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Embodying meaning visually:
From perceptual dynamics to motion kinematics

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Abstract: This paper adopts an embodied cognitive perspective to review the significance of dynamic patterns in the visual expression of meaning. Drawing upon the work of Rudolf Arnheim’s theory we first show how perceptual dynamics of inanimate objects might be extended in order to structure abstract meaning in fixed images such as paintings. Second, we evaluate existing experimental work that shows how simple kinematic structures within a stationary frame might embody such high-level properties as perceptual causality and animacy. Third and last, we take inspiration from these experiments to shed light on the expressiveness of dynamic patterns that unfold once the frame itself becomes a mobile entity (i.e., camera movement). In the latter case we will also present a filmic case-study, showing how filmmakers might resort to these dynamic patterns so as to embody a film’s story content, while simultaneously offering a further avenue for film scholars to deepen their engagement with the experimental method.

Keywords: animacy, dynamics, embodiment, film style, metaphor, perceptual causality

1. Introduction

Literature in embodied cognition increasingly shows that bodily and cultural experience plays a significant role in cognition and the construction of meaning in language (e.g., Barsalou, 2008; Gibbs 2006a; Lakoff and Johnson, 1980, 1999; Tversky, 2019; Varela, Thompson and Rosch, 1991). This realization opposes a long objectivist tradition that understands concepts as amodal symbols that, much like words, make reference to an objective state of affairs independent of the mind (e.g., Chomsky,

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1968; Fodor, 1975). In contrast to this view, theories of embodied cognition such as Lakoff and Johnson’s Conceptual Metaphor Theory, have emphasized the non-propositional and embodied nature of concepts, stating that conceptual structure is grounded in dynamic patterns of sensory-motor experience. These patterns are known as image schemas and are considered to play a crucial role in the emergence of meaning and in our ability to engage in abstract conceptualization and reasoning (Johnson, 1987; Lakoff, 1987). This is how for instance, people come to understand emotions metaphorically in terms of force schemas (“I was pushed into depression”, “She was carried away by the song”) and time in terms of path schemas (“The deadline is approaching”, “Time flies by”).

This changed conception of the mind has not only led to a fundamentally different way of viewing meaning construction in language (e.g., Evans and Green, 2006; Lakoff and Johnson, 1980); it also marks a decisive advance in our understanding of the visual arts. If the arts, in a general sense, can be viewed as a vehicle for expressing meaning (i.e., vital aspects of the human experience), and dynamic patterns of sensory-motor experience (rather than linguistic structures) are said to be the very essence of expression, it follows that these embodied patterns also play a vital role in the arts (see also Johnson, 2007, 2018). It is the final purpose of this paper to consider this hypothesis more concretely by investigating the significant role of movement patterns in the shaping of meaning in cinema (see also Coëgnarts, 2017, 2019, 2020; Coëgnarts and Kravanja, 2015; Forceville, 2017; Forceville and Jeulink, 2011; Gallese and Guerra, 2019; Kappelhoff and Müller, 2011; Pearlman, 2016). In order to reach this point we propose a gradual discussion of dynamic patterns at three different levels of visual display: first, the level of fixed images, where the dynamic patterns are elicited by inanimate visual objects within a fixed container (e.g., a painting); second, the level of moving images where the dynamic patterns are elicited by the kinematics of visual objects within a fixed frame; and third, the level of moving images where the dynamic patterns result from the interaction of the motion kinematics of a visual object with a mobile frame (e.g., the interplay of camera movement and object movement in cinema). Of these three levels the first two levels have received by far the most theoretical and experimental attention. Therefore, we will devote the first two sections of this paper to a review of some of the existing literature. The insights provided in these sections will serve as a basis upon which to
investigate, through a case-study of our own, the relationship between dynamic patterns and visual expressiveness in narrative cinema.

For the first level, we consider Rudolf Arnheim’s pioneering work on visual dynamics in fixed art forms. Even long before the embodied view gained foothold in the cognitive sciences, this theorist put forward the thesis that visual perception does not consist in the simple recording of physical properties, shapes and sizes, but in the grasping of the directed forces or vectors that underlie the appearance of static objects. In his two most celebrated works, *Art and Visual Perception: A Psychology of the Creative Eye* (1954) and *Visual Thinking* (1969), the author extended the notion of dynamics to the realm of artistic expression by showing, through various inspiring case studies taken mostly from the domains of painting and sculpture, how art works are able to portray human life “as a closed system in which all relevant forces are shown together in configuration, each in its characteristic direction and appropriate strength” (Arnheim, 1988, p. 590). Illustrating this claim will be at the center of the first section of this paper.

From the first inanimate level of visual dynamics we move on to the second animate level of motion kinematics by showing how certain simple visual displays consisting of moving geometrical may give rise to conceptual meaning. To assess this second level, we will review two strands of experimental research on so called “functional relations,” wherein one perceives various high-level properties in simple movies (Scholl and Tremoulet, 2000, p. 299). Both strands will be exemplified by two classic works: Michotte’s pioneering work on perceptual causality and Heider and Simmel’s classic study on perceptual animacy, respectively. Unlike the first section, which explicitly makes reference to the visual arts, the discussion of the second level will restrict itself to a review of visual displays that were not intended to be artistic. However, their findings will be key to developing the third and last level of understanding which aims at bringing the discussion of dynamic patterns to the artistic realm of narrative cinema.

In this section we further build on the theme of kinematics, except that now we also consider the role of the mobile frame in shaping embodied visual meaning. This addition allows for a new set of dynamic patterns to arise, which following Robert Dewell’s work, may be appropriately termed “dynamic patterns of containment” (Dewell, 2005). Distinguishing between these patterns will also lead
us to first review some of the camera movements that make these patterns possible. Having linked some of the techniques of mobile framing to their underlying patterns, we offer a more thorough cinematic case-study of our own by demonstrating how this new set of dynamic patterns may give rise to surprisingly high-level percepts about a film’s story content (e.g., intentions, motivations). With this case-study at the crossroads of film studies and embodied cognitive science we hope to present an opportunity for film scholars to further their engagement with the experimental method (see also Sluga, 2020) and thus continue the line of research on dynamic patterns and expression that has been set forth by Arnheim, Michotte, Heider and Simmel. Especially, given that experimental investigations at the third level have not yet been reported in the literature, we will argue that it would be opportune to further evaluate the perceptual and cognitive processes which are involved in a viewer’s construal of meaning in cinema.

2. Arnheim’s theory of perceptual dynamics in fixed images

If we were to ask Arnheim to single out the most important discovery in the psychology of the arts during the twentieth century, he would answer, “the insight that the world of sensory experience is made up primarily not of things but of dynamic forces” (Arnheim, 1988, p. 585). As Einstein rejected the distinction between energy and mass, Arnheim believed that the forces, which set up objects in motion, cannot be separated from the objects themselves. In his view, visual objects are the carriers of dynamic forces, and it is only as such that they are capable of transmitting expression.² Hence, it is to the dynamic patterns of forces, rather than their physical properties that we should turn to in order to account for the primary effect of paintings. As he writes, “a painting speaks only when it is seen as a configuration of directed forces, generated by its various visual components” (Arnheim, 1984, p. 296).³

²This belief is consistent with how many of the early 20th century abstract painters conceived of their arts including Vasily Kandinsky, Frank Kupka, Kazimir Malevich and Piet Mondriaan. Patricia Railing (2006, p. 17) nicely summarizes it when she states that, for these painters, “the sensations arising from the world of sense phenomena became both subject and object of their creations. They identified these sensations as energy and its different manifestations as force, motion, and so on.”

³In his distinction between the measurable and metric features of visual objects and the force patterns that underlie them, Arnheim finds an intellectual companion in the psychologist Heinz Werner who contrasted the mode of objective-technical or geometric-technical perception with its opposite mode, physiognomic perception (Rosar, 1994, p. 157). Both modes of perception are attuned to different perceptual attributes. The former mode relates to shapes, configurations, colors or sounds (i.e., the traditional primary and secondary qualities of Galileo and Locke), whereas the second mode relates to expressive physiognomic properties such as hostility, youthfulness,
Since visual art works typically have boundaries, which in the case of paintings, drawings, or photographs (and as we shall discuss later, also films) are most often represented by a rectangular frame, the question of dynamics principally becomes one of composition, that is, the organization of objects and forms in relation to one another within a boundary (see also McManus et al., 2011). In his book *Art and Visual Perception*, Arnheim devoted an entire chapter to this question by examining what happens when a single black disk (circle) is placed off-center on a white background within a square frame. “There is something restless about it. … The disk’s relations to the edges of the square [frame] are a … play of attraction and repulsion” (Arnheim, 1974, p. 11). The frame has an effect upon the disk, and indeed even an empty square frame, “is empty and not empty at the same time. Its center is part of a complex hidden structure, which we can explore by means of the disk, much as we can use iron filings to explore the lines of force in a magnetic field” (Arnheim, 1974, p. 12). It is important to note, as Johnson (1987, p. 79) does, that this hidden structure is only created by the viewer’s eye. That is, balance does not reside in the frame itself. The object seen “is only balanced in our acts of perception.” However, since all spectators are more or less equipped with the same perceptual tools and with the same desire for balance, “it will usually make perfectly good sense,” as the author points out, “to speak of the balance being in the perceived object.” It is precisely for this reason that Johnson considers BALANCE to be an image schema because it operates as a recurring structure or pattern of perceptual activity that is instantiated in a number of different bodily and perceptual experiences.

As Arnheim demonstrates, there are many pictorial factors that influence force and weight relations (and therefore balance) in a visual work of art including shape, size and color. With regard to the latter, for example, Scott Higgins (2011, p. 108) has pointed out that Arnheim did not direct his attention to the “question of harmony,” as most color theorists traditionally do, but to “color’s role in structuring composition and guiding the eye.” Arnheim (1954, p. 345) considered a successful composition one in which “hue, place and size of every color area as well as its brightness and saturation are established in such a way that all the colors together stabilize one another in a balanced whole.” The meanness, sadness and friendliness which Arnheim considers the attributes of forces. While physiognomic qualities correlate and coexist with objective technical attributes, they cannot be reduced to them. That is, they “are nothing derivative, but the most primitive perceptions of all” (Werner, 1978, p. 149-150). They are as intrinsic to perceptual experience as so called primary and secondary qualities.
frame or canvas is the field in which colors are organized and combined into configurations. As he writes: “Since perceptual patterns tend towards the most clear-cut organization available, a configuration of colors will strive either toward contrast or toward assimilation, depending on which is closer to the given stimulus information.”

Arnheim did not only seek to explain perceptual forces in a theoretical and abstract fashion. Through a unique style that communicated both clarity and insight, he analyzed a myriad of visual art works, showing the reader, over and over, how artists make use of them to tell stories and to convey the tendencies of centric and eccentric human motivation that inhabit them. Arnheim’s analysis of Pierre-Narcisse Guérin’s painting Phèdre et Hyppolyte (Musées Nationaux, Paris), as shown in Fig. 1, may serve to illustrate this point:

The play tells the mythological story of Phaedra, wife of King Theseus, who falls in love with her stepson Hippolytus and is persuaded by her confidante Oenone to accuse the son of trying to seduce her. The enraged king has his innocent son killed, while Phaedra, overcome by her sense of guilt, takes poison. The death of the two leading characters releases the tension created by the conflict. The painter Guérin, a classicist follower of Jacques-Louis David, shows the principal themes of the plot in their direct interaction. Hippolytus rejects the accusation; his father listens to him with deep apprehension; and the queen, in the turmoil of her conflicting impulses, turns away from the confrontation and is urged by her confidante to insist on the false accusation. Guérin, whom the poet Charles Baudelaire called an abstractor of quintessences, reduces each figure to its dynamic theme. Hippolytus, petrified and detached by some distance from the group, does not actively engage in his defense. The verticality of his stance and the right angle that straightens his gesture of rejection freeze his response into immobility, whereas the king, closed off by a rectangular backwall, is swept away from his son in a powerful diagonal wave. The queen is caught in this rebound but is nevertheless kept out of it by her frontality, which ties her to the equally frontal position of Hippolytus. The innocent youth and the guilty woman are kept parallel by their detachment from the sweep of the accusation, while the confidante seeks to increase the intensity of the attack (Arnheim 1988, pp. 590-591).
In its coupling of the perceptual with the conceptual, Arnheim already anticipated the metaphorical approach advocated by Lakoff and Johnson (1980) which holds that people draw on concrete patterns of perceptual experience (image schemas) to structure their thinking about abstract concepts. Likewise, we might translate Arnheim’s commentary in these terms, whereby the abstract content of the painting is expressed metaphorically by the configuration of directed forces (graphic vectors) within the overall composition (see also Coëgnarts, 2017, 2019a; Lakoff, 2006). This is also evidenced in the verbs that Arnheim uses to express the forces that are operative in the work. Expressions such as “The King being closed off and swept away from his son” and “The queen is caught in this rebound, but is nevertheless kept out of it”, betray the workings of a hidden structure in the work, a “structural skeleton” by virtue of which the visual content is organized “in such a way that the intended expression is directly conveyed to the eyes” (Arnheim, 1954, p. 152). Both Lakoff and Johnson have repeatedly acknowledged their debt to Arnheim. Johnson (2007, p. 228) calls his work to be “one vast celebration of the embodiment of meaning and thought” while Lakoff (2006, p. 153) considers him one of the intellectual forerunners of a “neuroscience of form in art”. As the latter writes, “what is most remarkable to me in respect is that Arnheim did have the idea that structures like image schemas give form to art, and that metaphors apply to image schemas in paintings, to give meaning to paintings” (Lakoff, 2006, p. 155).

3. Fixed-frame kinematics as carriers of causality and animacy

Arnheim’s work allows us to understand how a static object of art that is deprived of any movement may nevertheless give rise to forceful patterns and, through these patterns, the rise of concepts in the beholder’s mind. In Guérin’s painting the abstract meaning of the work is embodied metaphorically as a simultaneity of forces: it combines different phases of an event in one and the same fixed image whereby its content is revealed through a dynamic interplay of graphic vectors elicited by objects that in and by themselves are not only physically immobile but also undynamic, in the sense of not being inhabited by animating forces. As Arnheim (1988, p. 3) points out, “even a drawing of an arrow does
not go anywhere.” Subsequently, it would be interesting to go a step further and to ask how visual configurations which involve actual object motion in an equally stationary frame might give rise to abstract concepts. This question is at the core of two strands of experimental research that began with two classic works in the field of perceptual psychology: the publication of Albert Michotte’s book *The Perception of Causality*, which is also cited and discussed by Arnheim (1954, p. 388-395), and of Heider and Simmel’s influential article on perceptual animacy, entitled “An experimental study on apparent behavior”.

### 3.1 Perceptual causality

To illustrate the first strand of research, let us imagine viewing a simple 2D movie as shown in Fig. 2.

(Fig. 2 about here)

In verbal terms the diagram might be rendered as follows: two visual objects, A and B, here represented as two circles, are sitting in a line, separated by several inches. The first circle, A, moves in a straight line until it makes contact with the second stationary circle, B, at which point A stops moving and B starts moving in the same direction. This is all what happens objectively in the film. However, if we were to ask viewers to describe what they are seeing perceptually, the majority of people would not only provide an objective description of the screened kinematics. Additionally, they would also say that circle A forced circle B to move, that object A was seen to “kick, shove, or launch object B” (White, 2011, p. 341). In other words, observers would also report a visual impression of causality, despite the fact that there was no causality present in the stimulus. This effect, which became famous as the “launching effect,” has been first reported by Albert Michotte (1963) and since then has been confirmed by many other research as a reliable phenomenon (e.g., Choi and Scholl, 2004; Gordon, Day and Stecher, 1990; Newman, Choi, Wynn and Scholl, 2008; Schlottmann, Ray, Mitchell and Demetriou, 2006; Scholl and Tremoulet, 2000).

Interestingly, Lakoff and Johnson (1999, pp. 184-185; see also Johnson, 2017; pp. 206-207) would later capture the relationship between forced movement and causation in metaphorical and
embodied terms whereby the inferential logic of the former concept serves as a concrete source domain for fleshing out the second one. They find linguistic evidence for this metaphor \textit{CAUSATION IS FORCED MOVEMENT}, in such expressions as “FDR’s leadership \textit{brought} the country out of the Depression,” “The home run \textit{threw} the crowd into a frenzy,” “He \textit{drove} her crazy,” or “She \textit{pulled} me \textit{out} of my depression.” The authors are keen to stress the differences in meaning of each verb of forced movement. As Johnson (2017; p. 206) argues; “the causal logic of ‘bringing’ water to a boil is quite different from the logic of ‘throwing’ a crowd into a frenzy.” The former verb requires that we move something with continuous contact. For example, in order to bring a glass of water to someone we have to exert continuous force on the glass the whole time it was moving to that person. This logic then is extended to form the metaphorical concept of bringing water to a boil, “since that requires the continuous application of heat to the water to change its state” (Johnson, 2007, p. 206). By contrast, the latter verb requires “an initial strong force applied to propel an object through the air.” Thus, Johnson (2007, p. 206) argues, “to throw a crowd into a frenzy entails a sudden strong metaphorical force (here, the event of the home run).”

Likewise, one can say that different visual displays (different situations of forced movement) give rise to variations of perceptual causality. Consider, for example, the “entraining effect,” as diagrammed in Fig. 3, wherein A seems to carry B along with it (Scholl and Tremoulet, 2000, p. 300).

As Scholl and Tremoulet (2000, p. 301) summarize, much of the contemporary research on perceptual causality has attempted to further extend Michotte’s catalogue of functional relations to also include other phenomena and to generalize them in various ways. White and Milne (1997), for example, have convincingly demonstrated how certain visual stimuli might give rise to percepts of pulling. In one of their experiments, one middle object is seen to \textit{pull} other objects. As in Michotte’s launching display, the visual impression of causality seem to be robust and immediate despite the fact that what we see are merely the kinematics of simple geometric shapes in a static frame.
Not only have simple visual displays been reported to give rise to visual impressions of causality. They also have been reported to elicit strong percepts of animacy. This brings us to the second strand of research.

3.2 Perceptual animacy

Likewise, let us illustrate this strand by briefly recapitulating the original and foundational experiment of Heider and Simmel (1944), as also discussed by Scholl and Tremoulet (2000, p. 302). In it viewers were asked to interpret a visual display in which three geometrical figures (a large triangle, a small triangle and a circle) were shown moving in various directions and at various speeds. The only other figure in the field was a rectangle, a section of which could be opened and closed as a door is. As with the experiments cited above, the overall frame or container in which the kinematics occur, remained immobile throughout the two and a half minutes that the experiment lasted. Similarly, Heider and Simmel’s experiment showed a remarkable consistency in the way observers responded to the motion kinematics. With exception of a few test subjects, the majority interpreted the geometrical figures as being alive and having personality traits, emotions and intentional states such as desires, regardless of the instructions they were told. For instance, in the series of sequential snapshots, as shown in Fig. 4 (see also Scholl and Tremoulet, 2000, p. 302), the large triangle might be seen as “wanting to catch the small triangle” which is protected by the small circle. Once the “couple” is safe inside, the larger triangle gives up and exits the frame.

(Fig. 4 about here)

As with perceptual causality, later studies on perceptual animacy have confirmed the generality and robustness of such findings. Interestingly, recent research seems to suggest that it is not so much the spatial properties of the objects that are largely responsible for eliciting percepts of animacy as it is the motion kinematics. For instance, in a research conducted by Berry, Misovich, Kean and Baron (1992) it was shown that “a spatially quantized version of the original Heider and Simmel movie (which selectively eliminated featural properties) hardly affected observers’ descriptions, whereas a temporally
Items in the quantized version (which selectively eliminated motion information) resulted in a drastic reduction in reported perceptual animacy” (Scholl and Tremoulet, 2000, p. 303).

The existing experiments cited so far are restricted, however, in two general respects. First, they do not explore the potential of a mobile frame for eliciting percepts with high-level properties. Consequently, one may raise the question what kind of dynamic patterns may unfold perceptually once the frame itself becomes a moving entity relative to the motion kinematics of objects, and with those patterns, the new metaphorical possibilities for shaping meaning visually. Second, unlike Arnheim’s analysis of Guérin’s painting, which ties up the discussion of dynamic patterns explicitly with the intentions of an artist, the discussion never transcends its experimental framework. For one, the experiments do not show how these dynamic patterns might shape the thematic meanings of a visual work of art. This brings us to the third and last section of this paper.

4. Motion kinematics in narrative cinema

To start off our discussion of the role of motion kinematics in the structuring of meaning in cinema, let us first imagine the following hypothetical visual display as diagrammed in Fig. 5. Like the experiments cited above, the set-up is very skeletal, consisting of simple geometrical shapes: a frame and two circles, A and B. The crucial difference here, however, is that not only do the two circles move in relation to each other, but also does the frame now have the potential to move.

(Fig. 5 about here)

Verbally, we may render the scene as follows: two objects, A and B, are contained within the same frame. The second object B starts to move. The frame follows this trajectory, thus abandoning the first object A to the outside space (I). Then A enters again the frame, thus restoring the initial situation: A and B are together again within the same frame (II). Then object B exits the frame, thus leaving the first object alone within the container (III). Object A starts to move while the container follows its trajectory towards object B until both objects are again captured within the same frame (IV). Lastly, the three objects (A and B as included the frame) all start to move together (V).
This visual display is composed out of patterns of four different kinds: in one kind the frame is moving along with the object. In this case the vector of the object is continuing with the vector of the object: they both point in the same direction. This occurs when object A moves together with the frame to the same destination. Something similar occurs later when the contained object A and the frame move toward object B. In the second sort the object remains stationary while the frame moves. This is the case at the beginning when object A is excluded from the container’s inside. The opposite pattern unfolds at the end when object B is included in the container. Lastly, there are two patterns in which the container remains stationary. This is the case when object A enters the frame and when object B exits the frame. Adopting Robert Dewell’s terminology we may refer to these various patterns (i.e., inclusion, exclusion, entry and exit) as “dynamic patterns of containment”: they all unfold when either the container, the object or both has a vector quality and both entities are spatially related to each other (Dewell, 2005).

While visual displays such as above have not yet been subject to any experimental investigation, unlike the displays described above, it is tempting to attribute similar impressions of causality and animacy to the kinematics on display. Likewise, we could hypothesize that observers perceive the two objects as characters with intentions, and other social attributes. In this case we could make the assumption that A and B are persons who have a discussion, that person A keeps imposing him- or herself onto person B while B keeps running away. At the end, however, friendship is restored and they are together again. Similarly, we may infer a causal relation: person B moves away as a result of person A coming closer. Moreover, since the container is now also moving, observers may also see something additional which they could not have inferred on the basis of the visual displays in the experiments of Michotte and Heider and Simmel. The fact that the container seems to move together with the object, first with A and later with B, seems to suggest a relationship of contingency between the two entities. Following cognitive linguistics, we may further clarify this relationship through the embodied metaphor PERSONS ARE CONTAINERS (Kövecses, 2000, p. 90). According to this metaphor people have a tendency to conceptualize a friendship, for example, as consisting of persons as containers that open up to each other so they can reach a level of intimacy (e.g., the expression “to confide in someone”). In our case, however, the frame is the container, not the object, but because they both share the same destination,
there is a strong visual impression of likeness. As if both entities are interchangeable, and identical in their intentions. From this perspective, the spatial verbs “to exclude” and “to include” gain a significant social meaning (e.g., person A includes or excludes person B).

As with the visual stimuli of the experiments of Michotte and Heider and Simmel the visual display remains skeletal and highly abstract. Unlike the Guérin example, the dynamics lack any figurative and narrative context. To conclude this section, let us put some “flesh” onto the skeletal structure from above by illustrating how filmmakers might resort to such dynamic structures to embody a film’s story (i.e., a structure of purposive acts) visually. However, before providing a case example, let us first ask by which means the above diagram might be possibly fleshed out cinematically. Here, we may refer to two techniques of cinema: fixed-frame movement and mobile framing.

The first technique is suitable for expressing the patterns of EXIT and ENTRY. A visual object may enter or exit the frame along the three possible axes of the filmic frame: the horizontal x-axis, the vertical y-axis or the illusionary depth line or z-axis. Moreover, since we are dealing with film, we are also dealing with on-screen space and off-screen space whereby the latter space might be further divided, as film theorist Noël Burch (1981, p. 17) pointed out, into six segments: the space left of the frame, the space right of the frame, the space below the frame, the space below the frame, the space behind the set and the space behind and near the camera (see also Bordwell and Thompson, 2004, p. 258; Coëgnarts, 2019, p. 75). With ENTRY the object thus moves from a location beyond the frame (the off-screen space), along a pathway, towards the inside of the frame (the on-screen space). The opposite is the case with EXIT. Moreover, if the exit or entry pattern of the object runs along the z-axis, the movement is also accompanied with an increase or decrease of graphic size and visual weight. These patterns may be termed APPROACHING and DISTANCING, respectively. Unlike the visual diagram above, however, we do not actually see the object entering the frame. As we do not see the off-screen space, we cannot see any crossing of the boundary. However, as viewers we easily fill in the missing parts and perceive the whole through the automatic perceptual response of psychological closure: “a mental filling in of missing information” (Zettl, 2017, p. 147).

The second technique of mobile framing serves as the most suitable means to flesh out those patterns in which the container is the moving entity (e.g., INCLUSION, EXCLUSION). Here we are dealing
with camera movement. Naturally we do not see the vectors as represented above. We do not literally see the camera moving to the right or the left. What we do see is its effect on screen, the component changes in what the camera records when its moves. This has been well described and illustrated by Hochberg and Brooks (1996, p. 237-240) who distinguish between two classes of camera movements: “those classes that change things’ sizes on the screen (i.e., the dolly and zoom) and those classes that move the scene laterally on the screen (tracking or trucking and pan shots).” With a dolly, for instance, the direction of movement and line of sight of the camera are the same, both are directed into the layout of the shot, heading for the point of contact, or point of convergence of the optical flow pattern. The movement continues until the object has doubled in size. With a pan, by contrast, only the line of sight changes, the camera swivels around one point in space. Nevertheless, despite these optical changes, there is also a sense of unity at the underlying image schematic level, that is, in both cases as well as with the other camera movements, “old” space is excluded in favor of the inclusion of “new” space. These patterns are always recurring regardless of the sort of camera movement.

Once the individual patterns are created there are two ways of putting them together into a temporal sequence. The first is by means of the long take which depends on the duration of the shot: the longer the camera records, the more patterns of fixed-frame movement and mobile framing that there are to be combined in a single take with preservation of spatial continuity (Bordwell and Thompson, 2014, p. 284-286). The second is by means of editing: the movement patterns of various shots are assembled and put into sequence. In her own research Karen Pearlman (2006, p. 60), who is an editor herself, has termed this assemblage of movements appropriately “trajectory phrasing”, it “describes the manipulation of energy in the creation of rhythm” (see also Pearlman, 2019).

Knowing how the patterns might be elicited at the film technical level, let us now illustrate how these devices may serve as means to embody the skeletal structure from above, and by metaphorical extension, the motivational dynamics of a film’s story. To this aim let us consider the opening scene from Stanley Kubrick’s Paths of Glory (1957), as also discussed by Coëgnarts (2019, p. 150-153). The scene depicts a discussion between two French generals in the midst of the First World War: General Broulard (Adolphe Menjou) wants to have General Mireau (George Macready) to attack the Anthill, a heavy defended fortress by the Germans. Committing this action is destined to result in a high number
of causalities. Mireau initially refuses, citing the high human cost of such an action, but when Broulard mentions a potential promotion, Mireau quickly convinces himself the attack will succeed. To visualize this cat-and-mouse game of intentions and thus solve the scene’s key artistic problem of how to represent characters’ motivational dynamics, the film turns precisely to the structure of dynamic patterns of containment as diagrammed above. There is, however, one exception: as in Arnheim’s analysis of the Guérin painting, the structure is now hidden under the film’s figurative level, as can be seen in Fig. 6.

First, General Mireau’s initial cold reaction is met with his exclusion from the frame as General Broulard turns himself away from him (I). However, when he subsequently mentions the possibility of a promotion, General Mireau enters the frame again from screen left (II). He attempts to win General Broulard’s favour again by offering him a cognac. When the latter refuses, the film cuts from long shot to a medium shot in order to show General Mireau reaction as General Broulard exits the frame (III). When Broulard almost comes to the conclusion that he has to find another man for the job, Mireau and the camera counteract by moving towards the general. Thus, General Mireau forces General Broulard into “his” container (IV). He takes his arm and, in a gesture that recalls the “entraining effect,” as cited above, they circle together around the sofa (V). The camera follows their circular movement by panning first from left to right, and then back again from right to left thus accentuating their restored closeness.

The story and the narrative dynamics of the film have now been set off.

(Fig. 6 about here)

Much as Arnheim’s analysis of the Guérin painting, our analysis illustrates how a hidden dynamic structure, that lies beneath the art work’s perceptual level, serves as a concrete means to embody the abstract narrative content of the work in purely visual terms, except that here the embodiment involves motion kinematics rather than visual dynamics. There is also another difference that we should be aware of. This is the fact that in our filmic example language, as uttered by the actors, plays a significant role in conveying the specifics of the narrative. As with the experiments of Heider and Simmel, we may attribute human purposes to the motion kinematics, but from this we cannot infer, for example, that
these intentions relate to the warfare politics of two generals. This information is offered by the discussion that the two men are having. As such language provides the viewer with a specific narrative setting onto which to further map the inferential logic of the animate and purposive events portrayed by the round shaped protagonists in our self-made diagram.

It remains to be falsified, however, how this process of mapping knowledge from one conceptual domain (i.e., physical kinematics) to another domain (i.e., the social events of a story world) can be understood at the viewer’s cognitive level. Here, we may draw inspiration from experiments on metaphor understanding that were already conducted in the field of cognitive linguistics. Pioneering such studies, Raymond Gibbs has demonstrated that there is a connection between bodily movement and metaphor comprehension in language. In one study, Gibbs (2006b) has shown that performing (and even merely imagining) an action such as grasping shortens the response time required to verify whether metaphorical phrases such as “grasp a concept” make sense. Thereby he draws upon Vittorio Gallese’s concept of “embodied simulation” which is held to play an important role in empathy and social identification (Gallese, 2003), as well as the construal of metaphorical concepts (Gallese and Lakoff, 2004). In another study (Gibbs, 2013), when instructed to walk blindfolded towards an object in a room, subjects who read love stories in which the romantic relationship was metaphorically presented as an uninterrupted successful journey, on average walked further and longer to reach the object than those who read the story in which the romance was metaphorically presented as a troublesome journey with problems on the road. These studies strongly suggest that metaphor embodiment does operate under the level of linguistic meaning.

With these experiments in mind, we hypothesize that motion kinematics like those illustrated by Fig. 5 and Fig. 6 are understood in terms of conceptual metaphors, especially those of INCLUSION and EXCLUSION. One way to test for this hypothesis would be to present one group of subjects with the moving images as illustrated in Fig. 5 (i.e., with mobile framing). By contrast, the participants of the second group would only be subjected to a 2D visual display of the motion kinematics of A and B, where both objects, like in Heider and Simmel’s experiment, are contained within a static frame. Likewise, we expect that the first group, when compared to the second group, would have shortened response times for comprehending such metaphorical phrases as “he excluded her from conversation”
or “she included him in the group.” We also hypothesize that we could get comparable results for groups which are exposed to either the clip from *Paths of Glory* (Fig. 6) or the control clip with the following requirements: (1) static frame of (2) two people conversing who (3) are standing still and (4) their conversation does not involve any metaphors of exclusion and inclusion.

Alternatively, we may also consider other competing and complementary theories to explain the conceptual correlation between the dynamic patterns of motion and the purposive social acts by virtue of which we define a film’s story world. One such alternative framework is Conceptual Blending Theory (Fauconnier and Turner, 2002; see also Bateman, 2016). In contrast to Conceptual Metaphor Theory, this theory holds the view that meaning construction typically “involves integration of structure that gives rise to more than the sum of its parts” (Evans and Green, 2006, p. 400). Rather than employing a two-domain model, blending or conceptual integration employs a minimum of four mental spaces to explain how new structure might emerge: two (or more) input spaces, a generic space which provides information that is common to both the inputs, and a blended space which contains the information that is not contained in either of the inputs (i.e., the emergent structure). How such a theoretical model, in turn, might apply (or not) to the case-study above, might be a question worth exploring.

5. Conclusion

In this paper we aimed to assess the role of dynamic patterns of sensory motor experience in the expression of meaning in the visual arts. In the field of embodied cognition these patterns are assumed to play an important role in the metaphorical expression of abstract concepts. We subsequently explored this hypothesis at three different levels of visual displays. For the first level we considered Arnheim’s pioneering theory of visual dynamics in fixed images. Here dynamics were shown to be the carriers of expression in painting. As Arnheim’s argument goes, inanimate objects are endowed with directional forces or vectors by virtue of which they are able to embody the meaning, that consciously or unconsciously, the artist intends to convey. Arnheim’s own analysis of a painting by Guérin further served as a concrete case to illustrate this point. From static images we then moved on to the field of kinematics by showing how highly abstract and simple visual displays of actual object motion may give
rise to visual impressions of causality and animacy. The experimental frameworks as initially offered by Michotte and Heider and Simmel, respectively, were proven to be highly useful in further validating this point. Lastly, we also proposed to discuss the expressive significance of those dynamic patterns that arise when also the frame or container itself becomes a moving entity. Inspired by the works of Michotte and Heider and Simmel, we provided a simple visual display of our own consisting of a sequence of trajectories elicited by either the container, the object, or both simultaneously. Similarly, we argued that it is likely that observers will endow this dynamic configuration of motion kinematics with corresponding impressions of causality and animacy. However, further empirical research should be carried out in this direction, especially given that this level, unlike the previous ones, has met with less experimental interest. To further demonstrate its use in a narrative setting, we concluded this paper with a filmic case-study. Taking a scene from Stanley Kubrick’s *Paths of Glory* as an example, we showed how filmmakers might resort to such dynamic patterns of motion kinematics to visualise the character intentions that drive a film’s story. We offered a description that was similar to Arnheim’s description of Guérin’s painting, except that here motion kinematics, rather than visual dynamics, served as carriers to express the motivational content of the story. A key issue that still remains to be explored, however, is how all of this is processed cognitively by the viewer. A clear need for further interdisciplinary research and knowledge exchange among film scholars, cognitive psychologists and neuroscientists, has been expressed in this direction in the further hope to address a question that was already posed some twenty-five years ago by Hochberg and Brooks (1996, p. 267). Referring to the experiment of Heider and Simmel, they wrote the following: “What can those abstract paths taken by such abstract shapes share with human actors? We consider that to be a very important question, one that probably can be (but has not yet been) answered.”

References


FIGURE CAPTIONS

Figure 1. Phèdre et Hyppolyte by Pierre-Narcisse Guérin (Musées Nationaux, Paris).

Figure 2. The launching effect.

Figure 3. The entraining effect.

Figure 4. Perceptual animacy as trigged by the motion kinematics of objects within a stationary frame (after Scholl and Tremoulet, 2000, p. 302).

Figure 5. Perceptual animacy as trigged by the kinematic interplay of object movement and mobile framing.

Figure 6. How motion shapes thought in Paths of Glory (1957).