



Why Images Cannot be Arguments, But Moving Ones Might

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Abstract

Some have suggested that images can be arguments. Images can certainly bolster the acceptability of individual premises. We worry, though, that the static nature of images prevents them from ever playing a genuinely argumentative role. To show this, we call attention to a dilemma. The conclusion of a visual argument will either be explicit or implicit. If a visual argument includes its (explicit) conclusion, then that conclusion must be demarcated from the premise(s) or otherwise the argument will beg the question. If a visual argument does not include its (implicit) conclusion, then the premises on display must license that specific conclusion and not its opposite, in accordance with some demonstrable rationale. We show how major examples from the literature fail to escape this dilemma. Drawing inspiration from the graphical logic of C. S. Peirce, we suggest instead that images can be manipulated (erased, dragged, copied, etc.) in a way that overcomes the dilemma. Diagrammatic reasoning can take one stepwise from an initial visual layout to a conclusion—thereby providing a principled rationale that bars opposite conclusions—and the visual inscription of this correct conclusion can come afterward in time—thereby distinguishing the conclusion from the premises. Even though this practical application of Peirce’s logical ideas to informal contexts requires that one make adjustments, we believe it points to a dynamic conception of visual argumentation that will prove more fertile in the long run.

Keywords Visual arguments · Diagrammatic reasoning · C. S. Peirce · Existential Graphs

*It is true that if we had to do with photographs alone, however much we might look at them, we should never see them animated [...]. [T]he mechanism of our ordinary knowledge is of a cinematographical kind.
Henri Bergson (1911/1998, pp. 305–306)*

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[An argument] shall be represented by a series of such diagrams imagined to be phenakistiscopically combined (The “phenakistiscope” was the first animation device capable of creating a fluid illusion of motion).
Charles Sanders Peirce (MS 292b)

1 Introduction

If one asks whether arguments can *include* images, the answer is an unqualified yes. Premises must gain their truth or acceptability from some source; and there is no reason why images cannot be that source.¹ However, many who invoke the notion of visual arguments intend the images at hand to *be* argumentative, “in the traditional premise and conclusion sense” (Birdsell and Groarke 2007, p. 103). From the mid-1990s onward, argumentation theorists have thus taken the “pictorial turn” first announced by W. J. T. Mitchell in 1992 (Curtis 2010).² Salient objections to these rapid developments have been formulated,³ but those objections have rarely been addressed⁴—much less definitively answered. Proponents seem to think that the situation will eventually attain clarity as case studies accumulate. As a result, “[w]hile much early debate was concerned with the possibility of visual arguments,” the “discussion has since moved onto a wider range of questions” (Aberdein 2018, p. 2).

Presumably, a visual argument is “one in which the *essential argumentative work* (however that is identified) is done by images (rather than words)” (Johnson 2003, p. 3). Yet, when we look carefully at the examples given in the literature, what we find are mostly verbal arguments that have images in support of one or more of their premise(s). The notions at the heart of this research program could therefore be put on a firmer footing.⁵

Expressing individual propositions visually is one thing, but the crux of the problem is whether the *relation of illation* (which generates a conclusion from a body of premises) can also be expressed visually. We believe it can. Our confidence in this regard draws inspiration from the published and soon-to-be-published writings of Charles Sanders Peirce. In addition to his pioneering work in visual semiotics (Jappy 2013) and philosophy of mind (Champagne 2018a), Peirce made major advances in diagrammatic logic (Peirce 2019). Throughout his productive intellectual career,

¹ The use of photographic evidence in courtrooms, for example, amply establishes this. From a legal standpoint, the 1948 trial of People versus Doggett set a major precedent, since “[t]he only evidence introduced at the trial to support a conviction was a photograph of the husband and wife in the commission of the alleged act” of oral copulation (Mouser and Philbin 1957, p. 311).

² See for example the applied work on visual refutation (Lake and Pickering 1998) and contestation (McGeough et al. 2015), editorial cartoons (Edwards and Winkler 1997), visual enthymeme (Finnegan 2001), famous photographs (Hariman and Lucaites 2007), the use of visuals in charity advertising (Grancea 2015), and the reception of digitally altered images (Pfister and Woods 2016). This is not an exhaustive list.

³ Notably by Fleming (1996) and Johnson (2003).

⁴ One exception here is Blair (2015), the very person who initially voiced scepticism about the idea of visual argument (in Blair 1996).

⁵ For a similar concern, see Thomas (2014, p. 166).

Peirce was never drawn to the verbal mode of reasoning. He confessed that “I do not think I ever *reflect* in words: I employ visual diagrams [...] because this way of thinking is my natural language of self-communion [...]” (MS 619, p. 8).⁶ So, while other logicians around him were pioneering the symbolic notations we know today,⁷ Peirce explains that, “[a]t great pains, I learned to think in diagrams, which is a much superior method to [thinking in algebraic symbols]” (MS L 231). The American polymath should therefore be a go-to reference for anyone serious about visual arguments (and multimodal argumentation generally).

Above and beyond exploring Peirce’s promising ideas, there are real reasons why one should revisit the idea of visual arguments. If visual arguments are indeed arguments, then they can be judged as such. We can thus charge an image (or image issuer) with committing sundry formal and informal fallacies. But, if the persuasive power of images turns out to be merely rhetorical, it becomes a category mistake to import the various norms that were developed/discovered in the study of logic and dialectic. Now, as Blair observes, theorists “looking at argumentation tend to burrow down from the broad perspective of rhetoric to the narrower one of dialectic and ultimately to the narrowest one of logic” (2012, p. 148).⁸ It makes sense to start with what interlocutors actually find persuasive. After all, the most effective rhetorical devices and tropes are often visual in nature (see Saouter 1995). The problem is that, when we proceed in this direction, it can be hard to see why visual arguments should be governed by anything more substantial or enduring than mere conventional agreement among peers. If that is the case, then the best we can do, assessment-wise, is construe “bad arguments in the sense of being Gricean failures of co-operation which violate rules of a critical discussion” (Walton 1990, p. 400).

We find it too permissive to go from “X is a visual used to persuade” to “X is a visual argument.” So, at the risk of running afoul of “visual argument enthusiasm” (Grancea 2017, p. 17), we shall hold fast to the more demanding idea that arguments, visual or otherwise, are good or bad in part because they preserve or fail to preserve the truth of their premises. Such truth-preservation, no matter its extent or degree, is a structural feature that holds or fails to hold irrespective of what any social group thinks or wills. Our contribution, then, will move in a direction reversed from the usual one noticed by Blair—instead starting from the *logic* of images so as to climb upward to their dialectic and rhetorical use.

We want to spend the bulk of this article sketching a positive account, but that account will enjoy greater motivation if one can first see the problems it is intended

⁶ As Leja notes, “[t]his natural visuality had no bearing, apparently, on Peirce’s experience of the visual arts. In contrast to other members of his social class, such as his friends William and Henry James, Peirce’s interest in art was minimal” (2000, p. 97).

⁷ What professional philosophers now take to be logic is the product of purely contingent textbook wars that took place in early 1950s. For a historical account, see Pelletier (1999).

⁸ One should not forget that, according to the medieval tradition, there is a basement beneath logic, namely “speculative grammar” or semiotics, which studies how signs convey meaning. Given that “validity presupposes meaningfulness” (Bellucci 2017, p. 1), logical inquiry cannot do without such semiotic inquiry. For a reliable portal to the best philosophical literature on that topic, see Champagne (2014).

to fix. Let us therefore start by justifying our negative claim (that static images cannot be arguments) before transitioning to our positive claim (that moving images might be arguments).

2 Why Images Cannot be Arguments...

Although the persuasive power of images is already studied quite ably by scholars in the humanities and social sciences,⁹ the claim that images can be arguments has prompted a new wave of studies by philosophers and argumentation theorists. The production and interpretation of images is a multifaceted phenomenon, so the addition of new disciplinary voices is always welcomed. Still, the recent combination of images and arguments remains conceptually vexed.

To see this, consider the following disjunction: the conclusion of a visual argument will either be *depicted* in the image or *implied* by the image. This exclusive disjunction gives rise to a dilemma. If the (explicit) conclusion is depicted in the image, then we need to be told how to distinguish that visual component from the premise(s)—since it is a fallacy for an argument to assume the very claim that it is trying to establish.¹⁰ If the (implicit) conclusion is merely implied by the image, then we need to be told how to extract that specific conclusion from the visual materials—since it is trivial to say that images can be interpreted in various ways. Most of the examples presented in the argumentation theory literature fail to escape this dilemma. Take, for instance, the image shown in Fig. 1.

This is the “Coat of Arms of Death” by Albrecht Dürer. According to Groarke, the four elements¹¹ depicted in the image are “a bride in a sumptuous gown and crown, a wild man who stands behind her, a shield emblazoned with a skull, and a gaudy, florid helmet” (1996, p. 123). Argumentation theorists tend to be more interested in the intentions of arguers than in those arguers’ fidelity to source materials (see Kress and Van Leeuwen 2001, pp. 1–24; Van Eemeren et al. 1993, pp. 34–38). Still, it must be granted that the code required to decipher Dürer’s allegories is not available in the image itself. Indeed, one can no more unpack the meaning of a hairy male by looking harder at it than one can unpack the assigned meaning of P in symbolic logic by looking harder at that typographical character. Even so, we are told that the four premise-like parts jointly support an implicit conclusion, which is that one should reject coats

⁹ See Arnheim (1969), Saint-Martin (1990), Messaris (1997), Mitchell (2005)—or any number of specialist journals, such as *Imaginations: Journal of Cross-Cultural Image Studies*, *The International Journal of the Image*, *Philosophy of Photography*, *Visio: Revue internationale de sémiotique visuelle*, *Images: Journal for Visual Studies*, *Journal of Visual Communication and Image Representation*, *Visual Communication*, *Visual Communication Quarterly*, *Journal of Visual Literacy*, *Image & Text*, *Visual Studies*, *Visible Language*, *Journal of Visual Culture*, *The Visual Computer: International Journal of Computer Graphics*, *Antennae: The Journal of Nature in Visual Culture*, *International Journal of Semiotics and Visual Rhetoric*, and *The Journal of Visual and Critical Studies*. This is not an exhaustive list.

¹⁰ The fallacy of circularity is not endemic to visual arguments. For a survey of why begging the question is considered fallacious, see Caravello (2018).

¹¹ For a discussion of how viewers use social and cognitive inputs to carve images into parts, see Boeriis and Holsanova (2012).



Fig. 1 “Coat of Arms of Death” by Albrecht Dürer, dated 1503. Taken from the Museum of Fine Arts, Boston

of arms (Groarke 1996, p. 123). Although it is held that “[v]isual arguments can [...] be judged by common standards of reasoned convincing” (ibid., p. 107), the rationale that leads to this proposed conclusion is far from clear.

Why, one might ask, does the conclusion “Reject coats of arms” follow? Heraldry is certainly systematic enough to allow some kind of scholarly study. We might thus explain why viewers tend to interpret this image in certain ways under certain conditions. However, such a hermeneutic process is far removed from a predictable

procedure (Taylor 1971). Indeed, there are alternative readings of the print.¹² Philosophers trained to deal with arguments will understandably want to fit situations to a format that they know well, but it is probably simpler to view the Coat of Arms as a case of regular image interpretation.

Minimally, someone looking at the premises of a genuine visual argument should be given some sense of what the right conclusion ought to be. Verbal elements can be added to facilitate this. Roque (2012, p. 283) calls arguments that combine visuals and text “joint arguments.”¹³ It is significant, however, that almost all of the images invoked in the argumentation theory literature are joint arguments. Take, for example, Fig. 2, which is offered by Tseronis (2013, p. 10).

This carefully crafted advertisement was designed by Tim Cairns using a photograph by George Scott. Such professional authorship shows that photographs “are not drawn by the ‘pencil of nature’ but are symbols that imply concepts framed by theories and, as such, they must be learned like any language” (Becker 2011, p. 255). The conclusion that viewers are supposed to draw from this image is that Chux kitchen gloves are worth buying. As with the Dürer engraving, this conclusion is not present, either visually or verbally. The only premise-like element that is visually expressed is a set of glasses that was partially replaced by an ill-fitting item. To extract the desired conclusion from this image, one must understand that the kitchen gloves’ extra gripping surface will not let dishware slip and break. Verbal reinforcements are supplied in the lower right corner. Yet, without reading “Keep the whole set” and “Extra Grip,” arriving at the right conclusion would be nearly impossible. As a clever piece of advertising, the combination of text and image undoubtedly persuades. But, it is doubtful that the image persuades *visually*.¹⁴ If this was not a joint argument, it would not be an argument at all.

Pinto (2001, pp. 37, 68–69) once defined an argument as “an invitation to inference.” However, it could be held that anything—the weather, ambient sounds, the emptiness of one’s stomach—can be an invitation to inference, insofar as any experience can set a mind in motion. Our experiential world is woven with significant relations, but not all those relations are argumentative.¹⁵ Not surprisingly, Pinto (2009, p. 284fn22) has since distanced himself from this lax definition. When arguments

¹² For instance, one who masters the relevant cultural context might assign the following meanings to the image: the forest-dweller of Germanic folklore (likely a stand-in for Martin Zinner, a shrewd old business man) who embraces the bride (likely a stand-in for Katherine Frey, a relative of Dürer) brings with him sexual vigour on their wedding day, but the hidden side of his shield reveals him to be an agent of death (insofar as Zinner had syphilis). This reading, which has little to do with (and runs counter to?) “Reject coats of arms,” is proposed by the independent art historian Elizabeth A. Garner, who specializes in discerning “secret ciphers” in Dürer’s work (that are reminiscent of the conspiracy theories in Dan Brown’s novels).

¹³ The relation between text and image that one finds in joint arguments can be further clarified by using the taxonomy laid out in Martinec (2013, pp. 150–153).

¹⁴ For more on the idea that “visuals such as pictures do not argue” but “only influence or persuade—often in a manipulative way,” see Kjeldsen (2015, p. 118).

¹⁵ Even though, for Peirce, “an argument [...] is the first and paramount semiotic relation” (Bellucci 2017, p. 3), his full semiotic theory recognizes the argument as one kind of sign among ten possible varieties (see Champagne 2015a, pp. 533–541).



Fig. 2 Advertisement for Chux Extra Grip Gloves. (Released by the DDB Sydney advertising agency in 2006)

prompt inferences, it is usually hoped that those inferences will latch onto the premises' structure or arrangement so as to reach a specific outcome. Just as persuasion ranges from the strongly compelling to the mildly suggestive, this inferential movement can range from the deductively valid to the inductively probable. Still, a successful theory must identify some arguments as bad arguments.

At minimum, then, images like Dürer's engraving or the kitchen gloves ad should give one the visual means to answer an onlooker who challenged their conclusion. This seems like a modest and reasonable desideratum. Yet, given that it is unclear how the conclusions at hand were arrived at, it is equally unclear how the images could be invoked to repel dissent. To make this concrete, what if a person claimed that the proper conclusion of the advertisement is "Do not buy Chux kitchen gloves," because those gloves have already broken a set of dishware? How could one use *the image* to counter such a gloss? A visual argument can suggest more than one conclusion, but it surely cannot support a conclusion and its exact opposite. This is the first horn of the dilemma that we want to call attention to: *the conclusion must follow in a demonstrable and predictable manner from the visual premises.*

Ideally, an account of visual arguments should supply a criterion that demystifies (and eventually predicts) patterns of assent and dissent. Now, one might object that this holds images to an inappropriately high standard. After all, even when dealing with verbal arguments, there is often disagreement about the interpretation of particular arguments. That may be. But, there are still shared standards and exemplary cases. For example, most would regard the following as a paradigmatic

case of begging the question: “The current municipal administration is not trustworthy, because it cannot be trusted.” There are no subtleties here: the same proposition appears twice in different guises, yet one token is adduced as rational support for the other. We can all agree that such looped reasoning is corrupt (or at any rate uninformative). So, using similar norms (Godden 2017), what would happen to Dürer’s image if, say, a coat of arms was shown in a waste basket? Given the supposed conclusion “Reject coats of arms,” would the image beg the question? One could perhaps attempt to dodge this concern by saying that the new depiction would render the conclusion explicit instead of implicit. If so, then what would happen if the full waste basket was shown twice? Would that beg the question? This is the second horn of the dilemma that we want to call attention to: *the conclusion must be separated in a principled manner from the visual premises*.

Although he did not develop his misgivings in as much detail or construct a positive alternative, Fleming expressed concerns similar to our dilemma:

First, [a picture] lacks the requisite internal differentiation; it is impossible to reliably distinguish in a picture what is position, and what is evidence for that position. The distinction at the heart of argument, the difference between that which asserts and that which supports, is thus collapsed. Second, a picture cannot with reliability be refuted, opposed, or negated. It can be countered but only by introducing words into the situation; the picture itself makes no claim which can be contested, doubted, or otherwise improved upon by others. (Fleming 1996, p. 13)

The combination of images and arguments may be conceptually vexed, but it is too important to walk away from. So, to put the key notions on a more secure footing, we need (1) some means of demarcating premises and conclusions, plus (2) some principle that can take us from the premises to the conclusion in a deliberate manner. One fairly crude way of satisfying requirement (1) would be to introduce a spatial division within an image. It is common, for instance, to accept that whatever appears below a line counts as a conclusion when doing logical proofs. Obviously, this would be artificial in most visual contexts. We thus propose another solution: conclusions can be distinguished by being *added* to an image. The parts of an image can thus be dynamic or movable, so as to allow for what Charles Sanders Peirce called *diagrammatic reasoning*:

By diagrammatic reasoning, I mean reasoning which constructs a diagram according to a precept expressed in general terms, performs experiments upon this diagram, notes their results, assures itself that similar experiments performed upon any diagram constructed according to the same precept would have the same results, and expresses this in general terms. This was a discovery of no little importance, showing, as it does, that all knowledge without exception comes from observation. (Peirce 1976, pp. 47–48)

We surmise that diagrammatic manipulations can supply us with the principle linking premises and conclusion called for by requirement (2), as well as the division called for by requirement (1). Let us now explore this possibility.

3 ...But Moving Ones Might

To begin to see how a Peirce-inspired conception of diagrammatic reasoning can lead to a more robust understanding of visual arguments, consider the propaganda postcard shown in Fig. 3.

A rising sun is “a standard way for illustrators to refer to the future” (Groarke 2015, p. 147). On the basis of this metaphorical equation between the rising sun and a forward-looking perspective, further associations can be made “which suggest that a Nazi future will bring food and abundance” (Groarke 2015, p. 148), leading to an implicit conclusion that “You should vote Nazi.” We do not want to question this reconstruction, but rather the first link that triggers it. Specifically, what makes one confident that what is being depicted is a sunrise and not a sunset?

To the extent that a photograph is causally related to its object (Lefebvre 2007), it affords some epistemic assurance that the sun was moving (assuming that a photograph was used). Yet, since the sun can move up or down depending on the time of day, there is no evidential basis in the image itself to infer that the sun-like Nazi emblem is rising as opposed to setting. Much like a Necker cube or Wittgenstein’s (1958, Sect. 139) person on a steep hill, the static depiction is non-committal. Corroborating this, Roque notes that “in the graphic plane, the rising sun does not differ from the setting sun, which has the opposite meaning” (2010, p. 18; our translation). He thus observes that, to secure the desired interpretation, such images are typically accompanied by a verbal cue. So, were one to put the German word “*Zukunft*” in the Nazi postcard, one would presumably increase the chance that the sun will be taken as rising.¹⁶ There is nothing inherently wrong in converting an image into a joint argument. However, adding such a legend means that it is no longer *the image* that is securing the pivotal inference.

In the same way that a person interpreting the kitchen glove ad could take it as a critique of Chux’s defective product, a person could interpret the postcard as an image by the Allies “arguing” that the end of the German regime is near. Surely a genuine visual argument ought to repel such opposite conclusions. Alas, the Nazi postcard offers us no visual resource to counter such an opposite gloss. Make no mistake: the rising sun interpretation is justified. But, one must take care to properly locate the source of that justification—otherwise one risks attributing quasi-animistic powers to images that images simply do not possess. Ordinary folks routinely reify their habits and mistake culture for nature, but theorists attain critical distance precisely by halting this reflex. Context never vanishes, but an image has a determinate frame, so we can meaningfully ask what interpretations are supported by information inside or outside that frame.

In ranking the various interpretations that can be made and conclusions that can be drawn, can we rely on something more tangible than intuitions? We believe so. The sun-like circle of the Nazi postcard has a definite area. One portion of that area is occluded by the horizon. Saying that “The sun is rising” can therefore be

¹⁶ Naturally, establishing the motion of a star does not establish that a given party is enjoying *political* ascent. Being movable is thus a necessary but not sufficient condition.



Fig. 3 Nazi postcard from the 1930s. Taken from Groarke 2015, p. 147

translated as saying that “Were one to witness the next moment, a greater surface area would come into view.” Conversely, to say that the sun is setting is tantamount to saying that the visible area would shrink (and eventually disappear) over time. So, while the shape in the image is static, it can nevertheless prompt motion-like expectations in viewers, giving rise to what Rosenthal calls the “action-image matrix” (1994, p. 24). Correct contemplation can thus be cashed out as preparation for action.

Cognitive science supports this conception of visual engagement. Experiments conducted by Tucker and Ellis (1998) have shown that, when subjects are shown an image and are asked to indicate whether the everyday object depicted is upright or inverted, the subjects’ responses are quickest when the hand that they use to answer (by pressing a button) is the hand they would use to grasp the thing. Images that showed a frying pan with its handle in a less accessible position thus lengthened the subjects’ response times. The stimulus materials used in these experiments were depictions of mid-sized artifacts (see the list in Tucker and Ellis 1998, p. 846), but even when dealing with logical diagrams, the consensus is that “our visual systems must be able to simulate things and events in the world, in some spatio-temporal sense” (Burton and Coppin 2012, p. 55).

Although these motor affordances normally go unnoticed, we think they can be harnessed in a way that can police our inferences. Images can undergo transformations like addition, copying, and erasure. Indeed, “even a simple drawing [...] can be said to establish an entire *system* of permissible transformations of the line, and in so doing it institutes a specific horizon of anticipation” (Hoel 2012, pp. 268–269;

emphasis in original). If, for example, one is instructed to continue drawing a pre-existing straight line, some visual interventions become inappropriate. This is essentially how the Venn diagram method manages to prove categorical syllogisms. Write the premises on the various circles and you thereby write the conclusion. Godden (2013, p. 9) has thus suggested that Venn diagrams are good candidates for visual arguments.¹⁷ Peirce described Venn as one “whom I never disagree with without finding his remarks profitable” (CP 3.371). However, out of dissatisfaction with the fact that Venn’s “system affords no means of exhibiting reasoning” (CP 4.356), Peirce showed how diagrams can cover, not just categorical syllogisms, but the whole range of logics (see Peirce 2019; as well as Roberts 1973).

To illustrate this, let us look at the more narrow and accessible case of propositional logic. The first step of Peirce’s diagrammatic notation consists simply in taking stock that something is present before one, as shown in Fig. 4.

Figure 4 is supposed to be empty. Peirce invites us to “regard the ordinary blank sheet of assertion as a film upon which there is, as it were, an undeveloped photograph of the facts in the universe” (CP 4.512). Even when staring at the unbounded blank canvas of Fig. 4, one is compelled to acknowledge the presence of this indeterminate space. Whatever else may happen, an arguer must grant this much if she is ever to enter into a dialogue (with herself or others) and determine what follows from what. So, “before anything has been drawn on the sheet, the *blank* is [...] a graph. It may be considered as the expression of whatever must be well-understood between the graphist and the interpreter of the graph before the latter can understand what to expect of the graph” (MS 492, p. 19). As fallible creatures with limited cognitive means, our epistemic certainties are few and far between. But, deny the very arena of deliberation and deliberation becomes hopeless.

Once something is “scribed” on the blank sheet of assertion, that token inscription emerges from the depths of possibility and comes into contact with actuality. One may doubt whether a fictional animal like a unicorn exists, but a token sign-vehicle of this mythical beast certainly exists, so that sign-vehicle can be used to at least *claim* that unicorns exist.¹⁸ Figuring out whether such a claim is true or false requires empirical inquiry—Peirce was also a practicing scientist, after all. But, using diagrammatic reasoning, we can study the *relations* among claims. So, if we

¹⁷ Dove (2016, pp. 259–260) has objected that students are often able to distinguish valid and invalid syllogisms verbally, before they ever employ Venn diagrams. Although Godden (2017, p. 425) has retracted his suggestion in light of Dove’s objection, we do not think Godden should have backed down so quickly. It is true that, before inventing his improvement on Euler diagrams, Venn knew which syllogisms are valid and which are not. Venn nevertheless devised a diagrammatic notation capable of converting those intuitions into something that is publically verifiable. So, whereas medieval philosophers catalogued and memorized valid syllogistic forms, he was able to demonstrate—in a new pictorial fashion—*why* those rules may be considered rational.

¹⁸ Peirce’s choice of the label “existential,” which first appears in his letters and notes from the late 1890s, stems from this. As Roberts explains, in *Existential Graphs*, to “write something is to ‘aver that such a thing exists’ (MS 513), and is to claim that something having the character described exists in the universe which the sheet represents” (1973, p. 30).

Fig. 4 (Blank) Sheet of Assertion

Fig. 5 Assertion



take a proposition like “She eats,” we assert that proposition¹⁹ by putting a token symbol or icon of it on the sheet of assertion, as shown in Fig. 5.

To be clear, we are *not* suggesting that such quaint icons are natural depictions of the propositions that they stand for. The image of Fig. 5 is too coarse-grained to show, for example, that the eating subject is a woman. It was Otto Neurath (1936), not Peirce, who believed in the universal communicative power of these little designs. Peirce’s aim was instead to investigate how the *relations* among signs can allow us to derive conclusions in a demonstrable way.²⁰ Once we focus on relations, the choice of relata is up for grabs. Surely, if it is okay for mainstream symbolic logic to stipulate that P will stand for “She eats,” then it is likewise okay to simply stipulate that Fig. 5 will stand for that same proposition. The image, however, enjoys a bond to its object that is more than just stipulative, so opting for a motivated sign (as Peirce does in MS R 514) makes the scheme of abbreviation easier to recall (it also counteracts the totemization that can result from using symbols like P and Q— as if algebraic stand-ins somehow had a monopoly on what counts as logical).

Diagrammatic reasoning is more interested in relations than in relata. One ubiquitous relation is with the surrounding area. If putting the icon of eating food amounts to asserting that “She eats,” then putting the same icon on a space cut from the sheet

¹⁹ Stjernfelt (2014) is mandatory reading for anyone who wonders/worries whether images can be “propositional.”

²⁰ Since Neurath’s (1936) ideographic language lacks the expressive power to represent the consequence relation, it is devoid of even the simplest inferential principles (see Pietarinen 2009).

Fig. 6 Negation



of assertion amounts to negating that proposition.²¹ The diagram shown in Fig. 6 would thus say “It is not the case that she eats” (shading the cut area is not mandatory, but it makes the distinction easier to track).

So far, we have laid out the visual means of expressing assertion and negation. The final ingredient needed to get Peirce’s logical system moving is conjunction. Since Peirce’s aim was to find the most natural sign possible, he did not assign an extra symbol (like “&” or “^”) for conjunction, but rather let mere visual juxtaposition of two or more items signal that connective. Thus, to express a compound proposition like “She eats and she goes to the bathroom,” we need only put the two signs side-by-side,²² as shown in Fig. 7 (again, for the sake of simplicity, we shall let this new proposition be represented by a new icon). Since the space is non-oriented, Fig. 7 could just as well be the sign for “She goes to the bathroom and she eats” (such readings constitute what Peirce called “interpretants”).

Once we are able to visually express assertion, negation, and conjunction, we have the resources to visually express all the more complex relations of propositional logic. Let us run through some common specimens. The diagram of Fig. 8 would mean “She eats food and she does not go to the bathroom.”

The diagram shown in Fig. 9 would mean “It is not the case that she eats and she goes to the bathroom.”²³

Cuts thus do plenty of work, such as serving the role of parentheses. Additionally, one can cut a space within a cut. So, paraphrasing, the diagram of Fig. 10 would mean “There is no situation where she eats and she does not go to the bathroom.” A more compact way of translating this diagram would be “If she eats, then she goes to the bathroom.” We can therefore combine assertion, negation, and conjunction to do the logical work traditionally done by if-then conditionals.²⁴

²¹ Burke (1966, p. 419) may have been overly-confident when he claimed that “the negative is a peculiarly linguistic resource.”

²² For more on the primitive role of conjunction in constituting atomic and compound propositions, see Champagne (2019).

²³ It is a reasonable question whether the cut, instead of negating the assertion, divests a proposition of its assertoric force. This question has been dealt with in Bellucci and Pietarinen (2017). There is also the dual system of “entitative graphs,” where the main connective of the graph in Fig. 9 is NOR, not AND. In Existential Graphs, the sheet represents tautology, not contradiction.

²⁴ One can use a truth table, a device invented by Peirce (Anellis 2004), to confirm that the diagram for $\sim(P \wedge \sim Q)$ indeed captures the standard material conditional $P \rightarrow Q$.

Fig. 7 Conjunction

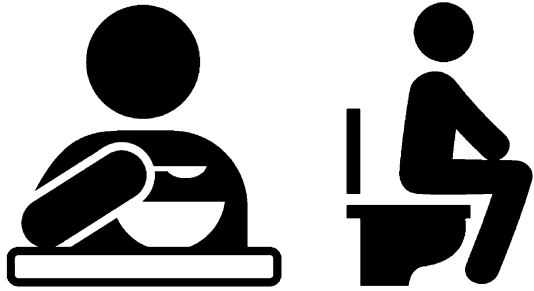


Fig. 8 Conjunction of assertion and negation



Fig. 9 Negation of conjunction



Fig. 10 Conditional



All logicians (formal and informal) use signs, but Peirce wanted to understand why signs are needed to begin with (Bellucci 2017). Peirce recognized that, while the formation of an opinion can occur with lightning speed and rest on nothing more than psychological self-confidence, proper reasoning takes time and requires the correction of external signs. A community of inquirers invests signs with meaning and then intervenes on these signs to test the consequences of their beliefs. When the signs in question are not wholly conventional, the results obtained are not wholly conventional.

Peirce devised diagrams capable of covering predicate and modal logic (Roberts 1973; Ma and Pietarinen 2017b), even augmenting the manipulations of his graphs with game theory (Pietarinen 2006). However, in this article, we deliberately limit our attention to his most elementary (“Alpha”) system, since it suffices to convey the insights that interest us. Peirce’s Existential Graphs is only one specific manifestation of diagrammatic reasoning (Hoffmann 2011, p. 191). Even so, his Existential Graphs illustrate in a vivid way Peirce’s belief that all inferences (not just deductive ones) are best conceived in a “moving stereoscopic view” (MS 683)²⁵ reminiscent of cinematographic technologies (see Pietarinen 2011, p. 269). Let us therefore use the representations surveyed earlier to put together a sample argument and test its merit.

Imagine that one were to argue the following: “If she eats, then she goes to the bathroom. If she goes to the bathroom, then she leaves. Therefore, if she eats, then she leaves.” Rendered in the idiom of Existential Graphs, the premises of this argument could look like the diagram of Fig. 11.

Notice that the conclusion of this argument (which is a hypothetical syllogism) is not yet depicted in this complex diagram. The task, then, consists in seeing if and how we can derive the desired conclusion from the starting image. Peirce devised five diagrammatic permissions that allow one to derive a conclusion from a body of premises: double-cut, insertion, erasure, iteration, and deiteration (the last two being fully reversible). For instance, the double-cut rule says that one is entitled to add or remove any twice-negated area, provided that there are no propositions other than the blank in the negated space. These permissions “will never permit transformation of a true assertion into a false one” (MS 492). Hence, as we shall now see, these incremental visual changes allow us to obtain the conclusion “If she eats, then she leaves.”

First, we can use the iteration²⁶ shown in Fig. 12 to reproduce the right-hand premise within the assertion space of the left-hand premise (although spatial inclusions and exclusions are important, scale and exact position are irrelevant, which is why the system of Existential Graphs can be described as topological).²⁷

²⁵ Addressing the resurgence of interest in early devices like the phenakistiscope, Carels notes that, “100 years before the GIF entered popular consciousness, Marey, Leprince, and several others, had already presented very short sequences of about a dozen photographic images” (2015, p. 34). Interestingly, spinning disks like the thaumatrope (1825) were sometimes marketed as “philosophical toys” (ibid.).

²⁶ Once again, one can use a truth table to confirm that the enriched diagram for $\{P \rightarrow [Q \wedge (Q \rightarrow R)]\} \wedge (Q \rightarrow R)$ is indeed equivalent to the previous step of $(P \rightarrow Q) \wedge (Q \rightarrow R)$.

²⁷ The thin black arrow has been added solely for didactic purposes and is not part of the language of graphs. The intent is to show the direction of the iterative movement on the static medium of the printed page.



Fig. 11 Premises

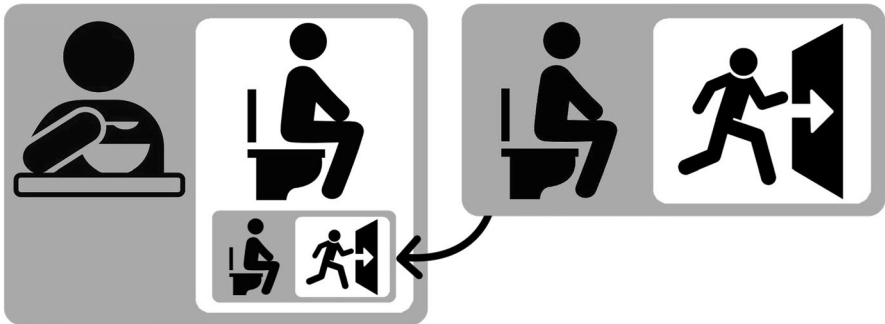


Fig. 12 Iteration transformation

We then use deiteration—essentially the reverse of iteration—to remove one of the inner contents of the diagram on the left, as shown in Fig. 13.²⁸

Because the previous transformation means that there is no longer any content inside the negated space, we can remove a needless double-cut, as shown in Fig. 14.

To claim that A and B are the case is *eo ipso* to claim that A is the case. A juxtaposed image on the blank sheet thus represents some fact independently of the representation of another fact in another part of that sheet. So, using the erasure permission, we are free to remove the diagrammed premise on the right, which yields Fig. 15.

Finally, when we repeat this move and erase another assertion, we obtain the conclusion shown in Fig. 16, namely that “If she eats, then she leaves.”²⁹

We have run through a sample proof, but proofs are nothing more than small well-known argumentative patterns that are deliberately strung together. Proofs thus differ from arguments in quantity but not in kind. In the previous example, “inference is performed by making a diagram of the state of things represented by the premisses [*sic*]” where “the reasoner then *observes* this diagram and notices some relation between parts of it which had not been expressly introduced in the construction

²⁸ Informally speaking, removal by deiteration is sound, because the image remains in the context of the image that was removed.

²⁹ Erasure is permitted on asserted areas, that is, on the sheet or on graphs resting on areas enclosed within an even number of cuts.



Fig. 13 Deiteration transformation



Fig. 14 Double-cut transformation

Fig. 15 Erasure transformation



Fig. 16 Conclusion



of the diagram” (MS L 385, emphasis in original).³⁰ What is required in diagrammatic reasoning is not thinking harder (whatever that means), but rather observing more keenly.³¹ One of the relations revealed by the observation of visual contents can then be the conclusion, which is arrived at by stepwise transformations.

Peirce held that the determination of a rational consequence can take place “by manipulating on paper, or in the fancy, formulæ or other diagrams—experimenting on them, *experiencing* the thing” (CP 4.86). As Clark and Chalmers (1998, p. 8) point out, in playing the video game Tetris, one can either rotate a mental tile or an on-screen tile. Either way, given an initial state, some transformations go through while others do not. The idea is that, if we imbue diagrams with significance and keep our adopted code constant, then the sign-vehicles (and not just the inference rules) become capable of stopping certain inferences, since there are real limits on what one can visually depict.³²

A parallel with poetry (or rap music) can help to clarify this difference between rule-based constraints and vehicle-based constraints. If we focus on what a sign-vehicle stands for, then a phrase like “The orange juice is liquid” combines quite sensibly with “I poured that juice into a glass.” But, if we take advantage of the use/mention distinction and focus on the phonetic properties of the sign-vehicles, then the last phrase will not rhyme whereas “I drank that juice as a kid” will. Similarly, we can fruitfully suspend our knowledge of what diagrams stand for and instead combine diagrams based on their plastic properties. Although the decision to cut out a shaded area in the Existential Graphs reflects a deliberate claim-making intent, facts about what lie inside or outside that cut are no longer under the claim-maker’s control. Unlike rhyming, determining fit with iteration, erasure, insertion, double-cut and deiteration produces, not just aesthetic satisfaction,³³ but truth preservation. Hence, just as toying with word combinations in poetry shows that “men and words reciprocally educate each other” (CP 5.313), toying with diagram combinations shows that minds and diagrams can reciprocally educate each other.³⁴

Crucially, the argument in Existential Graphs that we examined does not fall prey to the dilemma formulated at the outset. Because the initial diagrammatic layout did not

³⁰ Since imagistic systems of representation can provide a well-defined relation of consequence (and thereby perfect systems of proofs and demonstration), their power is not limited to the representation of structured semantic contents or arguments. See Ma and Pietarinen (2017b, 2018) for recent studies of Peirce’s proposed calculi of graphs as systems of algebra, deep inference, and sequent calculi.

³¹ For a discussion of the role of observation in diagrammatic reasoning, see Legg and Franklin (2017).

³² Despite advances in computer imaging, no special effect can successfully depict a square-circle. A world-wide contest was held inviting logicians and artists to depict contradictions visually (see Beziau 2015). Tellingly, no submission succeeded. Champagne (2016a) argues that this impossibility (which he dubs “contrapiction”) is the main source of diagrammatic reasoning’s normative power, insofar as some qualities or tones simply resist being squeezed into one token. For more on the type/token/tone distinction, see Champagne (2018a, pp. 22–26).

³³ Pietarinen points out that the notational simplicity and multimodality of logical graphs can make them beautiful. In an attempt to account for this experience of beauty, he conjectures that “logical graphs excite those Brodmann areas that are responsible for emotional experiences, whereas traditional (non-graphical) logical notations may fail to do so” (2018, p. 12). For neuroscientific investigations that used paintings as visual stimuli, see Ishizu and Zeki (2011).

³⁴ For an applied exploration of how diagrams can prompt discoveries in the social sciences and humanities, see Champagne (2016b).

include its conclusion, the visual argument cannot be charged with begging the question. Indeed, the final conclusion shown in Fig. 16 is separated from the initial premises of Fig. 11 by the fact that it comes afterward. Also, thanks to a series of transformations, the diagrams take us from the premises to that conclusion in a deliberate and predictable manner. As Rose explains, the most appropriate way to think of the conclusion is “as a further differentiation of the more undifferentiated premise, where the condition for the possibility of such differentiation lies, not merely in the premise itself [...], but also in the determining nature of the transitional, illative connection [...] whereby the premise and conclusion are combined (or conjoined)” (2011, p. 14). Pursuant with this, there is simply no way to use Peirce’s five permissions to obtain an opposite conclusion. One can of course refuse to accept the starting premises. However, one cannot refuse to accept what those premises entail. So, not only is this visual argument a good argument, one can use its visual properties to show *why* it is good.

The manipulable graphs that we just looked at call on a “[p]ragmatist epistemology” that “takes knowledge to be an achievement, which is a result of a [...] time-dependent process” where “what is also important is the description of that process and not only the outcome” (Ma and Pietarinen 2018, p. 3647). Peirce’s visual systems thus provide a counter-example to the standard view that logic studies only a product while dialectic studies a procedure and rhetoric studies a process (Blair 2012, p. 149). Peirce is often said to espouse a “process philosophy” (Hausman 2002), so it is only normal that his work in logic should reflect this.

To better appreciate how sequential relations can affect the interpretation of “rationally related objects” (MS 293), consider the following pair of arguments:

$$\frac{P \& Q}{P} \qquad \frac{P}{P \& Q}$$

These two arguments use the same contents. However, those contents have different orders of appearance (when reading from top to bottom). The argument on the left is valid whereas the argument on the right is fallacious. Similarly, we can appreciate the importance of sequence for arguments couched in normal language, like this one:

“She does not own a cat. She is afraid of cats.”

Due to the lack of indicator words, it is up to an interpreter to decide what is a premise and what is a conclusion. All other things being equal, it is more intuitive and parsimonious to interpret the pair of propositions as saying “She does not own a cat *because* she is afraid of cats” than as saying “She is afraid of cats *because* she does not own a cat.”³⁵ Given that a change of sequence can dramatically alter the

³⁵ Nothing about arbitrary strings of characters like “because” and “therefore” makes them intrinsically suited to be inference indicators. Hence, once a language-user becomes adept at recognizing the syntactic places and pragmatic roles that premises and conclusions play in a given system of meaning, these textual markers can eventually be dropped. One might take this possibility of absence to mean that the expressive needs of an argument are different—and quite less—than the expressive needs required to demonstrate logical consequence. However, such a view would overlook that (1) the textual markers needed to be present before they could be learned and eventually omitted and (2) the markers can at any time be reincorporated (in specific locations that are subject to robust standards of correctness).

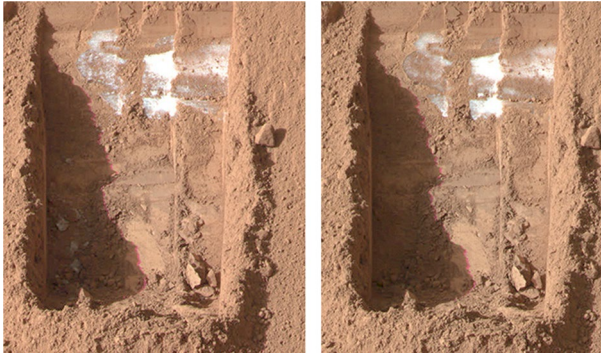


Fig. 17 Photographs of a dig by NASA's Phoenix Mars Lander. Taken on June 15 and 19, 2008

point of an argument, it is imperative that a visual argument display its contents in just the right way. To see this in a visual context, consider the two photographs of a Mars dig shown in Fig. 17.

The photograph on the left showed evidence of white spots in the soil. These spots were less pronounced when the photograph on the right was taken, three Martian days later. Scientists took this to mean that the white spots were water ice that evaporated when it was exposed to the Martian sun. The *Stanford Encyclopedia of Philosophy's* entry on "Informal Logic" (Groarke 2017) reconstructs the scientists' argument as follows:

(Visual) Premise: First photograph of the dig.

(Visual) Premise: Second photograph of the dig.

(Verbal) Premise: "The most plausible way to explain the changes we see in the photographs is by postulating the evaporation of water ice."

Inference Indicator: "We can conclude that..."

Conclusion: "...there is water on the planet Mars."

This is a verbal reconstruction. We therefore agree that "[t]he process of going from the image to the propositions they convey [...] will be heavily dependent on verbal reasoning [...]" (Johnson 2003, p. 6). Taken in its broadest sense, then, the activity of argumentation could be viewed as a language game (Patterson 2010). Yet, when this game of giving and asking for reasons is guided by a visual device that players jointly attend to, some moves become forbidden or permitted by the qualitative features of the device. In this case, without a suitable change in the visual properties, the scientific case for water on Mars would collapse.

Deleting one of the juxtaposed NASA photographs would revert the situation to a static state, like the Nazi postcard. In addition to rendering inference possible, before/after states can be used to separate premises and conclusion. For instance,

instead of verbally expressing her conclusion, a subject who grasped the NASA argument could signal her grasp by creating a third image that shows an even smaller patch of ice. In this way, figuring out what (logically) follows from what would manifest itself as figuring out what follows what (temporally). The ability to do this naturally presupposes access to collateral knowledge (about water evaporation and so on). These relevant bits of knowledge can nevertheless inform tangible visual interventions. Although one can gloss these visual interventions as a victory lap that one takes after having grasped an argument purely privately, the modification of a visual layout can, like interlocking Tetris blocks, be the very means by which one publicly establishes whether a given conclusion goes through or not.

One does not have to master Peirce's diagrammatic logic in its entirety or endorse his philosophical pragmatism to see the relevance of his ideas for argumentation theory (Larvor 2013, p. 249). So, leaving aside fascinating technical³⁶ and historical³⁷ details, we believe argumentation theorists can profitably apply the general spirit of Peirce's diagrammatic approach to informal specimens, like the one shown in Fig. 18.

It was by dragging depictions of the coastlines of South America and Africa closer that the geographer Alfred Wegener (and others before him) was led to hypothesize that the two continents are in fact breakaway portions of what was, at one time, a single continent.³⁸

Wegener's map differs from Dürer's heraldry in several important respects. First, unlike the coat of arms, the components of the map need to be *moved* in order to establish the relevant conclusion (the image is already mid-way through this process of transformation, since it makes the Atlantic Ocean look as narrow as a river).

Second, unlike the coat of arms, the diagrammatic interventions of an agent could be *wrong*—because of the image. If, for example, the shapes and/or bedrock properties did not align, then Wegener's conclusion would not be supported. The qualitative character of the image's components is thus pivotal in enabling or blocking certain inferential moves.

Third, unlike the coat of arms, one can literally *see* why the conclusion follows. One could say, using only language, that "There is a continent on one side" and "There is another continent on the other side" such that "The shores of the two continents match;" but relation of support linking the first two claims to the third would have to be taken for granted. Things are different when the continents at hand are actually *shown* side-by-side. Figure 18 thus meets the necessary condition laid down

³⁶ The derivation of residuation has a particularly apt diagrammatic proof in Existential Graphs that requires only the observation that the space between two cuts is empty (see the graph RG1 in Ma and Pietarinen 2017a, p. 180). This makes Peirce's transformations not only valid and sound, but also *evident* to reason.

³⁷ The discovery of diagrammatic logic was inextricably woven to the development of modern logic and modern metatheories of logic. In fact, "the very notion of iconicity comes out of deep issues in the discussion of formal logic and different ways of representing it" (Stjernfelt 2015, p. 35).

³⁸ Using an example from Peirce (CP 2.632) about a torn piece of paper, Dove (2016, p. 261) calls Wegener's map an "argument from fit." For a similar view (arrived at independently of Dove), see Stjernfelt (2014, p. 289). For more on maps and inferences, see Aguilerá (2016).

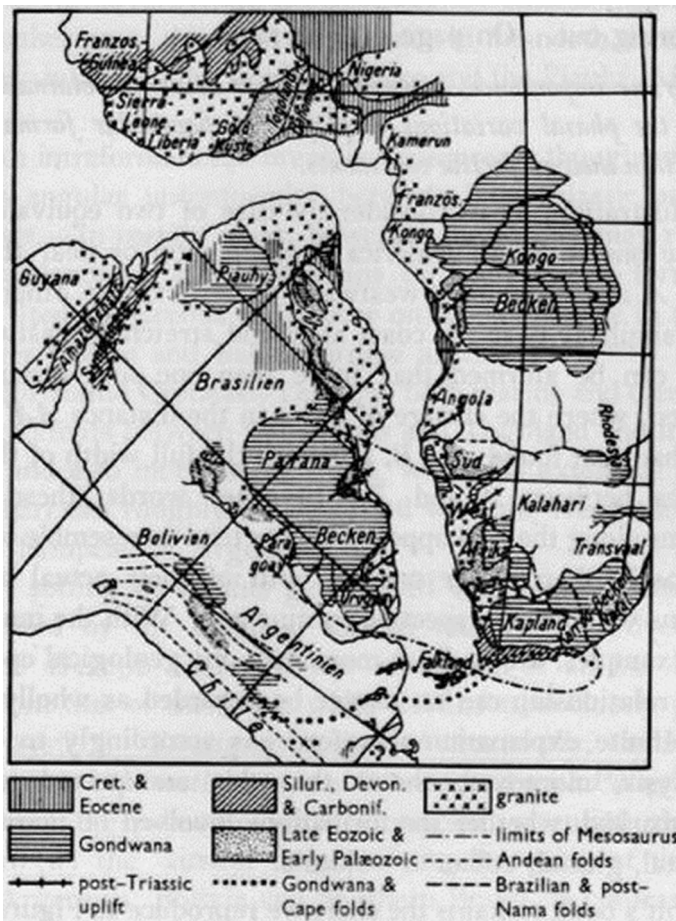


Fig. 18 Map of continents by Alfred Wegener (originally published in Wegener 1929, p. 73)

by Grancea, namely that “[t]he cognitive route that takes the audience from premises to conclusion needs to be changed, or at least substantially enriched, by the content of the visual” (2017, pp. 22–23).

Fourth, unlike the coat of arms, the continental map manifests *truth-preservation*. To be sound (i.e., valid with true premises), the coastlines of the Earth must possess the shape and soil in question (this is a matter for the geologist to verify). The argument’s validity, however, is ensured by the relational properties of the image. There are undoubtedly arbitrary stipulations at play (most notably in the legend), but the presence of motivated signs ensures that there are more than just stipulations at play.

Granite, for example, does not have to be represented by heavy dots.³⁹ However, this arbitrary assignment does not matter, since diagrams aim only to mimic relations, not *relata*. So, if both coastlines are in fact as they are depicted in the map, these truths will get preserved in the conclusion.

Just as moving the starting visual layout of Fig. 11 allows one to extract the conclusion “If she eats, then she leaves,” Wegener’s map shows why “once the continents are realigned to their supposed original configuration, geological, paleontological, and other *congruencies* appear” (Dove 2013, p. 5). It is the image, not the viewer(s), which decides who is right. Indeed, the grounds for Wegener’s conclusion can literally be shown, by bringing the continents together all the way. Since this slide is not (fully) provided in the image, we could fine-tune our titular claim and say that *movable* images might be arguments. In any event, what matters is that there are “before” and “after” states establishing a clear outcome.⁴⁰

In a genuine visual argument, the qualities of the image are able to repel opposite conclusions. By this standard, a mismatch would have spoken against Wegener’s proposed conclusion. Crucially, when Wegener appealed to a diagram for support, he took a risk, since the depicted landmasses and body of water wear their combinatorial power on their sleeves, so to speak. Claim-making involves responsibility-taking (see Brandom 1994). We are responsible for what our claims, taken jointly, entail. In Western philosophy, this has traditionally been glossed as a linguistic activity. However, when humans couch their claims in the right visual medium, they give themselves the means to visually justify what they say (Champagne 2016a). Anyone—friend or foe—can check whether Wegener’s conclusion really follows, by manipulating the image. Interpretation has limits (Eco 1990)—and here the diagrammatic properties of the image set that limit.⁴¹ Reaching a consensus still requires inquiry (and thus effort), but thanks to the image it at least becomes feasible.⁴² By contrast, if one is unconvinced that the conclusion “Reject coats of arms” follows, toying with the helmet, bride, wild man, and skull will do little to assist one. We submit that this actual reliance on visual properties makes the Wegener map more deserving of the label “visual argument.”⁴³

³⁹ As Tversky puts it, “maps, like many other kinds of visualizations, distort the ‘truth’ to tell a larger truth” (2011, p. 502).

⁴⁰ It may be that verbal arguments have occupied a prominent place, not so much because “argumentation is a *verbal* activity” (Eemeren et al. 2004, p. 2; italics in original), but because argumentation is a *sequential* activity.

⁴¹ Some researchers (like Messaris 1997) have suggested that lack of argumentative stringency is what makes images so rhetorically effective. That may be. But, if this lack of stringency is so pronounced that it opens the door to completely opposite conclusions, then the label “argument” becomes unwarranted.

⁴² For a discussion of the potential of diagrammatic reasoning in conflict resolution, see Hoffmann (2005).

⁴³ Scientific arguments are often complexes of verbal, graphical, tactile, and auditory modalities (Gross and Harmon 2013), so there is no need to lay excessive emphasis on the visual at the expense of many other facilitators of discovery, synthesis, and analysis. Richard Feynman, for example, famously claimed to “listen” to his imagination. For more on the role of sound in formal logic, see Pietarinen (2010) and Champagne (2015b). For more on the role of sound in informal logic, see Groarke (2018). For a practical exploration of gestures and body positions in regimenting elementary argumentative structures, see Champagne (2018b).

One could think that sequential representations of visual material such as comic books⁴⁴ or Orthodox Christian iconography⁴⁵ are counterexamples to our proposal, since those are quite unlike, say, YouTube clips. Naturally, a lot turns on whether we are focusing on a page (which is clearly static) or the interpretation of that page (which is clearly dynamic). Comic books cease to look like a counterexample once we adopt the latter perspective. Of course, a viewer's gaze and saccades likely also browse the visual contents of Dürer's "Coat of Arms of Death" (Fig. 1) in a non-static way. That is why we endorse additional criteria. To the extent that the interpretation of a comic book page is constrained by what is actually shown on the sheet, and to the extent that the key elements constraining the choice of conclusion are visual, and to the extent that the conclusion is (or stands ready to be) made manifest by a visual intervention, some comic books could fit our proposal.⁴⁶

In diagrammatic reasoning, not only are the reasons couched in a visual medium, one can respond in kind. Indeed, Figs. 11 to 15 let a rational interpreter signal her grasp of the premises' entailment by providing the conclusion of Fig. 16. Because such a concluding visual intervention necessarily comes afterwards, a genuine visual argument "cannot happen in an instant, but requires a time," which "is but another way of saying that every thought must be interpreted in another [...]" (CP 5.253). Illation—the distinctive transition from premise(s) to conclusion signaled by "Therefore"—thus involves a growth of signs (see Rose 2011). Our positive argument, then, can be restated as follows (with "p" signaling positive claims):

1. Illation involves a growth of signs.

2p. Moving images grow.

Therefore,

3p. Moving images can express illation.

4. A visual argument must be able to express illation.

Therefore,

5p. Moving images can be visual arguments.

Similarly, our negative argument could be restated as follows (with "n" signaling negative claims):

⁴⁴ For an introduction to the cognition of sequential images, see Cohn (2013). For a comparison of comics, scientific diagrams, and other sequential media, see Almeida (2016).

⁴⁵ For a discussion of sequential Christian depictions as precursors to modern-day comics, see Alaniz (2014, pp. 14-15).

⁴⁶ It is not necessary to require, atop all this, that a visual argument achieve inferential feats that no words ever could. This requirement of non-redundancy (as Grancea 2017 calls it) is too demanding. While some images exhibit unique properties that language cannot match, there is no reason why some verbal and visual arguments could not make similar points, in parallel. Even in such a redundant scenario, one can ask whether the visual argument is sustaining the passage from premise(s) to conclusion(s) visually. For an illustration of the disappointments that ensue when we insist that images must do their argumentative work non-redundantly, see Brody et al. (2000).

1. Illation involves a growth of signs.

2n. Static images do not grow.

Therefore,

3n. Static images cannot express illation.

4. A visual argument must be able to express illation.

Therefore,

5n. Static images cannot be visual arguments.

In a bid to secure claims 5p and 5n, we have endeavored to justify claims 1 to 3. Claim 4 has been taken for granted. One might reject it. After all, the problem with one horn of our dilemma is that visual arguments risk circularity—yet, circular arguments remain arguments. Similarly, the problem with the other horn of our dilemma is that visual arguments risk being enthymemes—yet, enthymematic arguments also remain arguments. This might not seem problematic. But, if the properties of visual arguments are such that these kinds of arguments *cannot help but be* circular or enthymematic, with no healthy or complete version possible, then that is certainly worthy of note.

One might tweak claim 4 to say that “A good visual argument should be able to express illation.” With such a change of wording in place, this article would only support a conclusion to the effect that “Static images cannot be good visual arguments.” In the same vein, the ability of moving images to express illation would only make them better arguments. One drawback (or boon?) of this weaker line of thinking is that it side-steps the ontological question of what visual arguments *are*. Still, acknowledging the expressive disadvantages of static images and the comparative advantages of moving ones would betoken considerable progress.

Peirce suggested that, when the inferences that bind premises and conclusions leave a visible mark on a sheet of contents, they can give us “a moving picture of the action of thought” (MS 296).⁴⁷ We have only drawn *inspiration* from this pregnant Peircean idea, so “it would be a mistake to identify diagrammatic reasoning with reasoning by means of Existential Graphs” (Hoffmann 2011, p. 190; for a similar warning, see Swedberg 2016, p. 257). A complete extension of diagrammatic reasoning to informal visual contexts would thus require further study and adjustments.⁴⁸ But, hopefully, the foregoing has shown why such study and adjustments would be worthwhile.

⁴⁷ For more on Peirce’s programmatic suggestion that diagrammatic logical notations can capture the motion-like activity of thinking, see Pietarinen (2006, pp. 103–180) and Stjernfelt (2007, pp. 89–116).

⁴⁸ One change that would put the conversation on a firmer footing would be to drop folk semiotic categories like “textual” and “visual” and instead employ principled distinctions like iconicity, indexicality, and symbolicity. A sign-vehicle like “S,” for instance, is both a similarity-based icon of a(ny) serpentine figure and a conventional symbol invested with a role in a linguistic code. The idea that a sign-vehicle like S is intrinsically a letter—which is unquestioned in the folk semiotic text/image distinction—therefore occludes more than it reveals.

4 Conclusion

One can, if one wishes, relax one's semantics so that visual support for a single premise (like photographic evidence in a court case) suffices to characterize a whole argument as "visual." However, it is unclear what is gained by such a move. Accordingly, we have taken visual arguments to mean "arguments in which the propositions *and their argumentative function* are expressed visually" (Alcolea-Banegas 2009, p. 261; emphasis added). This is a perfectly sensible definition, but can any image actually satisfy it? Here is a summary of what we have said.

We began with a dilemma: if the conclusion is present in the image, then the visual argument risks begging the question; but if the conclusion is absent from the image, then the visual argument risks supporting any conclusion. Using Peirce's Existential Graphs as our lodestar, we showed how images which move or stand ready to be moved can escape this dilemma. Stepwise diagrammatic manipulations can provide both a principled means of visually demarcating conclusions from premises and a principled visual explanation of how conclusions can come from premises.

To illustrate this, we contrasted major exemplars. Our foil at the static end was the "Coat of Arms of Death" by Albrecht Dürer (Fig. 1). This engraving has been put forth as a visual argument, but it is unclear how a specific conclusion is to be extracted from this image. Context-based verbal glosses can assist one, but the coat of arms itself does not have the visual resources to deal with head-on challenges. We contrasted this engraving with Alfred Wegener's map of continental drift (Fig. 18). Here, one can point to tangible visual features that indicate a match as opposed to a mismatch. Since the conclusion about a single continent is already nested in the shorelines, that conclusion can be made explicit, by gradually transforming the starting layout. We argued that such transformations are specific instances of a more encompassing phenomenon called diagrammatic reasoning.

Whatever else diagrammatic reasoning is, it is closer to kinaesthetics than to aesthetics. Indeed, our Peirce-inspired account requires those who grasp a visual argument to *do* something which accords—in a demonstrable and predictable way—with the premise-like materials that are shown. Regular interpretation of images by outside observers remains possible, even when no transformations are made. But, when an interpretation is unconstrained by the visual properties of an image, it is confused to think that we are dealing with a visual argument (or, at any rate, a *good* visual argument).

By moving away from a fixation with language, argumentation theory is generally heading in the right direction, but it could benefit from a course correction. Static picturing of states of affairs may, as Wittgenstein (1974, Sect. 4.01) once claimed, be a good way to describe the epistemic work done by propositions. But, if consciousness is an ever-moving stream and if arguments are structured segments of that stream, then visual arguments must be processual too.

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