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Super-Observational Techniques as Emergent Property Generators

Where does the distinction between NORMAL-OBSERVATIONAL and SUPER-OBSERVATIONAL ACCESS lie? Our current technology is a vast array of instruments which allows us to reach out into the world at a micro- and macro-cosmic, normally unobservable level. I argue 'super-observation' is a data set that, until translated into a normally observable medium in the relevant way, and not an 'observation' in itself. For instance, looking through a telescope and seeing Saturn is a normal observation, as it uses the human sensory perception directly. There is no need for a translation into an empirically observable medium.

In contrast, a super-observation—like the image of the black hole presented below—is empirically unavailable in the normal sense, and requires an often-intricate translation from some data set or sets to be represented in the relevant empirical way such that it is an observation at all. I argue that, in opposition to Grover Maxwell (1962), super-observations are emergent 'useful fictions' because they are mind-dependent entities based on the knowledge available to us to date. Of course, they can migrate out of that category at a later time. I am unsympathetic to Ernst Nagel in his assertion that, "[…]the opposition between [the realist and the instrumentalist] views [of theories] is a conflict over preferred modes of speech[…]" (Maxwell, Quoting Nagel: 3). If it was a terminological debate, we could agree to disagree—which is a dubious and undesirable status in itself. It is my view that the debate revolves around the actual ontological status of non-observable entities, and that forcing their distinction based on tiers of observation will be helpful in positing what kinds of entities get what kind of ontological status in our contemporary theories. Hempel and Oppenheim suggest that:

> "Emergence is not an ontological trait inherent in some phenomena; rather it is indicative of the scope of our knowledge at a given time; thus it has no absolute, but a relative character; and what is emergent with respect to the theories available today may lose its emergent status tomorrow" (Hempel and Oppenheim, 1948: 263).

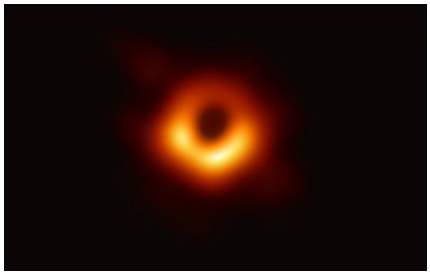
The distinction between observation and super-observation in scientific studies is fascinating; it shows how science ultimately relies on a kind of brute-force empiricist worldview at a foundational level, yet simultaneously accepts non-empirically verifiable entities into its ontology with ease. Science is often thought of as doing objective research regarding a priori facts—such as laws that fix the way things can possibly be—about the world. As Dr. Cory Wright notes, "Empiricism names the view that experience is the fundamental source of all of our understanding; experience is the only basis we have for justifying belief about matters of fact" (Wright, *Notes on Lecture*). For empiricists, then the limits of what we can know are woven intricately with the limits of what we can

experience. What follows from this is that the limits of our knowledge are based on the limits of our observational powers.

Recipes for Science defines 'super-observational access' as a means by which we detect, "[…] what would otherwise be undetectable to us, given our sensory modalities" (Potochnik, Columbo, and Wright, *Recipes for Science*: 42). Often, though, the goal of super-observation is to translate data about some non-empirically accessible phenomenon into an empirical representational token of that phenomenon. In the case of the picture of a black hole, the goal was to translate a wide set of data that was collected into an empirically or normally observable image. Yet, any person looking at the picture ought to say, "This is *not* what a black hole looks like; it is not available to our sensory modality of vision." A black hole, of course, is the definition of some phenomenon which lacks the property of being visible. It gravitationally devours light; because the light cannot escape and be reflected into our eyes, we simply cannot see it. This kind of distinction is crucial to understanding what is going on when a scientist uses an empirical representation of a super-observation to understand the world.

Without such a demarcation, one person's 'super-observation' could be another's normal observation, and this is unacceptable. For instance, when someone who has impaired vision puts on their glasses, or someone needs a hearing aid to hear normally. Where eyeglasses and hearing aids aim to bring a perspective-deficit human into the normal spectrum of perception, super-observational techniques aim to bring that which is outside the normal spectrum of perception down into it. Due to this, super-observations are illusory in the sense that our use of them does not necessarily give us an accurate representation of the way the world *is*, but a token of the way the world *might be* were it available to normal observation.

As previously noted, an example of this is our recent 'picture' of a black hole. As Ota Lutz explains, "…NASA observations did not directly trace out the historic image" (Lutz, *How Scientists Captures the First Image of a Black Hole*):



Credit: *Event Horizon Telescope collaboration et al.*

In a way, this 'picture' of a black hole presents us with some *new*, emergent property of the universe when we see it that did not exist before its empirical translation. This image is a representation of an immense data set that if we were to look at in printed out, coded form, would be nonsensical to our sensory systems. It would look like black text printed on white paper, perhaps, but it would not look like a black hole. This is a model of a black hole that is translated from the data set which we recorded with the goal

of producing an image that was empirically accessible. When looking at this picture, we are not looking at a 'photograph,' at least not in the traditional sense. We are looking at a translated data set from a globally connected network of telescopes which collected the data with this goal in mind. One could not peer through a super powerful lens on a clear night and *see* this sight. If you could, that kind of observation would be akin to a normal perception, similarly to my previous example of using a telescope to see Saturn directly through the amplifying lens:

Credit: *James Martin Photography*

When a philosopher of science puts these two pictures side by side, they ought to see two completely different kinds of representational tokens of the universe. The image of a black hole is an emulation attempting to bring black holes into the empirical scope of our understanding such that they can be compared to something like the photograph of Saturn in a useful way. This is because our sensory modalities are the only direct access we have to the world. We need to take care not to confuse these two kinds of representational tokens of the universe, however, and super-observational translations run the risk of complicating this kind of confusion. If we are being responsible in our uses of these two distinct mediums of empirical analysis, we must be careful not to conflate the two terminologically or ontologically.

If an 'observation' is defined as, "[…] any information gained from your senses," then a 'super-observation' is a unique case. Due to the requirement for translation from insensible data into an empirically accessible token, its pre-translation parts do not make up for the empirical sum which emerges when its representational token comes into being. As we now know, 'seeing' a black hole is a kind of empirical oxymoron. It cannot occur under the umbrella term 'observation' as is normally relevant. As such, scientific inquiry endorses a kind of EMERGENTISM as regards our epistemological theories and ontological posits which develop our worldviews.

Gerald Vision describes Emergentism as the thesis that, "On some occasions, a novel outcome results from increased complexity in that outcomes base. […] Ordinarily, what is taken to emerge is a *property* (or a feature, or a characteristic, or a quality" (Vision, *Re-Emergence*: 6). Some other examples he uses that have a seeming emergent set of properties are social norms, nations of people, and perhaps consciousness itself. A quiddity of Emergentism can be represented as 'the whole is more than the sum of its parts.' I suggest that it is helpful to think of super-observational access to the world as Emergentist because its goal is to add some property or quality to the world that is above

and beyond the fixed facts. This is especially apparent in examples such as our 'picture' of a black hole; a black hole is 'invisible' in an important sense, does not reflect light for a camera of *any* power to be able to photograph it, nor can any perceiver look through a telescope and *see* that which is being portrayed by the super-observationally translated image. The image of a black hole, then, is a token representation of both a data set of black-hole-ness and simultaneously a normal observational impossibility which allows for an empirical or phenomenal concept of 'black hole' to arise. When we observe the 'picture of a black hole,' we observe some irrational, non-empirical content.

Controversially, Emergentism is normally considered an ontological view. Less controversially, as the Stanford Encyclopedia of Philosophy notes, "Epistemological conceptions of emergence have clear and straightforward applications in current scientific contexts" (O'Connor and Wong, *Emergent Properties*: 2012). As epistemologically conceived, super-observational access to the world ought to be considered an emergent-property-generator because it is injecting empirical detectability into concepts that are, as previously discussed, undetectable due to the nature of our sensory modalities.

If the objects of super-observation are empirically undetectable as individuals, but through super-observational techniques become empirically detectable because of the representational tokens that arise from their being the chosen objects of super-observation, then they join the complex network of the emergent ontological entities which are derived outside of our knowledge of the world gained through brute-force empirical testability. If science can derive ontologies based on epistemically emergent conceptions of the world, then it might be said that not only does science *discover* the world in important ways, but *creates* or *invents* the world as it is knowable to us in the relevant way at hand.

Imagine that our scientific worldview was completely structured by empirical possibilities. We would only have access to anything our sensory modalities could directly perceive; the empiricist thesis is that the limits of our knowledge are the limits of our sensory access to the world. Without developing some mechanisms for decomposing non-empirically accessible reality into representations whereby we can commit them to our ontologies, we would be unable to perform meaningful theoretical analyses of the world.

Still, a representational token of a non-empirically accessible entity is *not* identical to that entity; making it sensory-accessible would involve altering its properties drastically. In some ways, representational tokens of non-empirically accessible reality—such as our 'picture' of the black hole—are negatives of reality. Due to these phenomena lacking the properties required to be empirically accessed, we invent emergent representations of them.

Super-observation requires multiple components: some species with limited sensory modalities, some objects to sense, some objects which lack the ability to be sensed, and the desire of that species to perceive them according to their limited sensory modalities. It is not clear to me that it is a necessary property of the world as it fundamentally is that some species must undertake the process of converting information

about sensory-inaccessible entities into sensory-accessible phenomenon. The goal of super-observation then is not an inherent property of nature, but one that arises out of a desire to understand that which is necessarily inaccessible in an empirical way. If science, at its foundation, is an empirically driven worldview which aims at discovering the underlying structure of reality, then it is striking that stunning feats of scientific achievement rely on an interjection of our own emergent inventions: super-observations.

Works Cited

Potochnik, A., Colombo, M., & Cory, W. (2019). *Recipes for Science: An Introduction to Scientific Methods and Reasoning*. New York: Routledge.

Maxwell, Grover (1962). The ontological status of theoretical entities. In Herbert Feigl & Grover Maxwell (eds.), *Scientific Explanation, Space, and Time: Minnesota Studies in the Philosophy of Science*. University of Minnesota Press. pp. 181-192.

Hempel, Carl G. & Oppenheim, Paul (1948). Studies in the logic of explanation. *Philosophy of Science* 15 (2):135-175.

Vision, Gerald (2011). *Re-emergence: Locating Conscious Properties in a Material World.* Cambridge, MA: MIT Press.

Stephan, Achim (1992). Emergence -- a systematic look at its historical facets. In Ansgar Beckermann, Hans Flohr & Jaegwon Kim (eds.), *Emergence or Reduction?: Prospects for Nonreductive Physicalism*. De Gruyter.

How Scientists Captured the First Image of a Black Hole - Teachable Moments | NASA/JPL Edu. (2019, April 19). Retrieved from: https://www.jpl.nasa.gov/edu/news/2019/4/19/how-scientists-captured-the-first-image-of-a-black-hole/

O'Connor, T., & Wong, H. Y. (2015, June 03). *Emergent Properties*. Retrieved from https://plato.stanford.edu/entries/properties-emergent/#StaOntEmeSupEme

Dr. Cory Wright (2019). *Lecture Notes on Course*: Philosophy of Science. California State University Long Beach.