

[Extended Abstract]

Supervenience, emergence, and individuals

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1. OVERVIEW

The somewhat slippery notion of supervenience helps clarify issues concerning emergence and individuals.

2. INTRODUCTION

Block [1] argues against Kim's causal exclusion argument on the grounds that if correct all causal powers (not just mental causal powers) will "drain away." (Given how fraught the notion of cause is I'm amazed how casually the term "causal powers" is treated.) Block summarizes Kim's defense [2] as depending on micro-based properties, "properties of a whole that are characterized in terms of its microstructure."

P is a micro-based property \equiv P is the property of being completely decomposable into non-overlapping parts $a_1 \dots a_n$ such that $P_1(a_1) \dots P_n(a_n) \ \& \ R(a_1 \dots a_n)$.

Kim [3] continues that "micro-based (or microstructural)

properties of an object are its macroproperties—they belong to the whole object—and they do not supervene on the properties of the object's micro-constituents.

If as Kim claims, supervenience fails, there is no drainage, and the drainage argument against causal exclusion fails.

Kim distinguishes between higher-level and higher-order properties. Properties differ by order only if they apply to the same individual—with the higher supervening on the lower. Properties differ by level only if the higher level, i.e., macro, property is a *micro-based* property of the lower as defined above.

But Block notes that a higher level property supervenes over

a specific mereological configuration of properties rather than a single property. ... But why should that make a difference to the draining of causal powers? ... [D]oes it matter whether the causal powers of the supervenient level drain away to configurations of properties rather than individual properties?"

Walter [4] adds that "in an earlier paper [5] Kim himself

characterized a supervenience relation between properties of objects in domains D1 and D2 that are coordinated by a mapping relation R such that for each object x in D1, R/x is the image of x in D2.:

The A-properties of the objects in D1 supervene upon the B-properties of the objects in D2, relative to relation R, iff for any objects x and y in D1 and any worlds w1 and w2, if R/x in w1 is B-indiscernible from R/y in w2, then x in w1 is A-indiscernible from y in w2."

McLaughlin [6] calls this strong *multiple domain supervenience*—weak without the multiple worlds. Multiple domain supervenience reinstates the causal drainage problem between levels unless one agrees with Kim's assertion [2] that

macroproperties can, and in general do, have their own causal powers, powers that go beyond the causal powers of their microconstituents.

Kim's argument for higher level causal powers is the standard observation that, for example, water is liquid but hydrogen and oxygen aren't, or a diamond is hard but carbon atoms aren't. This is a strange argument for Kim in that in allowing higher-level properties to have new (emergent?) causal powers Kim seems to be giving away his emergence position to defend his denial of mental causal powers. When compared to physical properties, he argues, mental properties are higher order but not higher level. Since higher order properties supervene, their causal powers drain. But since higher level properties don't supervene and emergence in his view [7] requires supervenience, their new causal powers are not emergent. This defines away the problem of emergence, but the solution does not feel satisfactory. And as Walter notes, higher level properties do supervene via Kim's own multiple domain supervenience.

In any case I disagree with Kim's perspective about higher level causal powers. In my view autonomous, emergent, higher level phenomena exist because higher level individuals are constrained in ways that produce autonomous *regularities*—such as Game-of-Life (GoL) gliders and Turing machines. But these higher level individuals don't have new causal *powers*. The only "causal powers" derive from fundamental forces. For more on emergence see [8] and my other paper in this workshop. Section 3 explores the consequences of taking supervenience seriously with respect to the GoL glider.

3. OVER WHICH CELLS DOES A GAME-OF-LIFE GLIDER SUPERVENE?

One of the simplest yet most arresting phenomenon of the Game of Life is the (epiphenomenal) glider. A glider is epiphenomenal because it is a "causally powerless" by-product of the Game of Life rules Yet it is an objectively identifiable individual. It can be defined formally as a Game of Life pattern—which itself can be defined as a connected region of *live* cells with a border of *dead* cells. (See [8].) A glider also has lower entropy and can be represented with fewer bits than the same GoL cells in random states. So, even though a glider is epiphenomenal it is ontologically real. Game of Life patterns and Game of Life grid cells are thus distinct domains of individuals.

GoL gliders and GoL grid cells co-habitate within a 2-dimensional space, the Game of Life grid. A GoL glider is characterized by the following properties.

x-location(g: glider, t: time): integer

y- location(g: glider, t: time): integer

These are the x and y grid locations of, say, the north-west corner of the glider at time t.

state(g: glider, t: time): {a, b, c, d}

This is the state of the glider at time t. (A glider cycles through 4 states.)

GoL grid cells are characterized by the following properties.

x- location(c: cell, t: time): integer

y- location(c: cell, t: time): integer

is-alive(c: cell, t: time): boolean

Do glider properties multiple-domain-supervene over grid cell properties? Multiple domain supervenience requires a relation between the domains. The only reasonable relation associates a glider with the grid cells that make it up. With this relation it's clear that at any time t, the glider properties supervene over the grid cell properties. A collection of grid cells in a particular live/dead configuration either is or isn't a glider pattern.

But from one time to another the grid cells that constitute a glider change. So how would one define a fixed relation so that the glider properties supervene over the grid cell properties at all times? The only possibility is for the relation to associate a glider with *all* the grid cells that ever make it up over its lifetime. With such a relation the glider properties supervene over the grid cell properties. Without such a relation, they don't. But this means that a glider must be associated with an unbounded number of grid cells, which is not useful.

It's not useful, but it's not unusual. Far more materials make up a person's body over her lifetime than at any moment. Far more people inhabit a country over its lifetime than at any moment. Supervenience tends not to be useful for biological organisms and social groups. The relational supervenient base is too large—often unbounded. (It is useful if one wants to poison someone or to embed a mole in a government bureaucracy.)

4. INDIVIDUALS

Table 1 reflects a categorization that I believe clarifies some of the issues raised. I will explain it and offer support for its usefulness. Within this framework an individual is a persistent *pattern* of components, not just the components themselves or the components in a particular configuration.

5. REFERENCES

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Table 1. Categories of individuals

<i>Energy status</i>	<i>Naturally occurring</i>	<i>Human designed</i>
Static. At an energy equilibrium; in an "energy well." Supervenience is useful.	Atoms, molecules, solar systems, ...	Tables, boats, houses, cars, ships, geo-stationary satellites, ...
Dynamic. Must import energy (and usually other resources) to persist. Supervenience is not useful.	Hurricanes(!), biological organisms, biological groups, ...	Social groups such as governments, corporations, clubs, the ship of Theseus(!), ...
Subsidized. Energy is not relevant since it is provided "for free" within a "laboratory" which has built-in support for individuals.	Ideas, concepts, "memes," ... The "individuals" within a mental system. (This paper is not about consciousness. This category just fits here.)	The "first class" values—such as objects, classes, class instances, etc.—within a computational system.