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Title: Strange Tools and Dark Materials : Speculating Beyond Narratives with Philosophical Instruments

Year: 2022

Version: Accepted version (Final draft)

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Please cite the original version:

Varis, E. (2022). Strange Tools and Dark Materials : Speculating Beyond Narratives with Philosophical Instruments. Partial Answers: Journal of Literature and the History of Ideas, 20(2), 253-276. https://doi.org/10.1353/pan.2022.0015

Strange Tools and Dark Materials: Speculating Beyond Narratives with Philosophical Instruments

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"A work of art," according to philosopher Alva Noë (30), is "a strange tool, an alien implement" we craft to "investigate ourselves." As it happens, a similar notion of "philosophical instruments," is also a key feature in Philip Pullman's acclaimed trilogy of speculative fiction, *His Dark Materials* (1995–2000): as the naming of the individual novels suggests, the story revolves around the strange, mind-bending mechanisms of the Golden Compass, the Subtle Knife, and the Amber Spyglass. All three instruments affect the ways the protagonists engage with their storyworld environments by granting them more possibilities for imaginative action. At the same time, using the devices renders the characters' thought processes more visible to the readers. In accordance to Noë's theory of art, this makes Pullman's trilogy itself a tool for thinking, imagining, and thinking about imagining.

This article investigates, in the framework of speculative fiction and contemporary cognitive theories, how instruments — alien, philosophical or otherwise — expand, reflect and become intertwined with the imaginations of characters and readers alike. In addition, I aim to demonstrate how speculation and imagination always overflow the limits of narratives — as well as other cultural and cognitive forms and devices. The first section queries speculation itself: I anchor the

concept to the metacognitive, self-reflexive strategies of speculative fiction on the one hand, and to various conceptualizations of imagination on the other hand. Since both Noë's and Pullman's works are influenced by cognitive theories that view the mind as fundamentally embodied, action-oriented and embedded in its environment, I seek to redefine imagining and speculating in a way that fits to this framework as well. The second section then zooms in on *His Dark Materials*[1] in order to illustrate how this kind of enactive speculation can be depicted and explored in speculative fiction.

Pullman's trilogy, often described as "*Paradise Lost* for young people" (Parsons and Nicholson 116), moves between several parallel worlds. Lyra Belacqua, the first protagonist, comes from a theocratic steampunk world, where consciousness is split between human bodies and shapeshifting animal companions known as daemons. Will Parry, the second protagonist, comes from our world. He sets on a quest to look for his father, who has been lost traveling between the worlds. Mary Malone, the third protagonist, also hails from our world but soon travels to a pastoral world inhabited by intelligent wheeled creatures called the mulefa. In the beginning of the story, Lyra is given an alethiometer, a truth-telling compass device; Will later comes to carry a knife that can cut through anything, even the fabric between the worlds; and Mary invents a resin spyglass, through which she can see the strange Shadow-particles she studies. Separately and together, they cross paths with armored bears, witches, angels, ghosts, and other fantastical figures, while trying to escape the clutches of the Church. Although the trilogy and its many adaptations, sequels and spin-offs would be ripe for any number of analytical angles – and indeed, their thematics and intertextual

[1] In the following, *The Northern Lights* or *The Golden Compass* ([1995] 2011a) — the title differs between different marketing areas — is abbreviated as NL, *The Subtle Knife* ([1997] 2011b) as SK and *The Amber Spyglass* ([2000] 2019) as AS.

connections have already been studied elsewhere (e.g. Lenz & Scott) – I focus solely on the original novels and their depiction of the three eponymous instruments.

Speculative Fiction: What Is It and What Does It Do?

Speculation is an oft-mentioned buzzword — and an equally oft-used slight — in these chaotic times marked with unprecedented global challenges. Thus, we all know vaguely what it means: it is a cognitive activity we engage in when we must think of something unknown — of uncertainties, futures, and mysteries suspended between plausibility and improbability (Dunne and Raby 1–6; Landon 24). Yet, speculation is something of a mystery in itself, as it has not been thoroughly investigated in any scientific field. Indeed, in *Merriam-Webster's Online Dictionary* (2021), the sole definition for *speculation* is the meaning it carries in the world of finance: "assumption of unusual business risk in hopes of obtaining commensurate gain." It involves, in other words, extending one's mind beyond its comfort zone, yet holding onto some kite-line of logic and experience so as not to slip all the way into the impossible, where nothing is to be gained anymore (cf. Dunne and Raby 3; Landon 27). The question that remains to be answered is what "unusual" risks and gains might be involved when one is speculating about something other than stocks.

Speculating in and on Speculative Fiction

Speculative fiction has appeared in literary handbooks and encyclopedias only rarely and recently, but it has deep roots in the science fiction fandom: the term was first coined in 1941 by Robert A. Heinlein, who used it to denote what others have called "soft" science fiction. As opposed to "hard" science fiction, which imagines new technological possibilities, "speculative" stories (in Heinlein's

sense) thus project alternative futures and realities based on societal or humanist concepts and scenarios. (Landon 28–30; Ozciewicz). Later authors of the genre have continued to underline this commitment to logical, rational or political plausibility, which has effectively caused the meaning of *speculation* to blur into that of *extrapolation* (Ozciewicz): "to predict by projecting past experience or known data; to project, extend, or expand into an area not known or experienced so as to arrive at a usually conjectural knowledge of the unknown area" (Merriam-Webster 2021).

Derived as it is from mathematics, this extrapolative sense of speculation corresponds well to the kind of rigorous, probabilistic prediction that Darko Suvin (6–8) and other theorists have dubbed the "scientific method" or "cognitive estrangement" of science fiction. However, as Brooks Landon (24–27) observes, this is hardly the only meaning authors and critics have attributed to speculation over decades: in some contexts, it can take much more of a creative license to imagine what might happen if a novel, alien, or even supernatural element was introduced to a given theory or situation. In *His Dark Materials*, for instance, Mary Malone has to concede to her fellow physicist that she is "just speculating" (SK 238) about the origins of the Shadow-particles. Yet, speculating is all she *can* do in her situation, as a new, unexpected variable has invaded their safely extrapolative research process: Lyra has arrived from another world to demonstrate how the particles respond to human consciousness. This turn of events seems so impossible to Mary's scientifically conditioned mind that it makes her feel physically unbalanced — "she felt as if she had stepped on a space that wasn't there" (SK 247), thus literally arriving to the "unknown area" where only "conjectural knowledge" is possible.

Indeed, whenever the central question of speculative fiction shifts from the extrapolative ”if this goes on” to the more speculative "what if” the genre opens itself to purely fantastical elements as well. Thus, it is perhaps no wonder that *speculative* has also increasingly started to replace *the fantastic*, a term that has linked contemporary genre fiction to the ancient traditions of myth and fairytale in older literary criticism (e.g. Brooke-Rose; Ozciewicz).

Overall, in current academic and commercial usage, *speculative fiction* is most often regarded as an open-ended umbrella term — or a “fuzzy set” (Attebery 32–39) — that blankets science fiction, fantasy as well as their ever-propagating hybrid genres across different media (cf. Roine). While it is impossible to say for certain why this shift towards ever-wider sense of speculative fiction is taking place, it could likely be attributed to the increasingly globalizing and transmedializing audiences and marketplaces of the 21st century – as well as to genre-defying authors like Philip Pullman. Although *His Dark Materials* involves witches, magical items, and other fantastical elements, many of Pullman’s ideas have also been extrapolated from such scientific concepts as evolution, dark matter, and the many-worlds interpretation of quantum mechanics (Pullman 2017: 85–106). This is why the trilogy has been studied alternately as science fiction and fantasy by different scholars (Lenz & Scott).

In this article, I want to side-step these generic frameworks, however, and offer a third possibility: discussing *His Dark Materials* as an example of speculative fiction in the sense that it engages and depicts the cognitive faculty of speculation. This involves embracing all the previous definitions of the word and accepting that speculation is simply not a precision instrument. Its virtues lie exactly in the opposite direction: it is the only cognitive action available when the limits of

certainty are reached or breached, the connecting of known dots in the open space of the unknown.

Of course, a concept as vague as this may not seem an appropriate tool for drawing any genre boundaries. Indeed, if science fiction and fantasy are too limited categories for such ambitious works of non-realist fiction as *His Dark Materials*, speculative fiction just might be the opposite: too all-embracing. As Brian McHale notes, "all fictions project alternative worlds…and they conduct thought experiments, actualizing 'what if' -scenarios. All fiction, in this sense, is speculative" (329). But *what if* speculative fiction was not called "speculative" only due to the speculation it *invites or facilitates* — just like all the other types of fiction — but (also) by the virtue of speculation it *portrays, highlights, and literalizes?*

If all the definitions of speculative fiction have something in common, it is that they concern themselves with works that invite the audiences to adjust their views of the reality – their experiential "choreographies" (see Noë; and Kaisa Kortekallio's article in this issue) or "habits of the mind" (AS 248) – more overtly, systematically or significantly than mimetic or realistic fictions do (cf. Ryan 12–13). Because speculative fictions demand such substantial cognitive efforts from their readers and creators, they also tend to convey a certain self-awareness of the narrative devices they employ (McHale 327; Roine 33–34). Indeed, several researchers (Brooke-Rose; Chu; McHale) have commented on speculative fiction's tendency to make lyric or abstract structures concrete parts of their storyworlds. Drawing on similar ideas offered by Samuel Delany, Ursula Le Guin, and Tzvetan Todorov, Seo-Young Chu (10–11) suggests that science fiction turns metaphoric expressions into "ontological features": the lyrical strategy of apostrophe is concretized as telepathy, personification is expanded into actual

animation of inanimate objects, and so forth. McHale (319, 328) goes on to propose that speculative fiction sometimes gives the same treatment to narrative structures as well: time travel re-organizes the experience of time in the same way the plot organizes the story, characters' immersion into science fiction's computer-generated artificial worlds model the reader's immersion in the narrative *et cetera*. He notes that narratologists themselves tend to perform similar "momentary thought experiments," but only "fleetingly," in jest; "SF goes further, rushing in where narratologists hesitate to tread" (319).

In short, speculative fiction likes to seize the elements it is made of — language, abstract concepts, heuristic models and various other tools for thinking (cf. Herman 2003; Lakoff and Johnson) — and put them on display in some novel, illustrative, defamiliarized form. If these metafictional notions are correct, one could claim that speculative fiction is always, in some ways, *about* speculation – not only is it meditation on different versions of reality but metacognitive investigation into speculative thought itself.

While this may seem a bold statement to make, Noë has formulated an even stronger version of the same claim: enabling and showcasing this type of metacognitive awareness might actually be the purpose of *all* art. Following the contemporary theories of mind, Noë sees most of human life as a tangled process of "self-organization," a series of half-conscious, half-automatized actions we engage and "get lost in" every day: walking, dancing, socializing, watching, reading, worrying — having our minds and bodies run along emergent, biologically motivated, functional patterns (Noë 3–10). Art, by contrast, is a "re-organizational activity" that allows us to "catch ourselves" in the flow of all the other activities (Noë 11–18). Thereby, paraphrasing Aristotle, Noë declares that not only speculative fiction and not only literary fiction but "every play, every poem, every

painting . . . is a *thought experiment*, and its value, as such, is, at root, philosophical" (197). Indeed, Marek Oziewicz describes speculative fiction in such a manner, as "a mode of critical inquiry that celebrates human creative power . . . with a potential for challenging consensus reality." If art reorganizes our lives by taking everyday things and activities out of their habitual contexts, making them strange, new, and noticeable,[2] I suggest, by analogy, that speculative fiction, does the same to our faculties of speculation: it shows us not only what but also *how* we imagine.

Speculation as an Imaginative Skill

This brings us to explore what speculation is and how it functions in practice, particularly in relation to fictional narratives. The first thing to underline is that, as intimately related as they might be, speculation is a larger, more nebulous phenomenon than the creation and consumption of fiction. Rather, it has been characterized as an "imaginative process" (Landon 31) or an operation that "encourage[s] people's imaginations to flow freely" (Dunne and Raby 2). *Speculation* thus appears to be either an operative part of or a prerequisite for *imagination* — and while these two dynamic modes of cognition can leave traces or even find crystallized expressions in the forms and structures of art and fiction (ibid.), the process and the product are never completely commensurate. On the contrary, if we understand fictional narratives as the means of practicing and investigating speculation, the action of speculation will always overflow the limits

[2] Here, Noë's theory of art comes close to a concept that has been evoked by researchers of fantastic fiction many times over: Viktor Shklovsky's *ostranenie* or *defamiliarization*. Noë and Shklovsky's ideas are not completely identical, however. Shklovsky (22) maintains that art helps us to notice reality in a new way: "The purpose of art is to impart the sensation of things as they are perceived and not as they are known." Noë, in turn, adds that art can also make us more aware of that cognitive act of noticing. This extra twist of meta-awareness is exactly what previous notions of speculative fiction are missing as well.

of the narrative form. Instruments are rarely created to *contain* action; they spur, generate, and amplify it. Thus, it pays to discuss briefly the cognitive grounds of speculation and consider how it works outside of the forms of fiction and narration, as an imaginative action.

One of the most famous theories of imagination was formulated by Samuel Taylor Coleridge, who distinguished between *primary imagination*, which entails non-conscious inference that unifies fragmentary sensory perceptions into a coherent and meaningful sense of the world (cf. perceptions heightened by Shklovsky's ostranenie or Keats' negative capability), and *secondary imagination*, which, in turn, consciously synthesizes the divergent, even discordant impressions into new, original ideas. Coleridge further distinguished this kind of "true" artistic creation from mere *fancy*, which is "nothing more than a mode of memory emancipated from time and space," an act of reordering experiences into a collage (Iser 186–194, Lachman 121–22.). According to David Herman, re-organizing experiences in this manner of fancy is the kind of cognitive work that the narrative form does.

In Pullman's trilogy, Lyra spins enough narratives of her own to acquire the nickname "Silvertongue," and her re-organizational practices are mostly fanciful in the Coleridgian sense. Her lies and tall tales simply mix together facts, cliched story tropes, and wishful thinking: the intimidating demeanor of her father becomes an ability to kill people "dead on the spot" with "a hard look" (NL 46), and her own unbelievable journey through different worlds turns into a fun swashbuckling adventure against aliens from the moon (AS 262–63). The narrator states that Lyra is a "sanguine and practical," rather than an imaginative child, adding that: "Being a practiced liar doesn't mean you have a powerful imagination. Many good liars have

no imagination at all; it's that which gives their lies such wide-eyed conviction" (NL 247).

By contrast, Mary, who is described as the most imaginative character in the story (AS 499) and demonstrates true Coleridgian originality on several occasions, is not a liar or storyteller but a scientist and tool-maker. Once she accepts the fact that her research has turned so strange that her only option is to speculate, she finally manages to create a software that allows her to communicate with the Shadow-particles: "within a minute, she had begun to manipulate the numbers on the screen, going half by logic, half by guesswork, and half by the program she'd worked on all evening at home; and the complexity of her task was about as baffling as getting three halves to make one whole" (SK 246). This creative work is not limited by any preordained forms or templates, such as narratives, previous programs, or even logic. On the contrary, Mary's speculation explicitly escapes and overflows them, fusing together the discordant "raw materials" of intuition and deduction. This signals that, in spite of being a feat of narrative imagination in itself, *His Dark Materials* does not conflate speculative thinking with narrative imagination or any other recognizable cultural forms but, rather, advocates for flexible movement between and beyond such frameworks.

Fancy's "emancipation from time and space" as well as secondary imagination's ability to create something completely outside of reality still correspond well to colloquial and academic understanding of imagination. Viktor Shklovsky (19) begins his discussion of defamiliarization with the "maxim" that "Art is thinking in images", and Wolfgang Iser (171) describes imagination as the power to "conjure up" and combine absent, even divergent images and discourses. These definitions reflect the cognitivist conception of the mind, which views the brain as a kind of neural computer that crunches symbolic representations — or

"mental images" (Varela et al. 37–57). This is also how the alethiometer works in *His Dark Materials*: by pointing its dials at the thirty-six symbols painted on its face, the device can communicate any meaning, provided the user knows how to read it (NL 79). This computational view of the mind has been criticized from numerous angles in the recent decades, however. For instance, it has never been conclusively explained how the symbolic data manifests on the neural level, or how raw experience is translated into symbols and vice versa (Varela et al. 40–42). Indeed, it is never fully explained how Lyra understands the alethiometer either: the skill that normally requires years of extensive scholarship simply comes to her naturally, "by grace" (AS 495).

Overall, *His Dark Materials* progresses from wondering at this symbolically coded worldview of Lyra's Biblical society — where "buildings and pictures were designed to be read like books," "everything stood for something else," and knowledge came "from a mysterious source" (NL 173) — to embracing the profound joys of embodied experience. In the end, Lyra must drop her fanciful story-spinning and learn to "trust her body and the truth of what her senses told her" because "the physical world . . . is our true home, and always was" (AS 320–21). Analogously, cognitive theorists have grown increasingly unhappy with the way cognitivist paradigm separates the non-conscious, symbolically coded "cognition proper" from the conscious experience and its embodied complexities. These criticisms have gradually birthed an entirely new paradigm, "the second generation" of cognitive theories, which conceives the mind as profoundly action-oriented, embodied, and embedded in its environment (Kukkonen and Caracciolo; Varela et al.). Indeed, Pullman (2017: 211) has mentioned being aware of the ideas of prominent "second generation" theorists, such as George Lakoff, Mark Turner, and Mark Thompson. He adds, however, that "in [his] butterfly way [he has] cheerfully

taken what [he] want[s]" from the works of the scientists "and carried it away to do something else with it" (ibid.). The point of this article is thus not to evaluate how accurately Pullman has grasped and portrayed cognitive theories but, rather, to inquire whether his imaginative work on and beyond them could inform our understanding of speculative thought in ways that theories cannot (cf. Noë 120–33).

One aspect of the contemporary cognitive theories that Pullman has certainly embraced is the idea of *extended* cognition. If cognition is understood in the "new way," as an activity that unfolds in complex interactions between minds, bodies, and their environments, there can be no "magical membrane" that would keep consciousness inside our brains. On the contrary, even things outside of our bodies become entwined in thinking and experiencing (Kukkonen 59; Telakivi 10; Varela et al.). Pullman explores this idea through "philosophical instruments," which will be analyzed closely in the next section, but also through the daemons, which embody such complex cognitive functions as free will, curiosity — and imagination (SK 199, 279). What is more, the daemons of pre-adolescent characters can shape-shift into different animals according to their situation: when Lyra needs to hide her emotions, her daemon "cleverly" assumes "his most inexpressive shape, a moth"; when they are on a ship at sea, he becomes a dolphin; when in snow, an arctic fox, and so forth (NL 95, 166, 217). This illustrates the concept of *affordances*, or possibilities of action emerging between the capabilities of an embodied mind and its environment (Kukkonen 57; Levine 1–10; Nagy and Neff). By changing their physical attributes to fit their changing situations, the daemons are able to curate and extend their range of affordances in a way that is analogous to humans' use of various instruments.

All of these changes in how the mind is viewed naturally affect the understanding of imagination as well. While most modelings of cognitivist thought

have replicated only limited, clearly defined problem-solving — an AI is taught to play chess, for example — problem-solving in real, embodied life is messier than that: more often than not, it involves an unknown element that can only be approached with speculation. As I will demonstrate, Lyra's reading of the alethiometer may be explained away with such "black box" solution as non-conscious symbolical processes or "grace," but the questions she poses to the alethiometer do not come from nothing: they emerge from the circumstances, needs, and skills of the characters. This part of the process requires another kind of imaginativeness, or "creative cognition," which does not necessarily consist in propositional, symbolically representable knowledge at all; it is more of a skill, a knowing of *how* rather than of *what* (Varela et al. 147–48). This connects to a very different definition *Merriam-Webster* (2021) gives to *imagination*: "creative ability, ability to confront or deal with the problem; the thinking or active mind."

Yet, most empirical studies of imagination have also been based on rather simple set-ups, with carefully defined inputs and outputs (see Valkenburg and Peter for summary). Gathering more such data-points can usher the research onward only so far; designing more sophisticated ways of investigating imagination empirically requires, rather, a firmer grasp on it theoretically and experientially (ibid., 115) — and here cognitive research of speculative fiction has much to contribute. Although speculative narratives are ultimately just another form of simplifying and seizing the expansive process of speculation itself, they provide stable, yet relatively complex and experiential cognitive environments where this "creative ability" can be exercised, highlighted, and investigated (cf. Roine). In the framework of contemporary cognitive theories, any straightforward subject–object dichotomies between fiction and imagination come undone, as the portrayals and exercises of imagination provided by fictional narratives always "loop back" to inform the more

spontaneous speculations as well (Noë 31; see also Kortekallio's article in this issue). We "live with" speculative works of fiction in a way that entangles them with our imaginations; in the same way we cannot think of language outside of writing, we cannot truly think of imagination outside of imaginative works of art (Noë 52). Therefore, analyzing fictional portrayals of imaginative actions should illuminate new or more accurate ways of viewing and using imagination. The next section will put this idea to a test by moving from the general affordances of speculative arts and narratives to a more specific kind of philosophical instruments: the imaginary devices invented by Philip Pullman.

Philosophical Instruments: How to Use Them?

The story of *His Dark Materials* hinges on the fantastical instruments the three protagonists acquire. Lyra is given "the Golden Compass" in the beginning of the saga, Will fights for "the Subtle Knife" in the middle, and Mary invents her "Amber Spyglass" towards the end. Not only the three books but also the three characters are, to a large extent, defined by these strange devices. Lyra momentarily loses her "beloved instrument" (AS 237) halfway through the story and feels instantly unmoored: "Without the alethiometer, she was… just a little girl, lost" (SK 160). Indeed, whenever the protagonists are faced with something unknown — a novel dilemma, a potentially threatening encounter, or uncertainty about what to do next — they always reach for their respective instruments first (e.g., AS 424, 432, 455–56). This implies that the mysterious tools factor in an important way into their speculative cognition and creative problem-solving.

Noë would not be surprised by this; he declares *tools* "hub[s] of organized activity" (19). When used with skill (Greek *techne*), tools form *technologies*, which can facilitate, amplify, or even increase the complexity of organized activities (24).

In *His Dark Materials*, the knife that allows the protagonists to move between the worlds is a prerequisite for nearly all of the major plot points in the second and third novels, and the children acknowledge it: without the knife "they'd be able to do nothing at all"; "the whole of the rest of [their] li[ves] depended on what happened in that tiny triangle of metal" (AS 167, 189).

Expanding Affordances with Technologies

This is one of the most crucial consequences of the contemporary, extended view of cognition: when utilized skillfully in fortuitous contexts, instruments can open possibilities for action, which would be unavailable — or even unimaginable — without them (Noë 24–25). If we accept the premise that bodily action and conscious thought are intertwined, opening new possibilities for doing new things almost inevitably opens new possibilities for thinking new thoughts — and vice versa. After all, "thinking, no less than dancing, traveling, and talking, is an organized activity" (Noë 27). Even the "creative ability" of imagination can thus be augmented with instruments.

As explained above, this link between tools and possibilities for action crystallizes in the notion of *affordances*. On the one hand, the tools only gain meaning against the background of their users' skills and capabilities (Noë 100). A compass or a spyglass would not help a blind person, and a knife is only really a knife for an agent who has suitable limbs for grabbing its handle. By contrast, Lyra has a special propensity for reading the alethiometer (NL 173–75), and the knife "chooses" Will as its bearer by cutting off two of his fingers (SK 180). This high compatibility between the characters' and the instruments' interfaces, which allows them to achieve unprecedented feats, is actually a common trope in speculative fiction: magical swords are only bestowed on true kings, and only the hobbits can

escort the One Ring to Mordor. Imagined instruments are excellent tools for storytelling — and the stories they unfold are, in turn, tools for exploring how technologies modify their users' interactions with their environments. Lyra's journey with the truth-telling device, for instance, re-directs her imagination from spinning false stories to asking relevant questions, so that she ultimately grows from a notorious liar into an earnest aspiring scholar.

On the other hand, as the king of armored bears reminds Will, instruments also have the power to steer their users' actions: "The intentions of a tool are what it does. Hammer intends to strike, a vice intends to hold fast, a lever intends to lift. They are what it is made for. But sometimes a tool may have other uses that you don't know. Sometimes in doing what *you* intend, you also do what the knife intends, without knowing" (AS 181). By the same token, narratives intend to narrate, seducing the reader to follow and believe their organized versions of experiences and events, instead of attending to the chaos and uncertainty of reality. This is the flip-side of affordances: according to the old maxim, to a man holding a hammer, everything looks like a nail. But the bear king's warning captures the views of contemporary cognitive theories even more accurately: if one's cognitions and surroundings always "arise co-dependently," every experience and action is a negotiation between one's intentions, resources, and circumstances (Nagy and Neff; Varela et al. 225).

Peter Nagy and Gina Neff (2) observe that these latent agencies of instruments are all too often ignored in the academic discourse. *His Dark Materials* highlights them: all its three fantasy instruments were created accidentally or have unintended side-effects. The alethiometer was supposed to be an astrological device, but the mechanism responded to something other than planets, "even if no one knew what it was" (NL 173). The spyglass Mary invents shows her "other

things" — vivid colors and double images — before she incidentally dips her fingers in the special oil that makes the Shadow-particles visible (AS 229). Finally, the knife, a classically catastrophic product of hubris-driven alchemy (SK 187), is revealed to be double-edged in more ways than one: although the characters are unaware of it until the very end, using the knife unleashes abyssal Spectres that feed on people's daemons (AS 491). This revelation brings about the decision to destroy the knife, which, in turn, eliminates further possibilities for interesting action — and so the story concludes.

All of these cases — and indeed, the instruments themselves — might seem too fantastical to have any bearing on real-life cognition, but, again, speculation need not stop at the limits of the narrative; similar volatility pertains to all instruments. For instance, words and terminologies — the primary tools of authors and researchers — can also contain hidden intentions. They are virtually everywhere: gendered pronouns and profession titles — "fireman," "chairman," and the like — have been hotly debated in recent years; the anthropomorphic connotations embedded in the narratological terms like "character" can intercept analyses of non-human figures (Varis 99–104; see also Newman in this issue; Kortekallio), and Pullman himself has unwittingly angered many Christian readers with the Miltonian overtones of *His Dark Materials* (Parsons and Nicholson). He has, in fact, spoken publicly about the writers' responsibility to their instrument: "We should try always to use language to illuminate, reveal, and clarify rather than obscure, mislead and conceal. The language should be safe in our hands" (2019: 11).

In addition to these risks inherent in technologies, making new actions available or salient also tends to create new problems (Noë 25) — as the real-world issues caused by social media or the environmental troubles caused by

industrialization amply illustrate. However, this loop of new affordances and new problems can also be viewed as a productive phenomenon, as it pushes our organized activities into greater complexities. Mary discovers this as she absorbs more and more of the language and culture of the mulefa: "The more she learned . . . the more difficult it became as each new thing she found out suggested half a dozen questions, each leading in a different direction" (AS 225).

Ultimately, these newly opened "directions" spur Mary towards imaginative innovation. After months of befriending the mulefa, she attempts to explain her research on Shadow-particles to them. This proves difficult because she is missing the appropriate instruments: she cannot see the particles herself, and they do not have a shared name for the phenomenon. The mulefa, however, do see the particles and attempt to describe them by way of another, more readily available tool: "like the light on water when it makes small ripples, at sunset, and the light comes off in bright flakes, we call it that, but it is a make-like" (AS 222). "Make-like" is the mulefan word for metaphor, a mental instrument that, again, allows bodily, sensory, or experiential grasp of abstract or otherwise unseeable things (Lakoff and Johnson). This works — it leads Mary to guess at a way she might be able to perceive the particles: "It was the comparison . . . to the sparkles on the water that suggested it. Reflected light like the glare off the sea was polarized: it might be that the Shadow-particles . . . were capable of being polarized, too." The expressive "make-like" thus catalyzes scientific speculation, a genuinely new combination of ideas that leads to the invention the Amber Spyglass. According Noë's (152) theory, art serves a similar function on the macro-scale: it can also make mostly

invisible organized activities — such as feeling, daydreaming, sense-making, or speculating — more accessible, complex and, ultimately, new.[3]

Engaging the Imagination with Philosophical Objects

The philosophical instruments of *His Dark Materials* are like works of art in themselves, which is to say that the alethiometer, the knife, or the spyglass cannot be reduced *only* to metaphors or story devices. Although I have argued that they can serve such literary functions as well, they are also aesthetic, forcefully mimetic products of Pullman's verbal craftsmanship. After all, no matter what philosophical or metacognitive value they might have in the end, all works of art begin in a very tactile place: even the strangest of tools have to be manufactured in some way (Noë 19). And indeed: we learn that the "gleaming," "exquisitely machined" brass compass has thirty-six little pictures on its face, painted "with extraordinary precision, as if on ivory with the finest and slenderest sable brush" (NL 79). The "beautifully balanced," "shadow-colored" knife has a "handle of rosewood" "inlaid with golden wires" and "a swirl of cloudy colors [living] just under the surface of the metal" (SK 181). Their weight and feel in the characters' hands are described repeatedly (e.g. ibid., AS 163), and Mary's laborious crafting of her spyglass — foraging for the materials, layering resin, polishing surfaces — is narrated in such minute detail that industrious readers could almost make their own replicas (AS 226–31).

And yet, these instruments would not fulfill the definition of "instruments" if they were merely beautiful. Lyra is appalled by the old collector who steals her alethiometer only to put it on a shelf with other antique devices: "You don't even

[3] Roine and Suoranta make a similar argument in their article in this issue: even though we are largely unable to narrativize or even stay aware of the effects our (technological) environments impose upon us, SF can help to extend our minds *towards* these effects.

know what it is you stole . . . you're just going to put it in a case and do nothing with it! You ought to die!" (SK 163). The collector treats the alethiometer *solely* as an art object, and according to Noë, art is, indeed, a perversion of function: it involves plucking an instrument out of its intended context and considering it in a new way. "Design stops and art begins when we lose the possibility of taking the background of our familiar technologies for granted. . . . Art starts when things get strange" (Noë 100). This is precisely what makes foreign or out-dated instruments fascinating: when a tool is no longer necessary for any practical purpose or when the method of using it has been forgotten, it becomes an alien thing, something that dares the onlooker to name it or explain it — in a word, to speculate. This, for Noë (101), is what art always does.

This is, therefore, what speculative fiction also does: as argued above, speculative stories take pieces of consensus reality and treat them in a way that challenges or stretches perceptions of reality. The speculative instruments of *His Dark Materials* therefore appear to us readers as *already strange*: their functions have already been altered from what we know the normal functions of compasses, knives, and spyglasses to be. Morever, since the function of speculative art is to investigate speculation, as I claim, one of the functions of the instruments in the trilogy is to make the characters' cognitive activities more apparent. This explains why the reader might be inclined to share Lyra's frustration: if the instruments are put away, the audience can no longer see how the characters think with them.

And think with them they do; Pullman has done his duty as the illustrator of speculation by twisting the functions of a compass and a knife in just the way that requires the characters to consciously engage their minds. Lyra has to "share" a "focused calm" with the alethiometer (SK 78). This, and only this, allows her to "see" what the device means. The process is described as highly visual, enjoyable,

gradual, natural, and often a matter of peering "down" somewhere deeper, "down the long chains of meaning to the level where the truth [lies]" (SK 91; see also NL 151, 173, 204; AS 165, 237, 385). Using the knife, meanwhile, requires being fully aware of — almost becoming one with — the instrument. As Will's predecessor tells him: "It's not only the knife that has to cut, it's your mind. You have to think it" (SK 182).

Thus, using the alethiometer or the knife requires entering a specific state of mind, which is repeatedly described as trance-like (NL 174, 357; SK 78, 91; AS 183, 237). This state bears similarities with concentrated flow experiences (Csikszentmihalyi), and even Zen-Buddhist meditation practices (cf. Parsons and Nicholson). Mary, however, likens it to something else entirely: to the *negative capability* described by John Keats (SK 88; AS 226, 461). She even quotes the letter where Keats first mentions the idea to his brothers: "I mean Negative Capability, that is, when a man is capable of being in uncertainties, Mysteries, doubts, without any irritable reaching after fact & reason" (qtd. in Ou 1; cf. SK 88). Traces of similar ideas can be found in the poet's later letters as well, and many of the characteristics presupposed by this skill, state, or attitude do, indeed, resonate with the cognitive efforts Pullman's philosophical instruments demand of their users.

First of all, because the core skill of negative capability is the ability to accept "mysteries" and "half-knowledge" in all their asymmetry and contradiction, it presupposes a degree of "disinterestedness" or "submission of the self" (Ou 8). This passivity — being completely open to whatever affordances unfold — is what makes the capability "negative" and the operation of the magical instruments possible. Lyra, for example, never really speaks of "using" the alethiometer; she "reads" it or "asks" it, patiently letting "the symbol-meanings clarif[y] themselves"

(NL 151). The twitching needle of the device is likened to “a bee dancing its message to the hive. She watched it calmly, content not to know at first but to know that a meaning was coming” (NL 204). Keats uses a similar metaphor in one of his 1818 letters: “Let us not therefore go hurrying about and collecting honey-bee like, buzzing here and there impatiently from a knowledge of what is to be arrived at: but let us open our leaves like a flower and be passive and receptive” (qtd. in Ou 3). Conversely, when Lyra grows older, the process loses its organic, instinctual quality for her and she begins to “reach after” the meanings. As a result, they slip away from her: “Holding the connections between [the symbols] in her mind… It had once been like running, or singing, or telling a story: something natural. Now she had to do it laboriously, and her grip was failing” (AS 385). This echoes a letter where Keats quips at a fellow poet: “Dilke will never come at a truth as long as he lives; because he is always trying at it” (qtd. in Ou 5).

Using the knife is a more active practice than reading the alethiometer — one has to choose where to cut and actively make the cut — but this heightened intentionality is coupled with equally heightened renouncement of self. When Will is cutting through to other worlds with the knife, he cannot think of anything else but what he is doing — not how he misses his mother (AS 154, AS 243), not even about a currently bleeding wound (SK 182) — lest the knife should break. As Lyra advises him, he has to let his “uncertainties” and “doubts” be — hold the knife “loosely” and “relax” (SK 183, SK 186, AS 311–12). This leaves room for another sub-skill of negative capability: “sympathetic identification” (Ou 6). Keats was known for identifying deeply with other creatures and even inanimate objects: in his letters to his friends, he reports ”taking part” of a sparrow picking at gravel on his window sill, and imagines himself being pushed into smooth and sudden motion like a ”Billiard Ball” (Forman 22, 54). Similarly, Will is advised by the previous

knife-bearer to "send his imagination" to the tip of the knife (AS 190): "Let your mind wander down your arm to your wrist and then into the handle, and out along the blade, no hurry, go gently, don't force it. Just wander. . . . You become the tip of the knife" (SK 183). Wandering is a keyword for Keats as well: he believed that mind should be a "thoroughfare for all thoughts" that must not "hurry to arrive at results" (Ou 5, 11) — just as art, in Noë's view (136–39), is never meant to "arrive"; it is, rather, like a long conversation that never concludes.

Together, these capabilities of passiveness, openness, selflessness, and identification afford a highly experiential and imaginative way of understanding that Keats advocated as an alternative to "consequitive [sic] reasoning." He claimed to be "certain of nothing but the holiness of the Heart's affections and the truth of imagination — What the imagination seizes as Beauty must be truth" (qtd. in Ou 2). This resonates with the first thing Mary says when she finally, after many years of scientific research, sees "the truth" — the glittering Shadow-particles through her spyglass: "*I didn't know it was beautiful*" (AS 231).

Due to this emphasis on beauty and feeling, Keats has been hailed as the poet of the senses (Ou 10–11); and a similar sensibility — "a deep slow ecstasy at being one with [one's] body and the earth and everything that was matter" (AS 369) — shines through towards the end of Pullman's trilogy as well. Noë, for his part, concurs that "physical feeling and emotional response" are art's preconditions, its "raw materials," and not something that could truly be "disconnected from what we know or understand" (60–61). The upshot of all these references to Keats, then, is that since the philosophical instruments operate on negative capability, they are also bound up in the characters' imaginations — but not in a way that could be considered either escapist or reducible to symbolic forms, such as narratives or even thoughts (in the cognitivist sense). On the contrary, "negative capability is a way of

being, conveying an attitude towards human experience" (Ou 22).[4] All sensation, according to Keats, "be it foul or fair, high or low, rich or poor, mean or elevated . . . end in speculation" (qtd. in Ou 6); and as much as speculation may be about the non-actualized or the not-readily-perceivable, we still relate to the objects of our speculation experientially, through our bodies and senses, in the specific context of our surroundings. The very concepts of the possible and the impossible arise from a very pragmatic sense of what one could or could not do, given one's circumstances and resources. Art is the meta-tool that helps us to explore, expand, and speculate on this space of possibility, and it does this by prompting us to look — not away from the world, but on the contrary, more intently at the world as it truly is "available to us" (cf. Kukkonen 59).

As an angel in *His Dark Materials* emphasizes, in the spirit of Coleridge, imagination "does not mean *making things up.* It is a form of seeing" (AS 499). In contrast to Coleridge's ideas (Ou 5), however, Keats argues that this widened perception of possible actions should remain constant and open-ended — the "how" of creative cognition rather than a set, symbolically coded "what." Thus, one way of re-defining *imagination* and *speculation* in contemporary cognitive paradigm would be to view them as skills of, first, perceiving and, second, utilizing affordances more widely, flexibly, and continuously, beyond ready-made forms and templates.

Thinking with a Compass, a Knife, and a Spyglass

So, how do the instruments of *His Dark Materials* help with this? How do the alethiometer, the knife, and the spyglass encourage more creative use of

[4] These perceptual aspects of negative capability also bring to mind *ostranenie*. Indeed, Shklovsky's understanding of art might well be just as compatible with Keats' ideas as Noë's theory of art. Discussing these similarities in more detail is beyond the scope of this article, however.

affordances, and how do their varying instrumental qualities relate to those of the narrative form?

The alethiometer's utility is perhaps the least obvious because, at first glance, it seems like an excellent emblem for Lyra's unimaginativeness: its main function seems to be erasing the area of the unknown that would normally be the realm of speculative faculties. In other words, it might seem like Lyra has no need to speculate about anything because "she has her symbol-reader; that will tell her anything she wants to know" (AS 483). On the metafictional level, of course, such a device only underlines the importance of speculative skills: for every time Lyra relies on the alethiometer for advice, everyone lacking such an instrumental extension, i.e. every reader, would only be able to speculate — to project possible scenarios and gamble on them.

It would be a mistake to assume that the alethiometer is a complete substitute for speculation, however. It may be an all-knowing device, but it is not an all-telling one. Thus, as with any technology, its usefulness is determined by the skill of the user: "You can ask any question you can imagine" (NL 127), but *only* the questions you can imagine: rather than freeing Lyra from speculation altogether, effective use of the instrument actually requires her to constantly scan the horizon of possibilities so that she could find the right questions to ask. One can, after all, only actualize the affordances that one is able to imagine and perceive (cf. Nagy and Neff). In this sense, using the alethiometer is less like blind certainty and more like using any other resource containing vast amounts of information — such as searching a library, browsing the internet or having an illuminating conversation. The last one is a simile Lyra uses herself: "It's almost like talking to someone, only you can't quite hear them, and you feel kind of stupid because they're cleverer than you" (NL 151). This, again, might recall Noë's comparing art to a long

conversation; the "truths" offered by the alethiometer are not final but mutable like life itself and can only be arrived at situationally. Thus, Lyra might begin her journey as a lying story-spinner but, compelled by the alethiometer, develops an open-ended extra-narrative faculty of speculation as the story progresses.

At the same time, the vast affordances opened by the Subtle Knife constitute a crucial counterforce to the truth-telling force of the alethiometer. Where reading the compass requires holding many possibilities in one's mind until the right questions and meanings are distilled, the knife operates the other way round: one has to concentrate fully on the present moment at first, to make a single intentional cut — which literally opens a whole new world of possibilities. The miraculous access to parallel universes serves to concretize the kind of extrapolative what-if thinking that speculative fiction is known for: "Perhaps in another world, another Will had not seen the window in Sunderland Avenue, and had wandered on tired and lost towards the Midlands until he was caught. And in another world another Pantalaimon had persuaded another Lyra not to stay in the retiring room, and another Lord Asriel had been poisoned" (SK 264). Indeed, Pullman seems highly aware of this virtual space of all the possible consequences that could spring from "a given origin" (2017: 87). He calls it *phase space*, by analogy with a term used in dynamical systems theory (25). It is clearly a central speculative instrument for him, as he reports conceiving his own storyworlds in this way, as "unstructured space . . . full of possibilities" (86).

However, Pullman goes on to say that no matter how alluring the "wild wood" of phase space might be, a storyteller must make a path through it, and "stick to it" (89). The same scenario is repeatedly presented in *His Dark Materials:* "At the moment all Will's choices existed at once. But to keep them all in existence meant doing nothing. He had to choose, after all" (AS 13). The alethiometer — in

the way that compasses do — helps the children with this: it guides them to pick one of all the million openings the knife makes available. Similar pairs of instruments can be found elsewhere in speculative fiction as well. In Mike Carey and Peter Gross' graphic novel series *The Unwritten* (2010), for example, the characters navigate from the real world to various literary worlds with the help of a map, which shows possible access points, and a magical doorknob, which opens the way. The dynamic is similar to that of the alethiometer and the Subtle Knife: one makes the affordances imaginable, the other makes them available, and consulting the first instrument again helps with choosing the best option.

As it happens, Noë's theory also mentions both doorknobs and maps. A door handle is an example of a tool that performs its function in its specific human-designed context so efficiently that it has become all but invisible to us, whereas "art is like mapmaking" in that it allows us to survey these very tools and affordances we take for granted (Noë 22, 30). These pairs of instruments thus seem to highlight another important point about speculation: that it is not the same as merely seeing the phase space, nor is it the same as generating some random narrative about pirates and aliens. Rather, skillful speculating involves both of these: seeing a vast number of as-of-yet unrealized possibilities and picking the most suitable or interesting ones for re-organization and extrapolation. Pullman's instruments thus symbolize the non-linear dialogue between negatively capable active seeing and creative action — between the open-ended process of speculation and the shaping of the (narrative) product of speculation.

This brings us back to the Amber Spyglass, which does not require negative capability to operate: anyone can simply look through it and see the Shadow-particles. It is, however, a concrete product of negatively capable thinking — the result of successfully perceiving "half a dozen questions, each leading in a different

direction" and pursuing one of them with a flexible attitude. Mary uses this skill quite knowingly: "She wasn't sure what she wanted to do, except that she knew that if she fooled around for long enough, without fretting, or nagging herself, she'd find out. She remembered quoting the words of the poet Keats to Lyra, and Lyra's understanding at once that that was her own state of mind when she read the alethiometer — that was what Mary had to find now" (AS 226). She also thinks of her creative work as "experimentation" and "play" (AS 227), both of which imply the kind of open-ended, wandering attitude that negative capability fosters. Pullman sends a strong message by igniting this process of invention with a simple metaphor — the "make-like" of light on water — rather than with a scientific theory, on which Mary's previous research must have been based.

What message is that? The same one that Noë's theory ultimately argues for: that art — and all the instruments and capabilities it engages and expands — "is its own manner of investigation and its own legitimate source of knowledge" (xii). It all "end[s] in speculation" (Ou 6) — and only speculation can take us beyond data, theories, and narratives.

The Shadow-particles, which we would see if we peered through the Amber Spyglass, are attracted to conscious beings and objects crafted by them: "a carved ivory chess piece," "a wooden ruler" (SK 89; AS 231) — artworks and other tools. The spyglass is thus an instrument that detects instruments; one of its affordances is to search for more affordances. In this sense, it is not unlike the trilogy itself, for the inevitable final conclusion — which the readers may have already glimpsed "from the corners of [their] eyes" as if by negative capability (AS 461) — is that *His Dark Materials* is in itself a potent instrument for speculating about instruments and speculation.

The reason why both the spyglass and *His Dark Materials* allow us to detect and investigate things that are normally difficult to notice or discuss is that both of them are products of open-ended speculative processes — processes that are, in turn, illustrated by the functioning of the alethiometer and the Subtle Knife. By encouraging the characters to ask about all possibilities and making them available as real actionable affordances, the compass and the knife allow us to perceive two sub-skills crucial to speculation: the negatively capable active seeing of the phase space and an ability to choose and act upon the option best suited to the changing circumstances. These processes feed into and overflow all narratives and other artworks. This means, on the one hand, that we can investigate speculation and imagination through the traces they leave in these works. On the other hand, speculation can always question its own products, because it is never fully contained by any narrative or symbolic forms – it never ”arrives”.

To quote McHale (329), “all narrative is prosthetic, a supplemental organ”, and to repeat Noë’s metaphors, all narratives are instruments and experiments. I thus suggest that similar insights into speculation could be gleaned from all the other works of speculative fiction as well, simply by analyzing them through a metacognitive lens.

These findings, in turn, could be applied to various practical or theoretical ends. The instruments of *His Dark Materials* have already inspired creative learning projects, where pupils have been asked to invent new narrative or speculative uses for various tools and inanimate objects (Corner 2012). One could also flip the idea of narratives as instruments upside-down, as Kaisa Kortekallio (2020, 142, 181) has done: one of the affordances of art is that it changes us — “impresses” on us — which means that readers can also effectively become instruments of the texts they “think with.” Most importantly, however, I hope this article has demonstrated how

cognitively informed analysis of fiction can become a tool for investigating the kind of complex, experiential cognitive activities empirical science has struggled to explore and define. As the trilogy itself testifies, a good piece of fiction is "like an imaginary number": empirically, it may not even exist, "but if you include it in your equations, you can calculate all manner of things that couldn't be imagined without it." (NL 370.)

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