpler way to deduce the outcome of the system than to go through iterations of the system<sup>6</sup>, we *can* predict future macro-properties (or patterns) through simulating micro-interactions in compressed time.

Bedau would likely object to this characterisation of the situation. He describes incompressible predictions of this kind (in the sense of the computational incompressibility of the deductive steps) as cases of “in principle irreducibility in practice” (Bedau, 2008, p. 449). So, is there a relevant kind of epistemological irreducibility at play here after all? Does this mean that his version of weak emergence ends up being more like strong emergence? There are good reasons to answer this question in the negative. To make this point, however, I have to make an additional assumption, namely that we are interested in using such computer models to study empirical social phenomena and that we can learn something about real world patterns from computer simulations. Only then can this discussion have implications for the emergence of social phenomena.<sup>7</sup>

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<sup>6</sup> It may be possible to make predictions about the types of patterns we can expect, though (see, e.g., Banos, 2012; see also Ghomi, 2022).

<sup>7</sup> Although Humphreys (2008) restricts his analysis to computer model systems, he does not appear to be opposed to an analysis of emergent patterns “from the perspective of the real systems being modelled” (p. 432).

It is true, there are social systems whose micro-interactions are so complex that they cannot be deduced via a principle that compresses the necessary information in compact form, i.e. without simulating the interactions and “crawling the causal web” of the system. But this does not change the fact that those systems’ future macro-properties *can* be predicted in an important sense: Let us assume there was a situation in a real-world neighbourhood that resembles a Schelling-style scenario in all relevant respects. We would not only be able to fully *understand* the emerging macro-properties (segregation patterns) of this neighbourhood by reducing these to the underlying micro-interactive logic, we could also predict these patterns through computer simulation, i.e. we could forecast emergent macro-patterns very quickly – before these occur in the real world.

Bedau thinks that cases like these are essentially unpredictable by closely linking predictability and computational compressibility. It is precisely because we have to simulate each of the micro-states of the system and cannot deduce its development in any other way that these simulation-based forecasts should not be considered genuine predictions:

“Some might find this [simulation-based prediction] so unlike what should be expected of a prediction that they would agree with Stone (1989) that it is no prediction at all” (Bedau, 1997, p. 394).

This conclusion, however, does not seem inevitable. Why should we restrict our concept of prediction in this way? This would mean that a large part of what is commonly called ‘prediction’ in science is in fact no prediction at all! In particular, most predictions of complex systems based on agent-based-models would need to be reclassified as some kind of *apparent* or *pseudo*-prediction. This would be especially odd in agent-based-modelling, since the predicted macro-patterns of the systems in question are completely transparent through our understanding of the underlying micro-interactional logic. There is no mystery regarding the predictive success of these simulations. If we accept, however, that forecasting of phenomena, system properties etc. ahead of time is a key function of many (future-directed) predictions in science, Bedau's conclusion does not seem to follow.<sup>8</sup> Moderately weak emergent social systems would then not be “in-principle unpredictable in practice”. Ultimately, they would simply be weakly emergent phenomena, thus unable to play their intended role in the (anti-)reductionism debate.

However, this conclusion does not appear to be without alternative. After all, there is a form of in-principle *non-deducibility* here, which I introduced above as a hallmark of *strong* emergence. Should we not therefore assume the opposite, that moderately weak (perhaps better: moderately strong?) emergence in fact tips over into strong emergence? Although I cannot provide an entirely airtight defence of the interpretation presented here, I will at least try to defend it as reasonable position. As explained earlier, in the

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<sup>8</sup> Notably, the paper by Stone (1989) cited in the above quote by Bedau leaves this door explicitly open: predicting ahead of time, even in non-compressed form, may for Stone still count as a prediction.

scenarios discussed by Bedau and Humphreys, we can do more than “just predict” the behaviour of a social system in compressed time. In addition, these predictions are completely transparent to us, since we can understand how the complex interactions lead to the predicted outcome. From my perspective, it seems odd to characterise this as a case of strong emergence in the sense of adding a fundamentally new feature to the world's setup (in this case, a new kind of behaviour or dynamics). However, for those who do not share this view, it may indeed be more natural to classify these scenarios as *strongly* emergent, (solely) based on the fact that the development of macro-patterns cannot be logically deduced from the micro-level.

#### 4. Unpredictability and strong social emergence

To move forward, I will now discuss three promising but underexplored unpredictability arguments that aim to support the existence of *strongly* emergent social phenomena.<sup>9</sup> If these arguments were successful, they would establish that not even rough predictions of a social system, its properties or behaviours were possible from knowledge about the micro-level of individual interactions. This could then indeed – and in contrast to the arguments discussed so far – support an anti-reductionist position that is of theoretical relevance to the debate in the philosophy of the social sciences. I will first focus on the intransparency of historical social systems as the basis of unpredictability in the social

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<sup>9</sup> I draw here on some of the arguments in Lohse (2019) and develop them further. This is also intended as a contribution to linking the German-language emergentism discussion to the English one. Note that I do not claim that these arguments are the *only* relevant ones in the discussion.



sciences. Next, I discuss the idea that social phenomena may exhibit chaotic properties. Finally, I examine epistemically disconnected micro-macro-laws as a possible foundation for the in-principle unpredictability of social systems. My discussion will also make clear that we are dealing with different types of (alleged) unpredictability. The first two cases are about *temporal* unpredictability of future state of affairs, while the last case focuses on *epistemic* unpredictability, i.e. cases concerning the generation of new knowledge claims derived from a theory, though not *necessarily* about future state of affairs (see Barrett & Stanford, 2006 for a discussion of this distinction; see also Kim, 1999).

#### 4.1 Intransparent historical systems

The argument from intransparent historical systems can, for example, be found in the work of the sociologist and systems theorist Niklas Luhmann (1990, 1995). He claims that many complex social systems, in particular organisations, do not follow a simple input-output logic. Rather they are “meaning-processing systems” that can be described as non-trivial machines in the technical sense of Heinz von Foerster (1992). This notion refers to systems whose behaviour in the face of environmental stimuli cannot be predicted, as it depends on historically evolved internal structures. Such systems are, in Luhmann’s terminology, “operationally closed”:

“Operationally closed systems are situated [...] within a specific historical context, [...] in a distinct state that is co-determined by preceding internal operations. This implies, above all, that they do not transform causes into

effects (inputs into outputs) in the same way every time and, therefore, operate in a calculable way if the transformation function (the ‘law’) was known. Instead, each operation is co-determined by the state into which the system has just placed itself through its own operations, and thus influenced by the structures that have been generated in each case” (Luhmann, 1990, p. 277, ChatGPT-assisted translation).

Systems with these properties, such as organisations, are unpredictable unless the internal structure of the systems can be known in high detail, which according to Luhmann is impossible. The underlying idea can be unpacked as follows. Many organisations and similar social systems have existed for some time.<sup>10</sup> They have a history. Their reaction to any outside stimulus (say a tax reform) will always depend on their internal operations. These operations depend on the internal structure of the organisation, which was generated by earlier operations within the system, in particular earlier decisions about organisational goals, staff structure and communication channels. This leads to a situation where the behaviour of an organisation that has existed for some time is based on processes that are channelled through extremely complex internal structures. These structures are not only extremely complex, but ultimately *intransparent* to us and lead to input-output transformations that we do not understand. In particular, it is not possible to predict the behaviour of an organisation by reducing it to the behaviour of

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<sup>10</sup> I will explain Luhmann’s argument using the example of organisations. It can also be applied to other social systems. Note that I simplify his systems theory for didactic reasons, but in such a way that this does not affect the validity of the overall argument.

individual agents and their interactions. This is so because organisational structures (through which these interaction are channelled) depend on the evolution of the system, the specifics of which cannot be known in enough detail by social scientists studying an organisation. On the basis of these considerations, Luhmann assumes that such systems are indeed in-principle unpredictable, suggesting that they contribute strongly emergent features to the social world (cf. Lohse, 2019).

A natural objection to this conclusion is to question the in-principle nature of the unknowability of the internal structure of an organisation. Why shouldn't we assume that this lack of knowledge is merely due to pragmatic constraints of social scientists? Surely, their insufficient knowledge could be overcome by investigating the organisation's past trajectory, interviewing key staff, studying artefacts that document communication pathways, organisational goals etc. (such as internal guidelines). Doing this might be extremely difficult, resource-intensive and even tedious, but there do not seem to be any insurmountable obstacles at play here.

A possible answer to this argument could be as follows.<sup>11</sup> This objection neglects the members of the organisations and *their* internal psychological structures. Arguably, we have no direct access to mental states and processes of individuals and do not know how

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<sup>11</sup> See Lohse (2011) for a more detailed discussion of this argument.

the internal system states lead to the formation of observable behaviour.<sup>12</sup> On the contrary, the mind can be considered a highly complex historical system too, transforming input to output in an intransparent way that makes it virtually impossible to predict individual behaviour in a reliable way (Luhmann, 1986), especially when this needs to be done for several individuals over a longer period of time and embedded in a complex social environment. In other words, the mental processes of the members of organisations – which are contributing to the internal complexity of organisations and are hence relevant for their behaviour – can indeed not be known on principle grounds as a consequence of how the world is constituted. Is this a case of strong emergence due to intransparent structures after all?

This conclusion does not seem to be compelling in light of actual social scientific research on organisations. The rejoinder would only work if social scientists would be committed to some kind of “mentalistic approach”, i.e. an approach that relies on intra-psychological explanations and prediction of social behaviour – but virtually nobody in the field endorses such an approach. Rather, social scientists use different, non-mentalistic strategies (and combinations thereof) to explain and predict the behaviour of organisations<sup>13</sup>:

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<sup>12</sup> For the purposes of this paper it suffices to assume that this applies at least to complex behaviour outside of strict laboratory conditions. Note that I assume (in order not to be overly restrictive) that emergentist arguments can be supported by in-principle barriers to gain complete knowledge about the micro-level, cf. section 4.2.

<sup>13</sup> Similar strategies are also deployed to explain and predict social movements, nation states and other social entities.

*The individualist strategy:* Methodological individualists rely on the indirect reconstruction of the motives, perspectives etc. of organisation members – based on behavioural data from interviews and surveys, participant observations, theories of individual behaviour and/or background knowledge about the “logic of the situation” (Popper, 1969), social norms, roles etc. (cf. Udehn, 2001) – in order to understand trajectories of organisations. Approaches of this kind do *not* rely on intra-psychological epistemic resources that would require any knowledge about the actual mental states and processes of individuals. Rather, methodological individualism – for instance in the form of rational choice theory – focuses on the observable behaviour of individual actors and social context. This claim may be surprising to some readers, as methodological individualism has at times been identified with psychologistic reductionism (see the classic and still instructive discussion in Lukes, 1968). This, however, is an artefact of the *philosophical* discussion. Individualists *social scientists* do not aim for psychologistic explanations or predictions, although psychological insights about typical forms of decision-making may be utilised (Udehn, 2002).

*The organisation-theoretical strategy:* This strategy includes approaches that use middle-range theories relying on typical empirical patterns and processes in organisations to explain and predict their behaviour. Neo-institutionalist approaches, for example, study the implementation of formal and informal structures in organisations and how these are co-shaped by their environment. Other examples for this general strategy can be found

in institutional economics and organisational culture theory (Shafritz et al., 2016). It is important to note that these “empirical patterns and processes” are not considered irreducible, but can in turn be micro-founded through the individualistic strategy – even if they do not have to be in order to be explanatory and predictive (cf. van Bouwel & Weber, 2008).<sup>14</sup>

These strategies do not guarantee success. Many aspects are uncertain, especially when relying on methods from the arsenal of social scientific field research that attempt to uncover latent motives and informal rules. Moreover, pragmatic constraints can be significant, be they resource-related or ethical in nature. Thus, we cannot predict the behaviour of organisations in detail. But this is not the main point. It rather is that organisational sociology has shown it to be possible to find stable patterns which can be used to make rough predictions concerning likely or unlikely future developments – and to do so without using a mentalistic approach. This is analogous to successful predictions in evolutionary and developmental biology that, although considered successful, often cannot predict the exact development of living systems in real world settings due to complexity and pragmatic constraints.

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<sup>14</sup> In cases, where this is *not* possible, however, these strategies could be compatible with strongly emergent properties that cannot be predicted from the lower level. The same applies to a third strategy, namely to interpret (and predict) organisation as collective agents to whom we can ascribe beliefs and desires that are rational given the situation they are in (Tollefsen, 2002). I will not discuss this variant here for reasons of space, but acknowledge that under certain assumptions this strategy can also be compatible with the strong emergence of characteristics and behaviours of organisations.

Note that it is not clear how *accurate* predictions need to be in the social sciences to convince an emergentist. I assume here that predictions that are both *explanatory* and forecast the occurrence of certain (organisational) developments or patterns with above-average probability are convincing, even if they do not get every detail right. I am aware that this assumption can be criticised as granting the reductionist too much, but I don't want to introduce an epistemic threshold for strong emergence that is so low that it would lead to concept dilution.

In summary, the argument from intransparent historical systems does not provide an adequate justification for the in-principle unpredictability of social systems. The reason for this is that social scientists have the epistemic resources to address Luhmann's challenge. These resources consist, first and foremost, in the use of approaches and social research methods that abstract from the inner life of individual agents and, at times, also from the need to generate high resolution analyses of the internal structure of organisations to make successful qualitative predictions.

## 4.2 Chaotic social systems

The next argument for the in-principle unpredictability of social systems is rooted in chaos theory. Since the late 1980s, chaos theory has been a recurring theme in the social sciences, raising hopes of using tools from complex systems science to explain and predict social phenomena (see, e.g., Gregersen & Sailer, 1993; Kiel & Elliott, 1997; Loye & Eisler, 1987). The use of the term 'chaos theory' in the social sciences is, however, ambiguous.

Mayntz (1997) makes the useful distinction between a wider and a narrower sense of the concept. The wider use links chaos theory to concepts like complexity, instability, non-linear dynamics, and self-organisation in the social realm. According to this understanding, chaos in social systems is ubiquitous. The narrower use of the concept refers to the mathematical theory of deterministic chaos. I will focus on the latter, as it is the narrower version of chaos theory that is relevant for the discussion about in-principle unpredictability and strong emergence.

In deterministically chaotic systems, tiny changes on the micro-level of a given system lead to exponential divergence in the system's trajectory, causing drastic differences in development over time. This is particularly relevant in the social sciences (Brown, 1997). According to proponents of this argument (Stephan, 2011), this is an in-principle limitation for prediction, since it is not even possible to determine the initial state of a social system with enough precision to *simulate* its development (cf. the discussion in section 3). Stephan (*ibid*) provides the example of developments in Berlin in November 1989 that led to the German reunification as an illustration: An improvised answer at a press conference by a spokesperson of the *Socialist Unity Party of Germany* caused the ad hoc opening of the Berlin wall and changed trajectories and properties of the political systems of both West and East Germany in drastic and completely unpredictable ways. Nobody could have forecast these developments, even as late as October 1989. In cases



like these, which can of course be multiplied at will<sup>15</sup>, there seem to be non-linear changes and radical shifts in the development of (previously) relatively stable social systems. These are caused by the tiniest differences at the micro-structure of these systems (e.g. answering a question, being in the room with somebody etc.) and are hence in-principle unpredictable. This would amount to strong emergence.

An obvious objection to this argument is to question the in-principle nature of this type of unpredictability. Since chaos of this type is deterministic, a Laplacian social scientists with (a) unlimited knowledge about the laws governing social behaviour (let us assume for the moment that these exist) and the relevant system including its history, (b) absolutely precise measurement capabilities, and (c) unlimited computational power could indeed calculate future states of *any* social system. While this is a valid argument, it misses a crucial point. For limited beings like us, predicting deterministically chaotic social systems would indeed be an unsurmountable epistemic barrier, since we *cannot* know all the details concerning the state of a social system with absolute precision, we *do not* have unlimited computational capabilities etc. So for human social scientists this seems indeed to be an in-principle limitation in predictability.

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<sup>15</sup> For instance, if the reader is sceptical regarding the alleged unpredictability in Stephan's example, as the political developments leading to the collapse of East Germany were already very advanced in October, I would encourage them to go back in time and consider the decision to allow East German refugees in Prague to leave for West Germany as an alternative tipping point that would have been unpredictable in summer 1989 (see the famous speech of the then German Foreign Minister at the Prague Embassy: <https://www.youtube.com/watch?v=Qh9EwNurawE&t=11s> [accessed 26 September 2025]).

There is, however, a much deeper problem for the argument from deterministic chaos. It is unclear whether there actually *are* social systems that have chaotic properties in the narrow sense of the term. This becomes clear when we zoom in on the technical details of what it means so say that “tiny changes lead to drastic change” (the butterfly effect) and the resulting rather demanding criteria for the empirical confirmation of alleged cases of deterministic chaos. An empirical, dynamic system is only a serious candidate for a deterministic-chaotic system if it can be described by a corresponding mathematical model. Such a model must show that the system in question not only behaves deterministically and non-linearly, but also exhibits what is called *sensitive dependence on initial conditions* as a critical feature of deterministic chaos (Smith, 2007, chapter 1). Sensitive dependent systems show wildly divergent trajectories in their state space given *arbitrarily* small differences in its initial conditions (Bishop, 2015). This leads to rapidly growing uncertainty about their behaviour and, correspondingly, to fundamental limitations in their predictability given our inability to determine the initial system states with absolute precision.<sup>16</sup> The empirical confirmation of such a state of affairs is anything but trivial and often contested, *especially* in the social sciences, i.e. outside the strictly controlled experimental environments of the natural sciences (Bird, 1997). Stephan’s example cannot help here either. It is based on the qualitative description of a suggestive example (as are similar cases), but is not a real argument for deterministic chaos. To make the argument from chaos work, we would actually have to *show* (or at least: make

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<sup>16</sup> The behaviour of such systems can only be predicted, if at all, within a very limited time frame, e.g. as in the case of state of the art weather forecasts through ensemble modelling.

plausible), that certain social systems can be adequately described by chaotic deterministic equations and are indeed sensitive dependent in the technical sense of the term. Otherwise, the failure to predict the respective social systems comes down to the complexity of the social world and pragmatic constraints of predicting human behaviour<sup>17</sup> – weak emergence once again!

Note that this is not meant to be a definitive argument against the existence of deterministic chaos in the social world. It is primarily an objection against arguments based on qualitative descriptions of chaos in social systems. However, it should be pointed out that more formal quantitative approaches to chaos in social system also run into problems: even stock markets, which are sometimes cited as clear examples of chaos in the economy, are considered controversial (Faggini & Parziale, 2016). With the current state of knowledge, it thus seems unclear whether social systems simply behave non-chaotically (in the technical sense) or whether we have not yet found the right tools to measure and model deterministic-chaotic social systems. Moreover, it is not clear whether we will be able to change this, given that there are several factors that make it very difficult to use mathematic models to demonstrate deterministic chaos in social systems (see section 3 in Bishop 2017 for other, fundamental challenges). *First*, in many cases it will be unclear how to delineate a social system from its environment. Consider Stephan’s example. What *is* the system in this case, ‘East Germany’ – ‘East and West Germany’?

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<sup>17</sup> I realise that it would also be possible to ground the unpredictability in case like these in human agency. I will come back to this point in the conclusion.

Where are the boundaries of the system? Does it include the wider political context, especially recent development in the Cold War? *Second*, it frequently seems unclear with which variables we can describe complex social systems in such a way that we can quantitatively capture their states and dynamics in relevant respects. *Third*, even in cases where we know which variables to measure, there is hardly any time series data of sufficient quality and information regarding data noise to enable mathematical modelling that can detect chaos (cf. Smith, 2007, pp. 55–57). *Fourth*, social systems are extremely different from physical and biological systems, as they are much more in flux, sometimes subject to intended changes and frequently disturbed by extrinsic factors that affect the functioning of the system as a whole. This makes it virtually impossible to decide whether a system’s drastic change is a consequence of its intrinsic “chaotic” properties or not (Bühl, 1992).

The result of this discussion is that the in-principle unpredictability of social systems based on deterministic chaos on the micro-level is an attractive argument for strong emergentism. However, it seems to point to a mere *possibility* since there are no uncontroversial examples of chaos in the social sciences. The main reason for this is that it is – and will continue to be – extremely difficult to establish sensitive dependence to initial conditions (in the technical sense of the term) in the social realm.

### 4.3 Epistemic disconnectedness

In this section, I will discuss the possibility of transferring C.D. Broad's (1980[1925]) concept of epistemically disconnected micro-macro-laws to the social sciences as a third argument for in-principle unpredictability. Broad was a key figure in *British Emergentism* and developed a general theory of strong emergence that has been very influential in naturalistic metaphysics and the philosophy of mind (Bedau & Humphreys, 2008). In the philosophy of the social sciences, Broad is sometimes *acknowledged* for his contributions to a general theory of emergence (Sawyer, 2005), but ultimately his position is either marginalised or rejected, since it allegedly implies substance dualism (according to Elder-Vass, 2010, pp. 29–32). However, this conclusion is too quick and misses a key element in Broad's position: Broad's general argument for strong emergence is based on the idea that the properties of a hitherto unobserved whole could be *undeducible* and therefore unpredictable even given comprehensive knowledge about its micro-structure. Thus, while in sections 4.1-4.2 the focus was on the temporal unpredictability of future states of a system, now the focus is on the epistemic unpredictability of types of properties of a *previously unobserved system configuration* (cf. Barrett's and Stanford's distinction introduced above).<sup>18</sup> Here is a longer quote explaining Broad's idea:

“Put in abstract terms the emergent theory asserts that there are certain wholes, composed (say) of constituents A, B, and C in relation R to each

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<sup>18</sup> See Sartenaer (2015, pp. 47ff) for a discussion on the interconnectedness of synchronic and diachronic emergence.

other; that all wholes composed of constituents of the same kind as A, B, and C in relations of the same kind as R have certain characteristic properties; that A, B, and C are capable of occurring in other kinds of complex where the relation is not of the same kind as R; and that the characteristic properties of the whole  $R(A, B, C)$  *cannot, even in theory, be deduced from the most complete knowledge of the properties of A, B, and C in isolation or in other wholes which are not of the form  $R(A, B, C)$* ” (Broad, 1980[1925], p. 61, my emphasis).

Broad’s main example for such a case is the state of chemistry in the early 1920s. At the time, there was no systematic and general knowledge about the laws of composition for chemical compounds. There was no systematic way of predicting the properties of a particular (hitherto unobserved) chemical compound based on knowledge about the properties of the relevant reactants and the chemical structure of the compound. Rather, for every chemical reaction of two or more reactants scientists had to find out – empirically – the properties the compound yields (nomologically), despite the fact that they had “the most complete knowledge” about the properties of the reactants, knew about their behaviour in other contexts and how they would be combined. The respective laws of composition (or ‘micro-macro-laws’) were epistemically disconnected and opaque, and they could not even in principle, be predicted from knowledge of the lower level (Hoyningen-Huene, 2011). Epistemically disconnected laws are fundamental and must be introduced as additional laws of nature (next to the laws of physics). This is, according

to Broad, a brute, i.e. inexplicable, fact about nature. At the same time, the properties of the respective chemical compounds are completely determined by its composition and structure. There is no additional non-physical factor or force at play – and hence, there is, *pace* Elder-Vass, no substance dualism involved (see the above discussion about metaphysical monism as hallmark of emergentism).

Broad’s general theory of emergence is not only consistent, but offers an interesting unpredictability argument that can be applied to the social sciences (see Albert (2013) for an “upside down” version of this argument in the context of Norbert Elias’ sociology): The properties of certain social systems could be undeducible and therefore unpredictable (also in the temporal sense) even given the most complete knowledge of their individual components (A, B, C), arrangement (R) etc. Perhaps there are disconnected sociological micro-macro-laws that can only be found through an empirical study of individual social phenomena since they cannot be predicted from knowledge about the behaviour of individual actors in other situations and relationships, a precise description of the social system under consideration etc. In the social sciences too, there could exist epistemically isolated laws of composition in Broad’s sense – and hence strong emergence.

Again, this proposal faces an objection, namely that the epistemic isolation can always be an artefact of our (unrecognised) insufficient knowledge base concerning the lower level. Accordingly, we could always be dealing with transient unpredictability and opaqueness. This objection must be taken seriously, especially in view of the fact that

Broad's prime example came under pressure due to the development of quantum chemistry, starting in the late 1920s. The application of quantum physics to chemistry allowed a reductionist understanding of key properties of hitherto unobserved chemical bonds and even seemed to allow the development of a general theory of chemical bonding. Consequently, compositional laws no longer had to be discovered individually and accepted as ultimately inexplicable empirical laws, but could be systematically predicted and explained – at least to a certain extent (McLaughlin, 1992; for a different assessment, see Scerri, 2007).<sup>19</sup> In a nutshell, Broad's main illustrative example of strong emergence came under severe scrutiny, and some even regarded it as an example for the success of a reductionist research programme in chemistry. What is to be said against analogous examples from the social sciences suffering the same fate?

A possible rejoinder, will have to concede that we cannot hope for some kind of impossibility proof for irreducibility in this case (Hoyningen-Huene, 1992). Rather, a promising strategy will need to find several convincing examples that could build the case for the existence of epistemically disconnected micro-macro-laws in the social sciences. Organisational sociology, for instance, might be a field where it could be possible to identify epistemically disconnected laws describing the properties of different types of

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<sup>19</sup> Note that it is indeed possible to predict key properties of chemical complexes, at least approximately – which goes against Broad's empirical assumptions. But this does not apply to all properties and not to all complexes. Furthermore, the development of quantum chemistry (and its philosophical reflection) opened up a multitude of new challenges for the reductionist research programme in chemistry and intricate questions regarding the existence of strong emergence in the field: “The matter of emergence in chemistry is far from settled” (Seifert, 2022, see also Seifert 2020).



organisations. Unfortunately, this strategy, although possible in principle, does not seem to be very promising considering the current state of the social sciences. Broad's case was extremely persuasive in the 1920s since scientists had made significant strides in understanding the structure and behaviour of atoms, the properties of different elements etc. Yet, it seemed completely impossible to generate an overarching theory of chemical bonds from this knowledge. It was only against the background of this type of knowledge that the chemistry case for strong emergentism could be persuasive. In the social sciences, however, we are not even close to this state of knowledge. We do not have the same amount of detailed und (more or less) uncontested knowledge about the properties of individual agents, their behaviour in all kinds of situations etc. We are, in other words, far away from a level of knowledge that corresponds to the level of knowledge of chemistry in the 1920s.

In summary then, given the current state of social scientific knowledge about the social micro-level, it will be impossible to make a plausible case for the epistemic disconnectedness of micro-macro-laws that could ground a form of in-principle unpredictability in the social sciences. Although Broad's argument could work in theory, there is – at least so far – no strong empirical support for the assumption that Broad-style scenarios exists in the social sciences (as opposed to pragmatic prediction problems) and, hence, no case for *strong* emergence.

## 5. Conclusion

In this paper, I attempt to show that it is worthwhile to analyse under-explored unpredictability arguments as a resource for emergentist positions in the philosophy of the social sciences. In doing so, I hope to contribute to a higher-resolution map of the discursive landscape. While *weak* emergence proves to be less fruitful from an epistemological point of view, arguments for *strong* social emergence offer interesting starting points for the debate on anti-reductionism. However, the discussion of three (initially) promising arguments shows that these arguments face great difficulties, especially when confronted with the actual practices and state of contemporary social science: Luhmann’s argument is not persuasive, since social scientists have the epistemic resources to address the challenge of intransparent historical systems; the case for deterministic chaos in the social sciences is hitherto a mere possibility without sufficient empirical warrant; and the current state of social scientific knowledge makes it very hard to make a plausible case for the existence of epistemically disconnected micro-macro-laws in the social sciences. While the first argument seems futile, in the latter two cases, a possible strategy would be to put more effort in a serious *empirical* corroboration of the respective positions – instead of engaging exclusively with conceptual issues. With this proposal I aim to encourage a methodological reorientation of the existing philosophical approach to analysing social emergence: It would be fruitful to move towards an approach in line with a philosophy of the social sciences *in practice* (Lohse, 2017). This does not imply, of course, abandoning insights from the analytical emergence discussion in philosophy. Rather, it means utilising them with a view to the current state of the best

social science practices. In my view, this would help to bring more clarity and relevance to the discussion. How promising this strategy will be for *defending* a form of strong emergence is another matter, of course.

Perhaps at this point the reader is overcome by a pragmatic concern, namely that these findings, although interesting from a philosophical point of view, do not make much of a difference *for the social sciences*. Even if strongly emergent social systems did not exist, predicting most social systems and patterns would still be impossible. Complexity and weak emergence alone are sufficient to account for this. This concern, however, presupposes too narrow a concept of social scientific relevance. First, all three of the discussed arguments have been or are used, in some form or another, in the social sciences.<sup>20</sup> So there is indeed a need for clarification regarding their force. As shown, this can lead to a situation in which we are unable to decide certain questions for the time being, at least in the absence of new empirical findings; e.g., we cannot decide whether we should currently assume that chaotic social systems exist or not – but we can treat this assumption as working hypothesis in need of further exploration. Second, many social scientists (not only philosophers of the social science) are genuinely interested in fundamental questions revolving around anti-reductionism. One of the reasons for this is that answers to these questions inform theory building and theoretical discourse more

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<sup>20</sup> See Klatetzki & Ortmann, 2023 and Tsoukas, 2005 for Luhmann-style arguments in organisational studies and Byrne & Callaghan, 2022 and Condorelli, 2016 for recent discussions of the implications of chaos (and complexity) in the social sciences. Broad's theory has, to my knowledge, only been applied by Albert 2013, but there is some critical discussion in Elder-Vass 2010.

broadly. Hence, the critical discussion in this paper can be considered an indirect contribution to social theory. Finally, my discussion provides building blocks for a better, more comprehensive understanding of the concept of unpredictability in the social sciences (and, I suppose, also for economics). Such an understanding will, of course, not only include different types of emergentist arguments, but also include arguments that refer to human agency, free will and performativity effects of different kinds, among other things (Basshuysen, 2023; Hacking, 1995; Khosrowi, 2023; Kuorikoski & Pöyhönen, 2012; Rosenberg, 2012, p. 14ff; Tanney, 2013). Developing a systematising framework for such arguments and their interconnections is far beyond the scope of this paper, but it seems a worthwhile task for the philosophy of the social sciences.

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[omitted]

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