Metaphysics of Diagrams

What are their 4 Causes?

Efficient: Diagrams are drafted by an "expert" agent
Final: Diagrams are tools to aid our understanding
Material: Diagrams are made in the writing tech of the day

} UNCONTROVERSIAL

Formal: Diagrams are abstract representations (... so, diagrams?)

Circular & Uninformative

What to do?

Mimesis:

Diagrams as Mimicking "Expert" Perspective

Diagrams enable a lay-person to see the world through the eyes of the drafter

This perspective is a kind of structural organization: it prioritizes certain features of the world as more important than others in order to emphasize specific relations between worldly content.

Not Truthy:
diagrams may be misleading
Not Representational:
the drafter may never have considered this situation

How do we interact with a 'perspective'?

Phenomenology:

Diagrams engage our Habits of Interpretation *to direct our perspective*

Can we get better at our Habits of Interpretation?

Our skill at using a diagram depends on how "Transparent" it is to us, i.e. how well it engages our talents & education.

Training Diagrammatic Reasoning: our ability to ***focus*** on arbitrary features

Maximizing our Skill in Combining our Talents and Training

Only by focusing on the right features, can we then apply strategic reasoning correctly.

Games of Focus:
Simon Says
Staring Contest
Musical Chairs/Freeze

noahgreenstein.com

On the Formal Cause of Diagrams: Mimesis & Phenomenology

Noah Greenstein[0000−0001−7460−1325]

Independent Scholar, The Bronx, New York, USA
me@noahgreenstein.com
noahgreenstein.com

Abstract. We investigate the formal cause of diagrams, initially realizing that diagrams have no obvious form. It is argued their form is to mimic expert perspectives. This perspective provides a organizational structure that represents the relations important in understanding the worldly situation. We then shift to a study of how we are to understand an expert perspective. Using the distinction between intuitive and formal logic, *logica utens* versus *logica docens*, we identify games of habituation: games of focus and distraction. The skills required for games of focus and distraction are phenomenological in regulating the way we see, *i.e.*, how we approach and analyze different situations. This unique phenomenological skill is characteristic of diagrammatic reasoning.

Keywords: Diagrams · Utens/Docens · Mimesis · Phenomenology · Games · Formal Cause

We inquire into the metaphysics of diagrams: what are their four causes? The material and efficient causes seem straight-forward. Diagrams are materially constituted by the writing systems of the day, be it ink on paper, digital pixels, *etc.* and are 'efficiently' drafted by expert agents. The final cause, too, seems uncontroversial: diagrams are tools that assist us to complete tasks. But what of the form of diagrams? Diagrams cannot be the form of thing they represent, as then the diagram would be no different from the object itself. Nor can diagrams have a totally unique form, as then they could not represent anything else. Hence there is no obvious form to a diagram.

So, consider having to leave a building in an emergency. We could follow someone tasked with public safety who already knows where all the exits are and the fastest routes to get to them. They also have to know which routes lead to dead ends in order to avoid those passages if their current way is blocked and need to reroute. These personnel need this expert understanding and the ability to act appropriately in emergency situations... or, we could follow a map. An exit map attempts to give a lay-person this expert perspective without having to learn the building's layout: if we have a map that indicates the shortest routes, and we can read the map, it is as if we were the expert.

Diagrams, then, obviate having to train our *own ability* to react to stimuli in the appropriate manner, to interpret phenomena correctly. That is, a diagram

replaces the *subjective experience of expertise*: it is an expert agent that can tell the difference between an easy and difficult route. But, having a guide or diagram means we gain an 'expert perspective' without having to do the work of becoming an expert. To be explicit: a diagram does not actually give a lay-person the subjective experience or expertise of an expert. But it does act as a replacement for the expert's ability in that it *converts* a difficult situation into a tractable one for someone of non-expert ability. While the expert understands how to read the *situation*, the lay-person just has to understand the *diagram*.

We can interpret this as a kind of mimicry. What a diagram does is mimic something of the subjective experience of an expert, enabling an interpreter to take on the *perspective* of the creator. This perspective is a kind of organization: to organize the world in a certain structured way, prioritizing certain features as more important than others. Merely taking on such a perspective will not grant a person expertise, but it will reveal certain relations between worldly content. If a diagram is useful, these relations will be relevant to solving worldly problems. Interpreting such a diagram will orient the agent to see certain relations, and, in doing so, imitate how an expert *might* see the world. This suggests a diagram's form is a simulacrum of an expert perspective.

This raises the question: if diagrams are simulacra of expert perspectives *that we do not have*, how do they enable us to have expert thoughts?

Note, the distinction between the expert's subjective experience and the diagrammatic perspective recalls an old Scholastic distinction, championed by Peirce, between *logica utens* and *logica docens*: the way the logic is used, versus the way the logic is described in a 'theoretical,' 'scientific,' or 'educational' way [6, p. 357]. While practitioners *use* logic, just as experts know how to do things, this is not necessarily equivalent to how the logic is represented, e.g., diagrammatically. And, just as many diagrams can be seen as representing formal systems [2], then they can be interpreted as revealing formal logical truth.

The problem is that the truth of *docens*, formal truth, is usually taken to be trivial. That is, truth tells us nothing we already didn't know: asserting some proposition P to be True, "'The sky is blue' is true," is no different than just asserting P, 'The sky is blue'. What we want is something of *utens*, to be able to *expertly* figure out the truth ourselves.

This triviality does not mean there are no further interpretations of logical truth: let us consider the tradition of logic and games, which have a long history together [5]. Importantly, a game-theoretic semantics (GTS) has been given for logic [4]. GTS interprets each of the logical symbols as different features of a game, where they present the players with different choices, such as instantiation. The strategy of choosing different ways to instantiate, conjoin, *etc.*, describes the 'game moves' that a player makes to ensure the winning condition obtains, that is, the truth of the proof. Truth, then, is defined as the *existence of a winning strategy* for one of the players and logic is a game of 'seeking and finding' such a strategy [4, pp. 415-416].

Is there, then, a corresponding concept to the formal *docens* 'existence of a winning strategy' for *utens*? As Pietarinen [6, p. 361] notes, for Peirce: "This is

not to say that the *logica utens* is in some sense utterly pretheoretical, or not subject to its own laws and intrinsic structure of how it comes to be constituted... the camouflage of *utens* as a form of instinct is not only consistent with, but also paramount to, Peirce's desire to implant instinctive aspects of reasoning in the conception of reasoning guided by habits." It is this notion of 'habit' that is crucial: habit instinctively guides the reason of the expert. Pietarinen [6, p. 364] continues along this line, saying: "the concept of habit... came to be replaced by the institutionalized concept of a strategy". We therefore have the instinctive 'habits' of *utens* in parallel to the formal 'strategy' of *docens*.

What concerns us here, then, are our *habits of interpretation*. Each of us interprets the world uniquely and has skills in different areas. But many will have significant overlap due to historical accident or by training. A diagram is effective because it exploits how we, for the most part, habitually interpret the world. By harnessing our extant habits of interpretation, it can orient our perspective as desired.

How well any diagram, notation, *etc.*, actually accomplishes orienting our perspective will depend on the skill of the drafter and the abilities of the viewer. On this point De Toffoli [1, p. 163] defines 'Transparency': "Transparency quantifies... to what extent [a notation] can be interpreted and used directly, by exploiting our cognitive abilities and our training. Therefore, the transparency criterion cannot be fixed once and for all, but it is indexed to the practitioner's background." Hence transparency is a contingent notion, as it is measured relative to particular practitioners. This contingency could signal an end to the philosophical investigation: there could be further research into, say, the psychological effects of different media, but this is an empirical question. If all that is left is empirical, then philosophical reflection is at its end.

However, this would be too quick. On the *docens* side, we described logic as a game of 'seeking and finding' [4, p. 415], kind of like a game of 'Hide and Seek' or 'Hot and Cold' [3, p. 14]. If there is a corresponding game for *utens*, then we could investigate it along the same game-inspired lines.

In this vein, consider games of 'focus and distraction', such as Musical Statues or a Staring Contest. Musical Statues, or Freeze, is a game where one player controls the music and the others dance to it. The DJ makes the music suddenly stop every so often and the Dancers need to freeze in place, like a statue, when the music cuts out. Anyone who gets too wrapped up in their dancing and doesn't freeze, loses. Similarly, in a Staring Contest, two people have to stare into each other's eyes and not break contact. Easier said than done. Due to psychological and biological factors, maintaining eye contact becomes increasingly difficult, almost a battle of the wills, until one person has to look away.

What is common to these games is that the participants need to focus their attention in spite of distractions. In Musical Statues, we become habituated to dancing, and then become distracted from noticing the music stopping. In a Staring Contest, we need to focus our attention on keeping our eyes fixed on the other without being distracted by fatigue. Importantly, we can get *better* at these games, *i.e.* we can be trained to focus on arbitrary targets and block out

distractions. This shows that there is a skill to being focused and implies that there is more than just our disposition and familiarity with a subject matter: there is more than just transparency. There is also a skill in combining the two, in maximizing how our natural disposition and training interact. Let us call this skill our 'meditative' ability.

The better we are at meditating on a topic, the more we can fix our focus upon it and hold everything else irrelevant. Given a diagram to analyze, it is our meditative ability that allows us to re-orient our perspective to make it most salient, while simultaneously blocking everything extraneous from our thought. Only by 'starting fresh' can we begin to search for how the diagram relevantly matches up with the world and provides an expert perspective.

That we 'start fresh' or 'with fresh eyes' is critical. These phrases refer to the *phenomenological* skill of bracketing our default way of 'seeing' a problem so that we do not become misled by our presuppositions. Nor is this just a blank slate: meditating on a topic is not to ignore our disposition and training, but to to re-orient both our disposition and training with respect to it. In this way, by exercising our phenomenological skills, we maximize our chances of appropriating whatever the diagram has to offer. Note, this makes the meditative ability a skill governing phenomenology itself, a phenomenological meta-skill regulating how we approach seeing problems.

Thus, by inquiring into the formal cause of diagrams, we've shown them to have a distinctive metaphysics: they mimic expert perspectives and, while we may sometimes use our meditative ability in other contexts, diagrammatic reasoning is characterized by it.

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