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A Philosophical Inquiry

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Introduction

This book addresses the question of whether static images can depict motion. It seems natural to say that pictures depicting objects caught in the midst of dynamic action – such as Henri Cartier-Bresson's *Behind the Gare St. Lazare* (1932), Futurist paintings like Giacomo Balla's *Dynamism of a Dog on a Leash* (1912), or comics utilizing motion marks, streaky images, chronophotographs, or Op Art paintings – are images of movement. However, given that pictures themselves do not move, can we make sense of such an idea?

While the puzzle concerning the spatial discrepancy between a two-dimensional medium of depiction and a three-dimensional scene – i.e., how can we perceive something three-dimensional on a flat, static surface? – has received much attention in the philosophical literature on depiction[1], the issue of depicting motion in static pictures has remained underexplored. It has only recently begun to attract more philosophical attention. Yet, this issue not only has an ancient and reputable history but is also theoretically significant, especially when considered in relation to contemporary theories of depiction.

[1] See, for instance, Peacocke (1987), Hopkins (1995), Lopes (2005), and Briscoe (2016).

In this introduction, I first briefly examine the historical roots of this question (0.1). Next, I situate the issue within the conceptual framework of contemporary theories of depiction (0.2). I then provide an overview of the (rather limited) contemporary debate surrounding the problem and explain how I intend to address the core question: *Can static images depict motion?* (0.3). Finally, I offer an outline of the entire structure of this book (0.4).

0.1 Historical Background

The theme of these pages has an ancient history. Or rather, it forms part of a larger puzzle – a particular issue within a complex theoretical problem where many different questions are intertwined. This complexity has given rise to a dispute that constitutes the historical background of my book: the eighteenth-century debate on the nature of the figurative arts. A central aspect of this debate, which led to the classification organized in the modern *System of the Arts*[2], was the distinction between spatial and temporal arts. It is from this context that Gombrich (1964) revisits the issue of whether static images can represent movement, bringing it to the attention of contemporary analytic philosophers working at the intersection of philosophy of mind and aesthetics.

0.1.1 A Piece of an Ancient Puzzle

Horace's tradition of *ut pictura poesis* (literally 'as poetry, so painting') tended to closely associate the arts of painting and poetry, emphasizing their unity. Leon Battista Alberti, in his *De Pictura* (1435/1996), claimed that the painter, through the power to give visible presence to people who are absent, is like a god. However, he argued that the

[2] The classical analysis of the emergence of this system remains Kristeller (1951, 1952). See also Guyer (2014).

true achievement of the painter lies in inventing and composing a 'story' (*historia*). After the Renaissance, both theoretical perspectives and practical approaches to painting changed significantly.

In practical terms, narrative painting was largely replaced by a more descriptive form of painting, one that sought to legitimize itself as primarily figurative in nature, emphasizing its status as an art of space rather than time (see Alpers 1983, xix). Theoretically, this distinction between spatial and temporal arts was elaborated throughout the eighteenth century by various authors, such as Jean-Baptiste Dubos (1719), Lord Shaftesbury (1714), and James Harris (1744). Their ideas were later synthesized in Lessing's masterpiece, *Laocoon* (1766/1887).[3]

In his *Réflexions critiques sur la poésie et la peinture* (1719), Dubos analyzes the relationship between painting and poetry, determining that painting is necessarily spatial and timeless – it freezes a moment – whereas poetry must develop a sequence of images, inevitably forming a minimal narrative. Shaftesbury (1714) and Harris (1744) shared similar views. For instance, in Harris's second treatise, *Concerning Music, Painting, and Poetry*, he argues that while all fine arts are mimetic, they differ in the media they employ and are thus suited to represent different kinds of objects. Because painting uses figure and color, it is best suited to represent external objects. Music, by contrast, employs sound and is suited to represent motions – such as the movements of water or wind – and emotions, such as grief and anguish (Harris 1744, 67). Harris further argues that, as with Dubos's comparison of painting and poetry, every picture must represent a *punctum temporis*, or a single instant (id., 63).

Lessing further developed these ideas in *Laocoon* (1766/1887), where he famously distinguishes between the arts of succession and

[3] For a comprehensive overview of the debate, see Guyer (2014) and Wallenstein (2010).

simultaneity, with poetry and painting serving as the primary examples. According to Lessing, the meaning of a poem unfolds in time, as its signs form a sequence of 'before and after', while a painting must present its meaning all at once. Unlike poetry or music, visual arts cannot depict events that evolve over time; they are limited to representing a single moment. As Lessing states, «the artist can never make use of more than a single moment in ever-changing nature» (id., 36). Therefore, he argues, figurative arts such as painting should focus on beautiful forms and abandon the temptation to narrate.

However, because painters continued to produce still images with narrative content, Lessing leaves room for narrative painting within the realm of fine arts. He suggests that while poetry can depict an action in its entirety, through its successive stages, visual artists must choose a *privileged moment* due to the constraints of their medium. Since paintings present objects in a single moment, artists must carefully select that moment – specifically, a moment that gives 'free rein' to the imagination: «Painting, in its coexistent compositions, can use but a single moment of an action and must therefore choose the most pregnant one, the one most suggestive of what has gone before and what is to follow» (id., 112). Paintings and sculptures should not depict the culmination of an action, which leaves nothing to the imagination, but rather a moment of anticipation, allowing the viewer to imagine what has happened before and what will happen next.[4]

Lessing's argument is intuitively compelling, yet it raises deep questions about the nature of depiction and pictorial experience. For instance, how should we understand the temporal content of a static image? Is it purely instantaneous, or can it represent a temporal span, given our imaginative engagement? Furthermore, how should we in-

[4] Harris made a similar claim, suggesting that since a picture is «but a point or instant, in a story well known, the spectator's memory must supply the previous and the subsequent» (Harris 1744, 64).

terpret Lessing's notion of imagination? Do we *see* what happens before and after, or do we merely *know* it? [5]

These questions remained largely unaddressed until Gombrich revisited them in 1964 in his seminal paper *Moment and Movement in Art*, which brought these issues to the attention of contemporary theorists working on depiction.

0.1.2 Gombrich's (1964) *Moment and Movement in Art*

Writing in the mid-twentieth century, Gombrich laments that «while the problem of space and its representation in art has occupied the attention of art historians to an almost exaggerated degree, the corresponding problem of time and the representation of movement has been strangely neglected» (1964, 293). To address this neglect, he argues that we must revise our preconceptions about how time can be represented in various artistic media, particularly those preconceptions reflected in Harris's and Lessing's contention that images represent nothing more than a *punctum temporis*. Gombrich calls this 'the traditional view' and asserts that while it «remained unquestioned in aesthetics» (id., 295), we must abandon it if we are to understand how the passage of time can be conveyed in paintings. The doctrine of the *punctum temporis*, according to Gombrich, is an error from which we must free ourselves: not only is the notion of an instant of time absurd logically and ontologically – as Zeno demonstrated in ancient times – but «it is a worse absurdity psychologically» (id., 297). He argues, «we are not cameras but rather slow-registering instruments which cannot take in much at a time... compared with the speed of a computer, we are indeed slow in the uptake» (ibid). In other words, the idea of a moment in time is completely at odds with how we perceive reality.

[5] It is not easy to answer such questions, and it is not my aim to interpret Lessing's view. But I think it is helpful to see where the issue I am dealing with in this book comes from, and that it has well identifiable historical roots.

To reconcile this psychological absurdity, Gombrich invokes St. Augustine's introspective account in *Confessions* of memory and expectation, both somehow existing in the consciousness of the present. He also refers to modern findings that «our impressions remain available for a brief span of time, the time known as the memory span or the specious present» (id., 299), combining this with the notion of working memory. He concludes that «the instant of which the theoreticians speak, the moment when time stands still, is an illicit extrapolation, despite the specious plausibility which the snapshot has given to this old idea» (id., 303). For Gombrich, the perception of an instant is an illusory abstraction, not only in our perception of the real world but also in our perception of pictures. Consequently, we should abandon the idea that pictures present us only with an instant of time. For Gombrich, there is no doubt: contrary to Lessing's view, pictures indeed represent motion and temporal extension.

Of course, not all of Gombrich's arguments are unproblematic. For example, appealing to the notion of the 'specious present' raises more issues than it resolves (see LePoidevin 1997 and Spinicci 2021 for further discussion). Furthermore, as LePoidevin notes in reference to Gombrich's argument, for the thesis in contention – that static images can represent temporal properties – to be meaningful, it must concern *depiction*. This is important because «pictures represent more than they depict... [and] they may represent aspects of time that they are unable to depict» (Le Poidevin, 1997, 183). However, Gombrich does not clarify in that paper how we should understand depiction as a unique kind of representation, nor does he address the underlying issue of whether static images can pictorially represent motion.

Granted, when Gombrich wrote his paper, the precise nature of depiction as a *sui generis* form of representation had not yet received much attention. It was only from the 1970s, and more intensely from the late 1980s onward, that the question of what makes a picture special became a central theme for philosophers working on aesthetics

in the analytic tradition.[6] In the next section of this introduction, I will reframe the question, 'Can static pictures represent motion?' in light of the theoretical refinements provided by contemporary theories of depiction.

0.2 Depicting Motion in a Timeless Medium

0.2.1 Theories of Depiction

A picture is a type of representation, meaning it is an object capable of evoking in the viewer the thought of something else. This arises from the combination of a material object – the picture's vehicle – with what provides the picture with its representational content, the subject matter. Pictures possess their content by instantiating their own patterns of features, such as patterns of color, light, and shadow. To be sure, not only pictures represent through patterns of features – words, diagrams, maps, and codes, for example, also represent in this manner – but pictures exhibit a distinctive kind of representation unique to them. This is known as *depiction* or *pictorial representation*.

Depiction is a deeply familiar phenomenon, at least for sighted people. Vermeer's *The Milkmaid* (c. 1660) depicts a woman pouring milk, Cartier-Bresson's *Behind the Gare St. Lazare* (1932) depicts a man jumping over a puddle, and Fu Baoshi's *Waterfall* (1965) depicts a waterfall.

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[6] In fact, although philosophers as diverse as Plato, Descartes and Peirce have remarked on it, depiction has only become the topic of sustained philosophical attention in its own right in the past few decades. This interest developed following the publication of Gombrich's *Art and Illusion* in 1960. Gombrich's ideas stimulated philosophers, notably Richard Wollheim (1980, 1987) and Nelson Goodman (1968), who responded with distinctive views of their own. Since then there has been a stream of papers on the topic, and there has been a growing collection of philosophical monographs that take depiction as their subject. On this, see for example Newall (2011) and Hyman and Bantinaki (2017).

There is much debate about how depiction works and how it should be properly characterized. Five major theories in the literature provide general frameworks into which most existing accounts fit.

(i) Conventionalism holds that depiction, like language, is based on conventional rules, but it is distinguished by its unique structure (Goodman 1968). While conventionalist and semiotic theories were popular in the 1960s and 1970s, they have been broadly discounted after thorough examination (see Newall 2011, ch. 1, for a summary of the main reasons behind this rejection).[7]

(ii) Resemblance theories argue that pictures depict by resembling their subject matter. These theories come in two main forms: *objective resemblance accounts* (Hyman 2006; Abell 2008), which posit that there are objective resemblances between the vehicle and the subject matter it represents, and *subjective resemblance accounts* (Peacocke 1987; Budd 2004; Hopkins 1998), which suggest that what matters is not whether the picture and subject truly resemble one another, but whether the viewer experiences the subject as resembling the picture's vehicle.[8]

(iii) Experiential accounts, such as Gombrich's illusion theory (see also Briscoe 2018), Wollheim's *seeing-in* theory (1987, 2003) (see also

[7] Kulvicki's theory has often been regarded as a form of neo-conventionalism and thus seen as an exception to this claim. However, he abandons a key tenet central to conventionalism as traditionally understood – namely, he argues that there is no inconsistency in introducing resemblance alongside concepts such as semantic and syntactic density and relative repleteness. Yet, because he places resemblance at the core of his account, his approach cannot be classified as a conventionalist theory.

[8] Indeed, it is ultimately developed in two ways: (a) a picture depicts its subject only if the experience of that picture's vehicle resembles (under a certain respect) the experience a suitable perceiver may have of that picture's subject (Budd 2004; Peacocke 1987); (b) a picture depicts its subject only if its suitable perceiver entertains a proper experience of similarity, that is an experience of that picture's vehicle as similar (under a certain respect) to that picture's subject (Hopkins 1998).

Matthen 2005; Nanay 2011; Ferretti 2016, 2018), Husserl's (2006) and neo-Husserlian *threefoldness* account (Wiesing 2010; Nanay 2016, 2018; Spinicci 2008), and Walton's (1990) *make-believe* account, hold that pictures depict by generating a particular kind of visual experience: *seeing-as* for Gombrich, *seeing-in* for Wollheim, or *imagined-seeing* for Walton.

(iv) Recognition theories maintain that pictures engage the same visual recognition abilities as those triggered by seeing the same thing in real life (Schier 1984; Lopes 1996).

(v) Mixed or syncretistic theories combine elements from the above accounts. These are increasingly popular and integrate various aspects in different ways. Hopkins' (1998) account blends experiential theories (*seeing-in*) with a specific type of (experienced) resemblance – resemblance in outline shape. Kulvicki (2006) combines conventionalism with a resemblance view. Newall (2011) unites experience-based elements with recognitional ones, while Voltolini (2015) reconciles *seeing-as* and *seeing-in* with both objective resemblances and recognitional claims.

While it is useful to have a general understanding of these contemporary theories of depiction, as they will arise at various points in this book, I will not analyze them in detail here. Instead, I build my conception of depiction and the puzzle of depicting motion on a general yet fundamental aspect of pictorial representation over which there seems to be broad consensus among theorists: its peculiarly visual nature.

Theories of pictorial representation differ not only on how we come to understand pictures as representing what they do, but also on which features pictures represent, which features they *pictorially* represent, and whether they represent particular individuals as well as patterns of features. Nonetheless, they agree on a few general points (see Kulvicki 2021): that pictures have attributive contents – they represent spatial patterns of features, such as colors or shades

of gray;[9] that pictures have the contents they have in virtue of instantiating their own patterns of features, namely patterns of color, light, and dark and that such features interestingly constrain their contents; that there is a distinction between what a picture depicts and what it represents in other ways; and, finally, that pictures are usually tied tightly to perception – that all properties constitutive of depictive content are perceptible.[10]

For the purposes of this discussion, I will assume that, in general terms, pictures make their *depicta* visible – they elicit visual experiences as of their subject matter. Pictures, I maintain, are a peculiarly perceptual kind of representation. In Vermeer's *The Milkmaid* we see a woman pouring milk, in Cartier-Bresson's *Behind the Gare St. Lazare* we see a man jumping, and in Fu Baoshi's *Waterfall* we see a waterfall. In general, pictures visually present us with their subject matter. In all these cases, we *see* – we have visual experiences *as of* – the objects that the pictures represent. When looking at

[9] As Kulvicki (2021, 2) notes, his (2006, 122) concept of 'bare bones content,' Lopes's (1996, 145) 'content recognition,' Hopkins's (1998, 124) 'seeing-in content,' Hyman's (2006, ch. 5) 'internal subjects,' and Abell's (2009, 209) 'recognized intention-based resemblances' are all versions of what pictures, in a minimal sense, represent. «These contents are minimal in two ways. First, they are purely attributive, involving no particular individuals, like Richard Nixon or Batman. Second, they reflect a thin consensus and thus constitute a fairly limited set of features» (Kulvicki 2021, 2). In the first two chapters, I will primarily work with this notion of depictive content, though I will sometimes contrast it with a broader notion, which roughly corresponds to Kulvicki's fleshed-out content, Lopes' subject recognition, Hopkins' depictive content, and Hyman's external subjects.

[10] Arguably, only strict conventionalists, such as Goodman (1968), would deny this claim. However, as mentioned above, strict conventionalism has been largely rejected.

a picture of *x*, we have a visual experience as of *x*.[11] What we see in a picture – what we have a visual experience of – is its depictive, or figurative, content.

Can such content include motion and temporal properties? After all, the images we are discussing are inherently still. Nothing moves, neither on their surfaces nor within their content. Static pictures are, by definition, static. But what exactly are still pictures? How do they differ from moving ones? The answer is not as simple as it seems (see Walton 2008, 162–164; Aasen 2020).

0.2.2 How Are Pictures Static?

A first solution to this question can be traced back to the Eighteenth Century distinction between temporal and spatial arts that I discussed earlier. While poetry, music, theater, and even literature involve a temporal structure and unfold over time, pictures are presented in space. Pictures are not temporal arts but spatial ones, in the sense that they are a structural organization of shapes, lines, and colors on an immobile surface. As Fodor puts it, «[w]hereas spoken language and music are presented in time, pictures are presented in space» (1975, 186). In this view, a picture is static because it is merely a spatial, not a temporal, object: it exists only in space.

And yet, this definition is problematic. After all, as Aasen (2020, 4) notes, «pictures are [...] spatio-temporal objects and are thus presented in both time and space». As spatio-temporal objects, they can be displayed for variable periods of time, sometimes for centuries. Moreover, the picture's surface – the space used to display it – can, and often does, change: photographs fade, paintings darken, and cracks appear on the surface. These changes can affect how we perceive what the picture displays: fading may alter the colors, a crack may obscure

[11] As we will explore in more detail in Chapter 1, where I advocate a broadly Wollheimian conception of pictorial experience, there is significant debate over the nature of this experience and whether or not it is essential to depiction.

a previously visible detail, and darkening may make discerning the subject more difficult. Strictly speaking, then, the properties of the surface are indeed subject to change over time; the paint can crack or darken. However, these changes are usually irrelevant to the picture's representational content, unless they significantly alter the visible design.[12] Therefore, the overall temporal properties of the surface are not the reason we consider a picture static.

Explaining the static nature of pictures by focusing on the surface's temporal properties is unpromising since, strictly speaking, those properties change over time. However, these changes pertain to the surface as a physical object in the real world, not as an object capable of eliciting visual experiences of another – artificial, virtual, or merely visible – world. The static nature of pictures must be found in the properties that cause us to see something in them as a depiction, not in all the properties of the surface.

In this sense, Lopes (2005, 25) made a helpful distinction between two types of surface properties: (i) design-properties and (ii) surface-properties. A picture's design comprises the features that support seeing the depicted scene. For instance, if we see a horse in a drawing by virtue of the way the pencil marks are shaped, the shape of those marks is part of the picture's design. Not all features of the surface play this role – the grain of the paper, for example, may not influence what is seen in the picture. While surface-properties can change over time (the paint can crack, darken, or fade), these changes are typically irrelevant to the figurative content unless they affect the design-properties.

[12] In other words, what does not change is what we see in the picture. Moreover, it is very rare that these changes are perceivable as unfolding over time. Unless the fading is caused, for example, by water dripping onto the surface while we are looking at the picture, we typically do not notice the fading, cracking, or darkening of the surface, as these changes occur so slowly and gradually that we lack the visual capacity to track them as temporal events – we are not aware of them in our immediate experience.

Only a significant, visible change – i.e., one that can be tracked in visual experience – in the design properties could affect how the temporal properties of the figurative content are experienced.[13] For example, a picture displayed on a malfunctioning LED screen may flicker, but this flickering does not alter what we see in the picture, except that it may make it harder to see.[14] The picture remains static in the sense that its temporal surface features are irrelevant to its content. The scene encoded in the surface does not change as time passes, even though the surface itself may undergo slight changes due to wear and decay. This is because the design-properties – those that support the visual experience of the subject matter – remain constant. In other words, a picture is static because it consistently presents what we see in it in the same way. As Walton puts it, the temporal properties of the surface have «no bearing on its representational content» (2008, 164).[15]

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[13] Another way to understand this point is in terms of the visual experience of continuous motion. By drawing on Broad's (1923, 352) discussion of the hands of a clock, we can distinguish between perceptible and imperceptible motion. Broad observes that, assuming the hands sweep around the clockface in uniform motion (rather than ticking), first-person reports of the phenomenal character of experience reveal that subjects see the second-hand moving, but they do not see the hour-hand moving – even if they were to stare at the clockface without looking away for an entire hour. This phenomenological contrast between perceptible and imperceptible motion motivates the idea that there is an *appearance* of motion (leaving open whether this appearance is a property of an object or of an event/state of affairs; see Shardlow 2020, 10–11). Continuous motion, such as that of the second-hand at a certain pace, has a distinct appearance, but this appearance is not presented to an observer when perceiving paintings that represent movement.

[14] On this and other examples see Aasen (2020).

[15] A similar idea is found in Currie, who writes that «[w]ith painting, the temporal properties of events are not represented by the temporal properties of representations» (1995, 98).

Walton (id. 163) also points out that cinematic representations do not present their objects statically in this sense. In films, some temporal features of the surface affect what is represented. A change in the film's surface corresponds to a change in the represented content.[16] In movies, the relevant surface properties can be temporal: duration and order within a shot typically represent duration and order in the filmed world (see also Currie 1995).[17] However, a painting's canvas does not have the multiplicity needed to accommodate actions and movements unfolding over time. The canvas of a painting is a surface covered with pigments that, through projection rules (ultimately rooted in the laws of perspective; see Spinicci 2008, 2021) and gestalt groupings (see Voltolini 2015), stage a given scene. The surface colors overshadow the object colors, and the boundary lines between chromatic areas cut out people and things from the background. As such, the scene depicted is strictly determined by the material structure from which it arises, and it goes without saying that motion and time cannot be figuratively staged on the surface of a canvas (see also Spinicci 2021). The pink patches of paint that depict the hands of the milkmaid in Vermeer's painting are dry and immobile, and their immobility fixes the milkmaid's hands in place.

In sum, a picture's design-properties – the properties of the surface that allow us to see a scene – are not temporally relevant. These

[16] It need not, though. As Walton (2008, 163) mentions, a changing surface can depict a stationary scene in cinema because it might be the camera and not the scene that moves.

[17] Currie (1995) raises a version of this worry while comparing still photos with moving images. Films manifest temporal patterns, which themselves serve to represent temporal patterns. Pictures are homomorphic representations (id., 97): they represent colors by manifesting colors, shapes by manifesting shapes, and time by manifesting temporal patterns. That's why films pictorially represent temporal patterns, while still images can at best suggest, or non-pictorially represent, them. «With painting», Currie writes, «temporal properties of events are not represented by temporal properties of representations» (id., 98).

properties are responsible for the static nature of pictures. Pictures are static because the design-properties that allow them to display a scene do not undergo significant, perceivable change. This fundamental fact ensures that what we see in a picture remains the same. The milkmaid will never stop pouring the milk, the man behind the station will always be in mid-air, forever jumping that puddle, and the stream of the waterfall will never change its course.

0.3 Can Static Pictures Depict Motion?

As we have just seen, pictures are static in a fundamental way. And yet, we often describe what we see in them as moving, changing, dynamic, or performing actions. Pictures are static, but we perceive objects in them as depicted in motion: we see moving objects in immobile two-dimensional patterns, and we describe the figurative content of these pictures using terms related to motion, time, and dynamism. For example, in *The Milkmaid*, we see a woman pouring milk; in *Behind the Gare St. Lazare*, we see a man jumping over a puddle; and in Fu Baoshi's painting, we see a cascade powerfully falling. Furthermore, the techniques picture-makers use to represent motion and change are even more varied than these three initial examples suggest. Chronophotographs, Futurist paintings, blurred and streaky photos, and Op Art paintings are all commonly regarded as effective ways to depict motion in static images. This raises the question: can static pictures truly *depict* motion? In other words, do these pictures represent motion *pictorially*?

As we noted earlier, Lessing wrote a book aimed at persuading painters and sculptors to abandon the temptation to narrate. Painting and sculpture, he argued, are arts meant to make a scene visible but are ill-suited to portray the development of an action, where beauty and intuitive richness arise. Lessing's position – labeled by Gombrich as 'the traditional view' – was common in 18th-century discourse on art and aesthetics. According to this view, static pictures have no temporal dimension; they freeze a moment and represent only a single instant, a *punctum temporis*.

In contemporary analytic aesthetics, this view remains widely accepted, with two main arguments supporting it: (i) static pictures cannot depict motion because there is nothing resembling motion in their content (no resemblance), and (ii) static pictures do not activate the spectator's motion-recognition capacities (no recognition).[18]

In fact, it is often argued that static images can, at best, represent motion *non-pictorially*, but they cannot depict it. For example, LePoidevin (1997) claims that pictures can only depict how moving objects appear at an instant, thereby *non-pictorially* representing broader movement.[19] Friday, following Warburton (1988), argues that «photographs are clearly not something that we can use to see temporally extended events» (Friday 1996, 33). Abell contends that still images «might depict a moment in time. It may even be possible to infer from the moment depicted what events have led up to it or what events will follow. However, such pictures are incapable of depicting events as occurring in a temporal sequence» (2010, 278).[20] Similarly, Benovsky argues that «a photograph can represent temporal extension via its

[18] See also Kulvicki (2016, 343), who identifies these two versions of the concern in Currie (1995), although Currie does not interpret the issue in exactly the same way (see Kulvicki 2016, footnote 14).

[19] LePoidevin puts forward three quite different views on pictures and motion, in 1997, 2007, and 2017. For a critical review see Young and Calabi (2018).

[20] In the same vein, Walton (2008, 171) writes that «pictures can represent movement without depicting it», suggesting that we should distinguish properly pictorial ways of depicting motion from merely representational ones. Currie, who critiques the possibility of static images depicting motion (see also footnote 17), provides a partial inventory of how static images can represent motion and time without depicting them: «Pictures may represent time in a variety of ways: by encouraging the viewer to infer what came before and what will follow from what is explicitly depicted; by juxtaposing distinct static images, as when we are shown a series of temporally related photographs; by transforming temporal properties into spatial ones, as in Filippo Lippi's *tondo* in the Pitti Palace, where earlier events in the life of the Virgin are depicted deeper within the picture space; and by special techniques such as blurring and multiple exposure» (Currie 1995, 95–96).

narrative function, but it cannot depict it, since no change or movement is visually accessible to the observer of the image» (2012, 202). Finally, Shardlow concludes that «we may be able to depict movement, stasis, and intervals of time in film, but on a canvas, there is no time to move» (2020, 20).

Opposing the traditional view, another theoretical camp claims that movement *can* be depicted in static images. Gombrich (1964) rejected the limitations imposed by Lessing, arguing that static images depict more than a *punctum temporis*, as such a thing does not exist – neither psychologically nor metaphysically. More recently, two main 'positive' approaches have emerged: (i) attempting to show how different accounts of depiction might accommodate the depiction of motion in still images (e.g., LePoidevin 2007, Walton 2008, and Young & Calabi 2018); and (ii) focusing on analyzing specific types of images that seem particularly effective in depicting motion, such as long-exposure photographs or Futurist paintings (e.g., Benovsky 2012[21], Kulvicki 2016, and LePoidevin 2017).

In this book, I aim to address the central question within the broader framework of depiction theories, though I adopt a different approach than those mentioned above. Specifically, my analysis differs from both the negative and positive accounts in two key ways: first, I do not commit to a specific theory of depiction but rather focus on the broader basis of our engagement with pictures – pictorial experience, also known as picture perception. Second, I do not limit my analysis to a particular kind of picture but instead consider a variety of ways in which pictures have been deemed capable of representing motion.

Regarding the first aspect, my choice stems from what I discussed in Section 0.2.1: although depiction theorists disagree on many things,

[21] Benovsky, therefore, belongs to both the 'negative' and 'positive' camps. He suggests that streaky photos can depict temporal patterns, though, as Kulvicki points out, «it is hard to square those remarks with the previous one» (Kulvicki, 2016, p. 346).

they generally agree that the properties depicted in an image are represented *perceptually*. Thus, to answer our question, it seems natural to investigate whether we can perceive motion in static pictures, even in the absence of actual motion or proper motion phenomenology. This does not mean that theories of depiction will be ignored in this book. On the contrary, I will analyze and engage with the views of philosophers who have attempted to account for or dismiss the possibility of depicting motion within the framework of specific pictorial representation theories. Elements from various depiction theories will be relevant and helpful in developing my arguments, and, conversely, I will often highlight how my findings impact individual or groups of theories.

Regarding the second aspect, my approach stems from the belief that a thorough answer to the question requires considering all the main types of pictures typically acknowledged as effective representations of motion. Scholars working on the depiction of motion have predominantly focused on a very specific type of picture – those depicting objects caught in the midst of dynamic action (e.g., Aasen 2020; LePoidevin 1997, 2007; Gombrich 1964; Shardlow 2020; Young & Calabi 2018), while Benovsky and Kulvicki focus on long-exposure photographs and LePoidevin (2017) on Futurist paintings. However, it remains unsettled whether one or more of these types of pictures can truly depict motion. Since they are all different, one may be depictive while another is not. Therefore, considering only one type of picture could lead to a flawed conclusion. Additionally, there are many other methods of representing motion that have been overlooked or dismissed by philosophers – chronophotographs, optical illusions of motion, and multiple images, among others. Are all of these depictive? None? Only some? Determining whether one or more of these types of pictures is genuinely depictive of motion would be an important result. Moreover, it would be useful to understand why pictures that are said to depict motion but do not actually depict it are still so effective in conveying information about motion. As we will see, non-pictorial representations of motion can have interesting relationships with those that are pictorial.

More precisely, then, the question I seek to answer in this book is not only, *Can static images depict motion?* but also, *Are the various kinds of pictures typically considered to effectively represent motion actual depictions of motion? If so, how? If not, why?* In the remainder of this introduction, I will outline the overall structure of the book and provide a preview of my main answers to these and related questions.

0.4 Structure of the book

This book is divided into three chapters, each focusing on whether a specific type of picture, typically considered effective in representing motion in static form, is actually a proper depiction of motion.

In **Chapter 1**, I focus on pictures that depict objects caught in the middle of dynamic action and present a new argument to show that motion and temporal properties can indeed be depicted in such static images. Specifically, I explore what experimental psychology and cognitive sciences reveal about our responses to these pictures and demonstrate that we have empirical reasons to consider the pictorial content of images such as *Behind the Gare St. Lazare*, as conveying visual information about an interval, rather than a mere instant. Psychological studies on implicit motion and representational momentum suggest that motion is genuinely perceived in some static images. Our visual system is designed to detect motion, even when it is only implied, and to anticipate probable outcomes of others' actions – even when the 'others' are the subject matter of pictures. I argue that the temporal and dynamic contents of our experience are richer than typically acknowledged in the literature – perceptual content extends beyond mere phenomenology – and that a range of popular depiction theories, particularly perceptualist theories of depiction, can accommodate depicted motion.

In **Chapter 2**, I turn to streaky images produced through long exposure and chronophotographs. I aim to demonstrate that while these pictures and the schemata they exhibit are highly effective representations

of motion and temporal properties, they should not be understood as proper depictions (contrary to Benovsky 2012, Kulvicki 2016, and LePoidevin 2017). Furthermore, I explain how these pictures represent motion non-pictorially and how we interpret their contents. After discussing the specificity of photographic images – drawing on Maynard's notion of the interplay between the depictive and detective functions of photography – and critiquing Kulvicki's account of our interpretation of streaky photos as properly pictorial, I argue that we interpret such images by engaging in games of make-believe, using what we see in the picture (what is properly depicted) as a prop. While I do not endorse Walton's theory of depiction, I argue that his general pretense theory provides the right framework for explaining how we interpret long-exposure photographs, chronophotographs, and certain Futurist paintings. These schemata, combined with appropriate principles of generation, guide our imagining in specific ways. However, I maintain that while this mode of representing motion is highly effective, it is not peculiarly pictorial.

In **Chapter 3**, I consider two cases of optical illusions of movement – Op Art's scintillating effects (exemplified by Riley's *Fall* and Leviant's *Enigma Illusion*) and peripheral drift illusions (exemplified by Kitaoka's *Rotating Snakes*) – and conclude that the latter is involved in the depiction of movement. It is important to examine both types of illusions because those that do not result in depiction have interesting relationships with those that do. While my primary aim is to address the specific question of whether static images can depict motion, this analysis also serves as an opportunity to engage with motion-based illusions in general, accounting for the complex visual experiences they elicit and their related phenomenology. Furthermore, this discussion has significant implications for theorizing depiction and pictorial experience more broadly, particularly concerning the depiction of (and through) illusory effects and for resemblance theories of depiction.

Chapter 1.
Frozen in Motion: the Depiction of Movement in Mid-action Static Scenes[1]

Can static pictures depicting objects caught in the middle of dynamic action pictorially represent motion and temporal properties? As we saw in the introduction, Harris, Lessing, and, in general, philosophers endorsing what Gombrich called 'the traditional view' do not think they can: there is no temporal dimension in static pictures; the scene depicted is frozen and merely represents a moment, an instant, a *punctum temporis*. In today's analytic aesthetics, this is a widely held position, with two main versions: static pictures cannot depict motion or temporal patterns (i) because there is nothing in the content of a static picture that resembles motion (no resemblance), and (ii) because the spectators' motion-recognition capacities are not activated while looking at a static picture (no recognition). Static images can at best non-pictorially represent motion, but they cannot depict it (Currie 1995; Le Poidevin 1997; Warburton 1988; Friday 1996; Abell 2010; Benovsky 2012; Shardlow 2020). Against the traditional view, the opposite theo-

[1] Parts of this chapter were previously published in Marchetti, L. (2022), "Depicting Motion in a Static Image. Philosophy, Psychology and the Perception of Pictures", *British Journal of Aesthetics*, 62, 3, 353–371. DOI: https://doi.org/10.1093/aesthj/ayab044. I would like to thank the editors of the *British Journal of Aesthetics* for granting permission to reuse material from the manuscript version of the paper.

retical camp claims that movement can, in fact, be depicted in a static image. While Benovsky (2012) and Kulvicki (2016) argue for this by focusing on long-exposure photographs, and Le Poidevin (2017) on Futurist paintings, Le Poidevin (2007), Walton (2008), and Young & Calabi (2018) all try to show how different accounts of depiction – respectively: recognition, make-believe, and experienced resemblance – can accommodate the depiction of things in time by still images of, for example, galloping horses. Before them, Gombrich (1964) already argued that static images depict more than a *punctum temporis* because such a thing does not exist, either psychologically or metaphysically.

In this chapter, I put forward a new argument to show that motion and temporal properties can be depicted in static images, but my analysis differs from the 'positive' approaches just outlined. On the one hand, I do not focus on streaky images – as Benovsky, Kulvicki, and Le Poidevin did – but I concentrate on pictures that depict objects caught in the middle of dynamic action, such as Henri Cartier-Bresson's (1932) photograph *Behind the Gare St. Lazare*.[2] This is partly because streaky images are not what Lessing and contemporary 'traditionalists' have in mind when they deny that static pictures can depict temporal properties, and partly because I think streaky images are a peculiar kind of image that deserves a specific type of analysis.[3] On the other hand, I do not focus on

[2] You can see the photograph here: https://www.moma.org/collection/works/98333.

[3] This analysis will be the subject of the second chapter of this book. Here, it will suffice to say that I consider streaky images to display a peculiar graphic solution that adds further complexity to the process of interpreting their pictorial content. The authors previously cited claim that long-exposure photographs (Benovsky 2012, Kulvicki 2016) – and their pictorial counterparts, some Futurist paintings (Le Poidevin 2017) – depict the temporal trajectory of the objects photographed and, therefore, depict a temporal pattern. However, not everyone agrees with this view (see, for example, Shardlow 2020, pp. 15–16).

a single theory of depiction. Instead, building on the analysis offered in the introduction, I base my argument on the foundation of our engagement with pictures more generally: pictorial experience, also known as picture perception. Moreover, to answer the original question, I examine what experimental psychology and cognitive sciences tell us about the nature of our responses to pictures such as Cartier-Bresson's photograph. While psychologists have been interested in the depiction of motion in static images, potential connections between their results and the philosophical debate remain underexplored. In this chapter, I show that we have empirical reasons to consider the pictorial content of images like *Behind the Gare St. Lazare* as providing visual information about an interval, not just a single instant: the temporal/dynamic contents of experience are richer than the above-mentioned theorists seem to acknowledge, insofar as they focus on the mere presence (in films) or absence (in pictures) of motion-like phenomenology. However, I maintain that perceptual content outstrips phenomenology. Consequently, I argue that perceptualist theories of depiction (broadly intended) should accept that motion and temporal extension can be depicted in static images.

Section 1.1 isolates the type of picture upon which this chapter focuses. Section 1.2 defines depiction, pictorial experience, and pictorial content, and outlines a general perceptualist theory of depiction. Section 1.3 focuses on experimental psychology and cognitive sciences, emphasizing the relevance of implicit motion and representational momentum in understanding pictures that depict objects caught in the middle of dynamic action. Section 1.4 argues that the analysis of these perceptual mechanisms shows that we have reasons to believe that the pictorial content of this type of image is perceived as temporally extended and that these pictures represent this temporal dimension in a pictorial manner. Sections 1.5 and 1.6 consider two objections and further elucidate the proposal: in Section 1.5, I tackle the question of why some pictures of moving things fail to depict motion, and in Section

1.6, I confront the problem of how the depiction of movement in static images differs from the depiction of movement in film.

1.1 The Depiction of Movement in Mid-action Static Scenes

In this chapter, I focus on images that capture moments in which their subjects, by virtue of how they are posed, are dynamically unstable – as can be seen in Cartier-Bresson's photograph *Behind the Gare St. Lazare*. In this picture, we see, among other things, a man jumping over – and probably into – a puddle. When describing the picture, we naturally say that he 'is jumping into a puddle,' even though we are looking at a static image.[4]

We describe the image with words typically used to describe actions and dynamic events. There is also a temptation to say that, phenomenologically, it seems as though what is depicted is a man jumping, not levitating – that the scene we are seeing appears to be moving, even if it is not in motion. And yet, these prima facie reasons are not enough for us to consider such pictures as depicting motion. Not least because our intuitions might pull us in the opposite direction: obviously, a picture like Cartier-Bresson's does not itself move. We can describe it, and it may seem like it is of a moving object, but a proper description of the picture and our experience of it is constrained by the inevitable fact that it is, indeed, a static picture – after all, nothing literally moves.

[4] Not every aspect of an event is the same. Motion can be represented in various ways. It can be depicted in its initial phase (*inchoative* aspect; for example, Spiderman has pulled back his arm and is ready to throw a punch at the bad guy on duty), in its intermediary phase, while it is actually unfolding (*durative* aspect; for example, we see Spiderman's fist mid-course or as it punches the bad guy), or finally, in its final phase (*terminative* aspect; for example, Spiderman has already punched the guy, who is falling backward, and continues to move his arm and fist, slowing them down). On this, see Polidoro (2008).

In this chapter, I present an argument for thinking that movement can legitimately be said to be depicted in *Behind the Gare St. Lazare*. I claim that we can consider motion to be part of the content of a subject's perceptual experience when encountering images like this, even though we need not think that proper motion phenomenology is involved in such cases.[5] I begin by addressing the nature of pictorial experience, pictorial content, and depicted properties.

1.2 Depiction, Pictorial Experience and Pictorial Content

Although there are various accounts of the nature of depiction – as discussed in the introduction – one way theorists have articulated the intuition that depiction is inherently pictorial is by referring to the viewer's unique perceptual state. One of the most popular frameworks for understanding depiction as perceptual is Wollheim's seeing-in theory: when we look at a picture, we see the picture's subject within a marked surface (Wollheim, 1980). *Seeing-in* is distinguished by what Wollheim called *twofoldness*: a viewer looking at a picture undergoes a *twofold* experience. On one hand, she is visually aware of the flat surface of the picture; on the other, she perceives the subject matter of the picture. Wollheim called the first of these folds the *configurational* fold, and the second the *recognitional* fold.[6]

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[5] Part of the task will then be to clarify what it means to say that there is 'motion' in the perceptual content, even though there is no motion-like phenomenology. Sections 1.2, 1.3, and 1.4 will explain why we should consider the temporal content of some pictorial experiences to be richer than is normally acknowledged. Section 1.6 will specifically address the phenomenology.

[6] Among the myriad contemporary philosophers who have built on Wollheim's proposal, two main theoretical camps can be distinguished: one occupied by experiential theorists, who maintain that a picture depicts its subject only if it elicits the appropriate experience in the viewer (Peacocke, 1987;

According to contemporary seeing-in theorists (see, for example, Matthen 2005; Nanay 2011a; Ferretti 2018), pictures evoke perceptual states similar to those evoked by the depicted objects: part of what it means to be a picture is to be capable of eliciting such states. The depictive content – which consists of the properties a picture represents the world as having – is interpreted in perceptual terms: what is properly depicted in a picture depends on what may be perceived by means of it.

In this context, I assume here that our experience of seeing something in a picture is a perceptual experience – seeing-in truly is seeing the depicted object in a particular way, namely, within the picture – where a perceptual experience is a mental state consisting of perceptually attributing properties to the perceived scene.[7] In these terms, the depictive content of a picture – what is seen in it – is constituted by the properties our visual experience attributes to the pictorial scene. In particular, I hold that a property *x* is depicted in a picture *P* if *x* is perceptually attributed by an observer's perceptual mechanisms to a depicted subject *S*

Budd, 2004; Hopkins, 1998; Walton, 1990); and the other by recognitional theorists, who argue that a picture depicts its subject only if it engages the same recognitional capacities people use when faced with that subject (Schier, 1986; Lopes, 1996). There are also syncretic paradigms that integrate both experiential and recognitional aspects, such as Newall (2011) and Voltolini (2015). See Hyman and Bantinaki (2017) for a review.

[7] But see Goodman (1968) for a contrasting view. Here, as an aside, I want to note that my perceptual account, even if it does not fit within Goodman's framework of conventionalism, could align with the best-developed contemporary semiotic theory – Kulvicki's (2006). As Voltolini (2015) rightly notes, Kulvicki's theory implies, firstly, that it is not necessary for a semiotic account of figurativity to make reference to the perception of a picture in order to hold true. One can account for a picture's figurativity without such reference. Secondly, perceivable properties are relevant because they enable a perceiver to discern not only the picture's vehicle but also what that vehicle presents.

– that is, if the observer *O* has the visual experience (or forms perceptual representations)[8] as of *x* when looking at *S* in *P*.[9]

Since pictorial representation has this distinctive perceptual and visual character, the driving question of this chapter – whether motion can be pictorially attributed to the subject of a static picture – concerns pictorial seeing. It can be understood as part of a broader problem concerning depiction and picture perception: what kinds of properties does our visual system attribute to depicted objects? We can reformulate the question in perceptualist terms: can we perceive ongoing movement as opposed to arrested poses in depicted scenes? Can we perceive motion and a temporal dimension as properties of the pictorial content of a static picture?

True, the claim that the depicted object and its properties are represented perceptually is not a particularly strong one (see also Nanay 2011a, 467), and it is worth noting that there has been considerable debate about what properties are represented perceptually (see, for

[8] I want to emphasize that even though I speak in terms of 'perceptual representations,' I am open to these claims being interpreted in anti-representationalist terms (perceptual states 'presenting,' 'being sensitive to,' or 'tracking' certain properties).

[9] I have described pictorial experience as *seeing-in* and as a twofold experience, but note that my claim about depicted properties also works within the theoretical framework of the other main paradigm of pictorial experience, *seeing-as* (Gombrich 1960), recently reinvigorated by Briscoe (2018), who defends a sort of 'weak onefoldness.' In fact, for the purposes of this chapter (and the next one), I could very well remain neutral on whether we simultaneously represent surface and scene properties (seeing-in) or, on the contrary, oscillate between an awareness of the two (seeing-as). Also, note that Briscoe's account does not deny, as 'strong onefoldness' does, that our visual system attributes properties to both the depicted object and the surface at the same time. It simply emphasizes that pictorial experience is 'onefold' «in the sense that its content reflects a single, consistent 3D scene interpretation of the retinal image» (2018, Sect. 4).

example, Siegel 2006; Nanay 2011b). We perceive objects (both real and depicted) as having various properties – such as a certain shape, size, and color. However, not all properties that we represent objects as having are perceptually represented. I perceive my laptop as black, as in front of me, and as fairly small. But I can also non-perceptually represent it as the same laptop I use daily for reading and writing (Nanay 2011b). Without entering into this debate, it is enough to ask: can our visual system perceptually represent the motion of depicted objects even when there is no actual locomotion and in the absence of the phenomenology characteristic of seeing real-life motion?

If perception is the key to depiction, and a property is depicted in a picture if it is perceptually attributed to the pictorial scene, I suggest we should look for an answer in the sciences of vision. This is inspired by the idea that only a combination of empirical and philosophical research can provide a satisfying theory of picture perception and depicted properties in particular (Matthen 2005; Nanay 2011b; Ferretti 2016, 2018; Briscoe 2018), as well as a well-founded theory of perception in general (Block 2014). In the next section, I turn to research from experimental psychology and cognitive science to show that we have good empirical reasons to think that motion is experienced in the pictorial content of certain figurative static pictures. If this is correct, and if we think of depiction in perceptual terms, we should allow for the possibility that movement can be depicted.

1.3 The Psychology of Depicted Motion

«To survive in a dynamic world, the sensitivity of the human visual system for detecting motion cues is a critical evolutionary advantage. This motion sensitivity is so delicate that motion perception can occur even when no physical motion is present but only implied» (Lu, Li, and Meng, 2016, 668). We can begin to understand how this is possible by considering various psychological studies of motion perception by Freyd and collaborators – specifically, on what they called implicit

motion and representational momentum – and their contemporary development. As I will show in this section, these two interrelated psychological mechanisms are responsible for the viewer's experience of depicted motion in *Behind the Gare St. Lazare*. While both have been – and still are – extensively studied, there is no agreement on the interpretation of the empirical data from experimental psychology and neuroscientific studies. In fact, two main interpretations of how implicit motion and representational momentum work are available: an 'internalization' interpretation, which posits that implicit motion and representational momentum are the results of purely perceptual mechanisms (dependent on the fact that some of our mental representations are intrinsically dynamic), and a top-down perceptual interpretation, which claims that implicit motion and representational momentum are fundamentally top-down mechanisms, dependent on high-level cognitive processes and beliefs.[10] In this section, I unpack both in order to analyze the psychological mechanisms underlying the experience of depicted motion; in the next, I argue that both interpretations support the thesis of this chapter: motion can be depicted in static images.

Let's start with the 'internalization' reading. This is Freyd's theoretical interpretation of her seminal work on what she originally called implicit motion and its link with representational momentum. First of all, what is implicit motion? Freyd's view is that we represent movement «independent of whether the stimuli are dynamic or static» (1983, 575). But how can some static pictures and photographs lead to the mental representation of movement? Freyd's experimental investigation of this question began with a test of the hypothesis that frozen-action photographs might involve the representation of dynamic information. Her 1983 experiment showed that we can mentally represent a still figure as being in motion: Freyd called this 'implicit

[10] These are the two main interpretations of the data. See Hubbard (2010) for a review of more nuanced positions on representational momentum.

motion,' motion perception cued by a still or frozen-action shot. For her experiment, irreversible action sequences – such as a man jumping down from a wall – were filmed with a movie camera, and pairs of individual frames were selected to use as stills. The frames in these pairs were separated by 55 to 500 milliseconds in real time. In the experiment, individual stills were presented to subjects. They were asked to look at one frame for 250 milliseconds and hold it in memory for another 250 milliseconds, then determine whether the second frame was the 'same as' or 'different from' the first. Subjects took longer to complete the task correctly when the pair was in real-world temporal sequence than when it was in reverse order, supporting the hypothesis that «when people perceive the first member of the pair, they cannot help but anticipate the continuation of the implied motion» (1987, 430). Freyd concluded that subjects 'unfroze' the frozen motion implicit in the frame by creating a dynamic mental representation of the static photograph; in other words, they anticipated the motion in the scene.[11] These results supported her hypothesis that the visual system represents the motion implicit in a photograph.[12]

For Freyd (1993), implicit motion is closely related to another perceptual mechanism: representational momentum. Representational momentum is a small but reliable error in our visual perception of moving objects. Instead of seeing the exact location of a moving object, we perceptually represent it as slightly farther along its trajectory.

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[11] One year later, Freyd and Finke (1984) also argued for a similar visual effect related to the direction or path of movement.

[12] I would like to stress that none of Freyd's claims concern proper motion phenomenology. In fact, she is explicit in distinguishing her claims about 'mental representations of movement' from 'perceptual illusions of movement' (where motion is visually experienced even though no object is moving, as in op-art paintings like Bridget Riley's *Fall*). This distinction is consistent with what I argue in this chapter: while there is no motion phenomenology, the temporal content of our experiences of certain static pictures is particularly rich.

Freyd and Finke (1984) demonstrated that when a rotation of a visual pattern is implied, an observer's memory for the pattern's orientation tends to be displaced forward in the direction of the implied rotation.[13] Freyd and Finke termed this phenomenon 'representational momentum' because of its similarity to physical momentum, where a physical object continues along its path of motion through inertia. Just as a moving physical object cannot be immediately halted due to its momentum, so too a mental representation of that motion cannot be immediately halted because of an analogous momentum within the representational system (Finke and Freyd, 1985; Finke et al., 1986). Freyd's idea is that the perceptual system has internalized – or evolved to include – basic principles of Newtonian physics. This is why Hubbard (2010) labeled her position 'internalization theory.' What Freyd's internalization theory suggests is that the perception of a given motion or event includes its present state as well as its 'implicit' future state – all within the perception of that motion or event. Perception is not momentary, but temporal: «just as time is a dimension in the external world, inseparable from other physical dimensions, so might time be a dimension in the represented world» (Freyd, 1993, 105).[14]

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[13] In a similar, subsequent study (Freyd and Finke, 1985), subjects were presented with a static figure in a sequence of orientations sampled from a possible path of rotation. Subjects were instructed to remember the third orientation they saw and were then presented with a fourth orientation that was either the same as or different from the third. Subjects showed a shift in memory for position. Effects similar to those found for implied rotational motion (e.g., Freyd and Finke, 1984, 1985; Freyd and Johnson, 1987; Kelly and Freyd, 1987; Verfaillie and d'Ydewalle, 1991) have been discovered for implied translational motion (e.g., Finke and Freyd, 1985; Finke, Freyd, and Shyi, 1986) and for an implied spiral path (Freyd and Jones, 1994).

[14] For Freyd, «of relevance to this interpretation of representational momentum is evidence that the phenomenon is apparently not particularly cognitively penetrable» (1993, p. 104). In a moment, we will see that this is not uncontroversial.

In more recent years, Freyd's implicit motion has been extensively studied from a neurophysiological point of view under the label of *implied motion*. Converging neurophysiological and neuroimaging evidence indicates common neuronal substrates between real and implied motion in both monkeys (e.g., Jellema & Perrett, 2003; Krekelberg et al., 2003) and humans (e.g., Kourtzi & Kanwisher, 2000; Senior et al., 2000; Lorteije et al., 2006; Urgesi et al., 2006; Kim & Blake, 2007; Proverbio, Riva, and Zani, 2009; Osaka et al., 2010; Lu, Li, & Meng, 2016; Cattaneo et al., 2017; Mineo et al., 2018): the medial temporal (MT) and medial superior temporal (MST) areas, which play a central role in the perception of motion, respond not only to physical movement but also to dynamic information contained in still photographs when motion is not presented, i.e., implied motion.[15] What these studies suggest is that the dynamic information in static images does not come from direct motion signals but may instead be inferred from object categorization and knowledge about how animate and inanimate objects move. The MT/MST (V5) area is more active when presented with real-life images that imply motion than when similar images are shown that do not.

These studies seem to reinforce Freyd's original idea that motion is experienced in static pictures thanks to implicit (or implied) motion and representational momentum. And yet, several experimenters have questioned Freyd's 'internalization' interpretation of these mech-

[15] Other interesting findings correlate real motion and implied motion: (i) common direction-selective circuits for both real and implied motion have been suggested by motion and positional after-effect experiments in both adults and infants (e.g., Lorteije et al., 2007; Winawer, Huk, and Boroditsky, 2008; Pavan et al., 2011; Shirai and Imura, 2014, 2016); (ii) both real and implied motion led to increases in perceptual estimates of temporal duration (Kanai et al., 2006; Yamamoto and Miura, 2012); and (iii) Acik, Bartel, and König (2014), using eye-tracking, demonstrated similar fixation selectivity when comparing real versus implied motion stimuli, concluding that static cues can be sufficient to reveal movement in a scene.

anisms, arguing that representational momentum and implied motion are affected by knowledge of the situation. In this view, implied motion and representational momentum result from cognitive processes that penetrate our perceptual experiences (along the lines of Pylyshyn, 1984; see also MacPherson, 2012, 2015).[16] For example, this interpretation is endorsed by two of the main studies that initiated the analysis of implied motion's neural correlates: Senior et al. (2000) and Kourtzi and Kanwisher (2000). Senior et al. (2000) used functional magnetic resonance imaging (fMRI) to explore the neural substrate for representational momentum. Subjects participated in two experiments. In the first, they were presented with video excerpts of objects in motion (versus the same objects in a resting position). This identified brain areas responsible for motion perception. In the second experiment, subjects were presented with still photographs of the same target items, only some of which implied motion (representational momentum stimuli). When viewing still photographs of scenes implying motion, activity was revealed in secondary visual cortical regions that overlap with areas responsible for the perception of actual motion. Important-

[16] Already in the 1980s, Hubbard and Bharucha (1988), Ranney (1989), and Finke and Freyd (1989) debated the extent to which representational momentum is cognitively penetrable. Finke and Freyd (1989) argued that representational momentum is relatively impenetrable – that is, subjects cannot instantaneously halt the represented motion, no matter what they think or attempt. However, Hubbard and Bharucha (1988) disagreed: in their experiment, they found that representational momentum seems to involve knowledge of the future position of the moving target, implicating a high-level cognitive mechanism that predicts the future position based on its previous pattern of behavior. For them, the context influences representational momentum. In 1996, Reed and Vinson tried to provide a more convincing demonstration of Hubbard and Bharucha's results – i.e., the non-modularity of representational momentum – and argued that «conceptual information about objects and motion held in long-term memory could influence many aspects of representational momentum» (Reed and Vinson, 1996, p. 849).

ly, the experiment suggested that higher-order semantic information can act on secondary visual cortex to alter perception without explicit awareness: «higher-order information that interacts with representational momentum is processed within the 'object identification' ventral pathway without the need for 'executive' involvement. Semantic and conceptual factors can modulate dynamic mental representations. This, and the functional neuroimaging findings, imply that higher-order information can act on specialized motion-specific regions of the visual cortex to alter perceptual experience in the absence of awareness. Implied motion is cognitively penetrated» (Senior et al., 2000, 20).

In the same year as Senior et al., Kourtzi and Kanwisher (2000) conducted a very similar study that activated the MT/MST (i.e., V5) area, showing that real and depicted motion register in the same region. Since object recognition was involved, they postulated long-term memory assistance from outside the motion processing zone: the fact that pictures of houses evoked no response from observers, while pictures of people moving did, strongly suggested cognitive inference. «Inferring motion from still images depends on object categorization and knowledge about the repertoire of behavior different objects can exhibit. It seems most likely that such high-level perceptual inferences occur elsewhere in the brain and modulate activity in the MT/MST in a top-down fashion» (Kourtzi and Kanwisher, 2000, 52).

Now, what do these experiments tell us about the perceptual content of pictures such as *Behind the Gare St. Lazare*? Is motion depicted in it?

1.4 Depicted Motion and Pictorial Experience

If we take psychologists' interpretation of implied motion at face value, we should commit to the fact that our visual experience automatically represents various information about motion when seeing certain static images. The experiments show that perceiving a picture depicting an object caught in the middle of a dynamic action automatically involves the representation of motion in the perceptual content of our visual ex-

perience: when seeing a picture of a dynamic object, our visual experience perceptually attributes motion to that very same depicted object.

As we have seen in Section 1.2, for a general perceptualist account like the one I endorse here, a property *x* is depicted in a picture *P* if *x* is perceptually attributed by an observer's perceptual mechanisms to a depicted subject *S* – that is, if the observer *O* has the visual experience (or forms perceptual representations) as of *x* when looking at *S* in *P*. Experiencing a picture's content involves representing its subject matter as having the properties the picture represents it as having.

What the studies on implied motion and representational momentum suggest is that among these properties, motion can also figure. When the subject matter is depicted as being in the middle of a dynamic action, motion is represented in the perceptual content of our experience as a property of that very subject. Both interpretations analyzed in the previous section support this claim: (i) From the point of view of Freyd's internalization theory, some of our mental representations are dynamic, and this dynamicity is also present in pictorial seeing: we represent some static scenes as being in motion because this peculiar trait of our mental representations is reflected in the recognitional fold of our pictorial experience. In Freyd's framework, understanding the dynamicity of some of our perceptual representations is fundamental to understanding depicted motion: if certain objects of perception are intrinsically temporal, we have no reason to believe that the pictorial content of a static image cannot also be temporally extended. *Behind the Gare St. Lazare* and Freyd's stimulus are very similar images with a very similar subject: they both depict a man caught in the middle of a dynamic action. Both images' depictive contents – men jumping – are perceived as including relevant information about their motion – direction, speed, implicit future position – and this is so because our mental representations intrinsically include perceptual knowledge about the expected motion of objects in the form of a dynamic mental representation. (ii) From the perspective of the top-down perceptual reading, our mental representations are not intrinsically dynamic, but

it is nonetheless maintained that perception attributes motion to the depicted object thanks to high-level perceptual inferences. The perceptual content of our visual experience is enriched by expectations automatically provided by higher-order semantic information.

At this point, one may wonder if experiencing depicted motion truly means that we perceptually attribute motion to the depicted scene: am I endorsing too liberal a view of perceptual content? There are two reasons why I do not think that I am. First, as we have just seen, psychologists speak of these phenomena in perceptual terms – even if it is a matter of cognitive influence on perception. Second, a number of philosophers have recently maintained that perceptual content is richer than traditionally acknowledged and that the border between perception and cognition is not so clear-cut – cognition can influence perceptual content both in general (Siegel 2006; Raftopoulos 2019) and in the particular case of pictorial experience (Zeimbekis 2015). And if we maintain that the perceptual content of visual experiences is rich and vertically articulated (Kulvicki, 2007), I suggest that we should also maintain that the recognitional fold of pictorial experience is richer and more articulated than usually thought. In these terms, we still maintain a temporally extended perception of the pictorial content of Cartier-Bresson's photograph: motion constitutes a property of the recognitional fold of pictorial seeing because the recognitional fold is cognitively penetrated. Significantly, this view is in line with Wollheim's original idea: as Wollheim (2003) claimed, *seeing-in* is cognitively penetrated as far as its recognitional fold is concerned – namely, the content of that fold is constituted by concepts of the items that the picture presents (see also Voltolini 2020).

In sum, both psychological perspectives tell us that motion is really perceptually attributed to the depicted object in *Behind the Gare St. Lazare*, which is why we speak of its contents in dynamic terms. Prima facie, we would be tempted to say that no temporal properties are depicted in this kind of image because nothing really moves. While most agree that two-dimensional surfaces can pictorially repre-

sent three-dimensional objects and spatial relations between them[17], we might think that static pictures are not obviously temporal. And yet, as we saw in the previous section, experimental psychology and cognitive sciences tell us that the perceptual content of this kind of picture is more complex than it appears: it represents objects caught in the middle of a dynamic action as being in motion, as having a temporal extension. The perception of dynamic figures in static pictures includes relevant visual information about their motion, offering an experience that provides a kind of perceived temporality to the pictorial content of some static images. This means that perceptual theories of depiction should make room not only for the depiction of space on a flat surface, but also for the depiction of time in a still picture. In fact, implicit motion and representational momentum suggest that the depictive content of Bresson's picture is perceived as temporally extended. If we agree that depiction is to be explained in perceptual terms, we are bound to acknowledge that motion is depicted in Bresson's *Behind the Gare St. Lazare* and, more generally, in many pictures that depict objects caught in the middle of a dynamic action.

1.5 On Pictures of Moving Things That Do Not Depict Motion

There are photos of moving things that fail to give the experience of motion. In fact, there are images of bodies or objects in motion that we experience as if their subjects were still: imagine, for example, a series of photographs of a singer who appears to make grotesque faces – and we are apt to misinterpret her as 'making a funny face' – when she is actually in the middle of movement, e.g., singing.

As we saw in Section 1.2, the properties depicted in a picture depend on the visual information encoded in its depictive content, not on

[17] See for example Hecht, Schwartz, and Atherton 2003.

the real-life scene originally recorded; all the viewer has at her disposal for interpreting a picture are marks on a surface – or clusters of pixels, since the vast majority of pictures nowadays are viewed on light-emitting displays like smartphone screens – and her perceptual abilities. Consequently, the difference between *Behind the Gare St. Lazare* and the freeze frames of the singer lies in the different interpretations the spectator gives to the visual cues available in their depictive contents. Knowing that the photograph was taken while she was moving does not change the depictive content of the picture. So, how do the interpretations differ? As before, I suggest we should look to vision science for an answer – or at least hypothesize one that would require further empirical studies.

While the photographs of men jumping are strong stimuli for activating implicit motion mechanisms, the singer's picture is not: we see the singer as standing still and grimacing rather than being in the middle of a dynamic action, e.g., singing. In fact, recent neuropsychological evidence has shown that implied motion activation depends on both object categorization and the depicted situation, and that both kinds of information can determine different levels of perceived implied motion speed (Lu, Li, and Meng 2016) – not every still picture depicts motion with the same degree of force. For humans, categorizing postures and facial expressions is essential for dynamic interpretations, and we can hypothesize that we most readily categorize the singer's facial expression as a 'still grimace' rather than 'singing,' and that in this case implied motion mechanisms are not activated. For example, in a study, Proverbio et al. (2009) presented participants with static pictures of women and men engaged in simple dynamic and almost static actions while event-related potentials (ERPs) were recorded. Observation of static photographs of human actions with implied motion produced an increase in cortical activation, much greater for dynamic than less dynamic actions. Not every photographic recording of movement depicts motion because depiction primarily depends on the perceived features of the depictive content: different subject matters and different configurations modulate motion and speed responses in viewers differently. In short, it is because we have

the visual experience of motion when we look at a picture – or form perceptual representations of motion – that the picture depicts motion. Pictures of moving objects that do not elicit the right visual experience in their viewers do not depict motion.[18]

1.6 The Perception of Motion in Static Images and in Films

How does the depiction of movement in *Behind the Gare St. Lazare* differ from the depiction of movement in film? In fact, there is a big difference between the phenomenology of motion in films and the phenomenology of depicted motion in static pictures. In seeing a movie shot of a man jumping over a puddle, we really see a man jumping from point A to point B, whereas when we see the man in Cartier-Bresson's photograph, we do not see anything moving – as the terms 'freeze frame' and 'still' suggest.

When the stereoscopic technique was invented in the first half of the 19th century, it became possible for the first time to produce images – called 'stereograms' – capable of eliciting a realistic illusion of depth and three-dimensionality. But the fact that there is a difference in the way three-dimensionality is experienced in standard pictures and stereograms does not imply that depth is only properly depicted in stereograms, while it is not depicted in standard pictures. In fact, every philosopher working on depiction agrees that two-dimensional surfaces are perfectly able to render three-dimensional configurations and depth relations in their depictive contents without the help of stereopsis. It is true that stereograms add an essential depth cue – stereopsis – to the ones already available to standard pictures – linear perspective, dwindling size perspective, aerial perspective, texture gradient, occlusion, elevation, familiar size, and highlights and shading – but

[18] This issue – the discrepancy between what a photograph detects and what we take it to depict – will return in Chapter 2.

this does not prevent standard images from eliciting the experience of depth and three-dimensionality. The two kinds of images only differ in the type and quantity of depth cues available to the spectator, but both are perfectly capable of rendering depth in a pictorial manner.

I argue that we should view the question of depicted motion from a similar angle: film's capacity to show actual motion depends on a different kind of motion cue that strengthens its ability to depict motion by engaging peculiar characteristics of the human visual system – the multifaceted and complex perceptual mechanisms underlying 'apparent motion.' Even if we grant that in one case (films) there is proper motion phenomenology, and in the other (pictures) there is not, this does not mean that motion can only be depicted by films. In fact, showing motion has always been a possibility for static images, because their depictive content is able to provide motion cues that engage the spectator's motion-perception mechanisms. As I have argued throughout this paper, we perceive motion in *Behind the Gare St. Lazare*, and this motion is depicted through static motion cues to which we easily respond, owing to peculiar mechanisms of our perceptual system – implicit motion and representational momentum. It is not depiction through apparent motion, but it is depiction nonetheless. Films and static images are different media, and they depict temporal properties in different ways, using different motion cues to engage viewers' perceptual systems. In short, *Behind the Gare St. Lazare* depicts motion without actually instantiating motion. Static images can depict an extremely wide range of properties without actually instantiating them, and they can do so by exploiting in various ways the vast array of the viewers' perceptual resources. Depicted motion is one of these properties.

If motion is not instantiated and there is no perception (or illusion) of actual locomotion, should we conclude, then, that motion per se is not depicted? I do not think so. What is depicted in Cartier-Bresson's picture is indeed motion, but motion perceived in the perceptual context of experiencing a static image. All we have to acknowledge – and remember – is that pictorial representation and depicted properties come in different varieties depending on the medium the observer is viewing. In the case of

Cartier-Bresson's picture, the spectator is seeing a static image, and this 'perceptual context' influences how the content of the picture is perceived and the properties that are perceptually attributed to it: we see the man as jumping, not as levitating in midair. This becomes clearer if we consider the case of freeze frames inserted in motion pictures. As Walton notes, «for a moment, until she realizes that it is a freeze-frame, the viewer may read the frozen image as portraying a frozen scene – an athlete or dancer stuck in midair, for instance. Once it is evident that the image is a still picture, once she understands it as such, all-at-once features of the unmoving image may induce her to see the athlete or dancer as in motion» (2008, 164). Once it becomes clear that what we are seeing is a static image, the dynamic disposition of the depictive content stimulates our visual system into perceptually attributing motion to that very scene. That is why, I maintain, we can legitimately talk of the depiction of motion, even in the absence of proper motion phenomenology. Of course, what static pictures display is only a part of the movement – partial information about the motion of the subject matter – but it is motion information nonetheless, and it is sufficient for the viewer to perceptually represent it as motion. Obviously, in static images, depicted motion is displayed through a static medium – that is why we define the picture as a 'still' picture and its content as 'frozen.' Frozen is a keyword here: it is a word that implies movement; more precisely, it implies its negation. But for there to be the negation of motion, it is necessary: (i) that there is something that suggests motion; (ii) that there is something that denies it. In static pictures, while the depicted subject appears to be moving, the picture surface itself does not – motion and immobility are properties ascribed to two different objects, the surface and the subject matter, respectively.[19] This contrasts neatly with film, where both the depicted subject and the light on the surface

[19] If they were both attributed to the same object, we would have an experience with contradictory content. But it does not seem accurate to describe experiences of pictures like *Behind the Gare St. Lazare* as contradictory.

itself appear to move. We perceive a static image for a relatively long period of time, and this is enough to react both to the impression of movement and to its denial. This is why we say that the scene is frozen – a frozen scene is one in which movement is both perceived and denied. And this tension between the depiction of motion and its negation, far from being a failure, is exactly why our experience of an image like *Behind the Gare St. Lazare* is so interesting, both perceptually and aesthetically.

1.7 Conclusion

In his paper *Moment and Movement in Art*, Gombrich (1964) argued that the idea that static pictures depict a moment in time by showing a scene without temporal extension is, in itself, problematic. For him, static images depict more than a *punctum temporis*, because such a thing as a *punctum temporis* does not exist, either metaphysically or psychologically. According to Gombrich's psychological analysis, we never perceive moments understood as instants: the idea of a moment in time is totally at odds with how we perceive reality. The same is true for the perception of pictures: static images create in us the «memories and anticipations of movement» (1964, 61); they are temporal because we perceive them as extending over a span of time.[20] In this first part of the chapter, I have shown that Gombrich was right all along and, more importantly, *why* he was right. We really do experience motion in some static images, thanks to the fact that certain configurations activate perceptual mechanisms such as implicit motion and representational momentum – two phenomena that have been (and still are) extensively studied in psychology. Furthermore, I have shown that if we agree to explain depiction in perceptual terms – as most of today's depiction theorists do – we must acknowledge that there is not merely representation, but *pictorial* representation of motion.

[20] A similar idea, developed within the framework of an experienced resemblance account of depiction, is present in Young and Calabi (2018).

Chapter 2.
Depiction, Detection and Pretense in Streaky Images, Chronophotography and Futurist Paintings

This chapter examines various pictures typically taken to represent motion: streaky images – photographs streaked and blurred due to long exposure – chronophotographs, and Futurist paintings. While the schemata exhibited by these images are pictorial in the sense that they can only be employed in pictures, it is unclear whether we can understand them as properly depictive ways of representing motion. Some thinkers have argued that we should. Benovsky (2012) claimed that in blurs caused by long exposure, we can see the change that the subject matter underwent over a span of time, and, therefore, we must regard them as properly pictorial. Kulvicki (2016) also argued, albeit for different reasons, that streaks are properly depictive ways of representing temporal patterns. LePoidevin (2017), too, believes that Futurist paintings depict an aspect of our experience of motion. However, I disagree with all three of them. In this chapter, I attempt to show that while these pictures and the visual solutions they employ – streaks and multiple exposures (since I argue that we can take Futurists to parasitize this peculiarly photographic schema) – are highly effective representations of motion and temporal properties, we should not consider them as properly depictive. In brief, I argue that in all these cases, in order to understand what they represent, we pretend: we engage in games of make-believe using what we actually see in the picture – what is properly depicted (i.e., the image object) – as a prop. As will become clear (2.2), I do not endorse

Walton's theory of depiction (which I, in fact, criticize in 2.2.2). However, I demonstrate that his general pretense theory provides the right framework for explaining how we interpret streaks, chronophotographs, and (certain kinds of) Futurist paintings: these schemata, coupled with certain appropriate principles of generation, guide our imagination in specific ways. Nevertheless, I argue, this mode of representation, while extremely effective, is not peculiarly pictorial.

To support this argument, since streaky images and chronophotographs are photographically produced, I begin (2.1.1) with a discussion of what is special about photography as a means for producing images, following Maynard (1997) in his distinction between the depictive and detective functions of photography. In fact, the interplay between these two aspects is key, I believe, to understanding how we interpret these pictures as representing motion and temporal properties. To get a sense of this interplay, I consider Maynard's discussion of photo-finish images (2.1.2) – photographs where the depictive and detective functions interact in specific – and, as I will show, problematic – ways. Then (2.2), I draw a distinction between image object and image subject. After criticizing Walton's theory of depiction – essentially because to understand what an image depicts, its image object, we only need to see it; we do not need to imagine-seeing – I argue that his general pretense theory is nonetheless useful for understanding how competent spectators can interpret what photographs detect – i.e., their appropriate image subject – through depictive elements. Essentially, they use the image object, or certain elements of it, as props in a game of make-believe. In the following sections, I apply this account to streaky images (2.4) – after criticizing Kulvicki's view – to chronophotographs and Futurist paintings (2.5).

2.1 Maynard on Photography. Depiction, Detection and Their Interaction

In *The Engine of Visualization*, Patrick Maynard calls for thinking about photography, first and foremost, as a technology that uses light

to mark surfaces in order to produce images, and secondly, to investigate what the more specific versions of this general technique are used to accomplish.[1] This approach facilitates an expansive view of photography that is not limited to the production of images used as depictions. In fact, according to Maynard, photography is a family of technologies for producing images – not pictures, since images need not depict – by marking surfaces with light. Maynard understands the notion of an 'image' somewhat technically, as a 'visual display marking,' that is, a surface discontinuously marked for the sake not only of being seen but, in a broadly Gricean spirit, being recognized as having been produced for that purpose. Images are the global physical states of such surfaces. Only some of these images are pictures, and only some of those, in turn, are pictures *of* anything.[2] Indeed, one of the main themes of the book is the distinction between using photographic images as depictions and using them to make detections. Maynard argues that although these functions are independent, it is often the case that the depictive function of photos aids detection.

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[1] The fundamental goal of Maynard's work on photography is to shift attention from the question 'What is a Photograph?' to the question 'What is Photography?' Maynard's answer to the latter is that photography should be understood as a technology and, as such, a means of amplifying our natural capacities or powers. It is a technology for marking surfaces with a variety of overlapping and sometimes conflicting functions and uses. It is important to grasp that Maynard's concern is not with technologies *of* photography, but with photography as *itself* a technology. As a technology, we understand photography best by asking what it enables us to do. Before we can understand the nature of its products, we must first understand the nature of the process itself.

[2] The latter point is important: it signals Maynard's refusal to theorize photography primarily in terms of the relation 'photograph of.' As a result, Maynard's account includes no fundamental commitments to realism, resemblance, or even reference.

2.1.1 Depiction and Detection

As *Behind the Gare St. Lazare* by Cartier-Bresson clearly shows, photographs are often used as depictions: when seeing the picture, we have a visual experience of a man jumping over a puddle, and that's what we take the photograph to depict. While in this book, as I have explained above, I am using a rather general – and broadly Wollheimian – perceptual framework for understanding depiction and pictorial experience, Maynard draws on a specific account of depiction: Walton's (1990), according to which pictorial comprehension is a matter of using the picture to imagine seeing what it depicts and to imagine, of your visual activity, that you are actually seeing what is depicted.[3] «As we look at our marked display surface depictively, our visual activities are guided by the imagining activities that it automatically incites in us» (Maynard 1997, 104). In this sense, as a depictive technology, photography enhances our powers of imagining and visualizing. Like the pictorial arts more generally, when photography is employed as art (though not only when it is), it amplifies our powers of visualization. Maynard says little about what distinguishes photography's specific form of such enhancement, beyond the lack of evident 'facture' in most photographs. Indeed, for Maynard, what distinguishes photographic depiction is less how it depicts than the way its 'depictive function' interacts with its 'detective function.' «Photography might be most simply characterized as the site of historically the most spectacular interaction of depictive and detective functions » (id., 120). Photography is the interaction of a depictive function with a prosthetic extension of our innate powers of visual detection by means of light. As Costello and Phillips (2008, 13) note, «Maynard is here reprising, in his own terms, Walton's stress on photographs as both pictures through which we indirectly see the world and 'mandates

[3] Walton (1990, 293).

to imagine' that we thereby see it directly. But Maynard has more to say about detection than Walton».[4]

As Maynard explains, it is possible to make many kinds of detections with photographs through visual perception because the states of the marked surface include traces of other things.[5] For him, a key aspect of detection is the transmission of information. Following Dretske (1981), Maynard distinguishes between the information source (such as an object photographed), the channel (such as the photoreceptive surface, camera mechanism, and so on), and the receiver of the information. As Perini (2012, 151) notes, « [t]his is an objective account of

[4] Walton (1984) argues that photographs are *transparent* because, according to him, we see objects *through* photographs. Walton's claim is that when I look at a photograph of my great-grandmother, I see her *through* the photograph. Similar to Susan Sontag, who suggested that «having a photograph of Shakespeare would be like having a nail from the True Cross» (1977, 154), and Roland Barthes (1981, 3), who believed he could literally *see* Napoleon's brother in an old photo, Walton also thinks he can see his deceased relatives in a picture. Although he acknowledges that he sees them 'indirectly,' through the photograph, he insists that he sees them nonetheless: for him, seeing through photographs and seeing *simpliciter* constitute 'a single natural kind'. Walton explicitly warns against interpreting this claim metaphorically: «I must warn against watering down this suggestion... My claim is that we see, quite literally, our dead relatives themselves when we look at photographs of them» (id., 251–2). Nonetheless, it is crucial to recognize that Walton's stance does not imply that photographs are not pictures. For Walton, seeing through photographs is not incompatible with photographs being representations. Photographs serve both functions: one indirectly sees the object depicted through the photograph and one imagines seeing it directly. It is, in fact, this interaction between actual, if indirect, seeing and direct, but imagined, seeing – only the latter of which photography shares with other forms of depiction – that distinguishes photography. In Section 2.2.2, I will critique Walton's use of imagined seeing to explain depiction. His transparency thesis has also faced extensive criticism. See, for example, Martin (1986), Wartburton (1988), Currie (1991, 1995, pp. 11–22), and Friday (1996).

[5] Maynard (1997, 122).

information: information transfer depends on relations between states of the subject and those of the marked surface». Maynard (1997, 217) claims that there are certain «functional relationships between some states of a subject and the states of the photographic image. These relationships are durable and repeatable under wide variations in other conditions».[6] We all assume these relationships «whenever we take or look at photographs» (ibid). These assumptions are important because the detective function of photography is not accomplished simply by storing information in marked surfaces. Making detections involves extracting that information; as a result, the receiver knows something about the detected item. Detectable information in photographic images can include states of the source and states of the channel, such as the shutter speed. Photography can be, and often is, used to make detections – but only because the information is stored in a visible form and only to the extent that we are able to extract information from that visual form. Again, with Perini (2012, 151), «the problem Maynard recognizes is that the capacity to store information is not sufficient for the image to have epistemic value. Viewers must register the information as detected». Because detection is connected to an objective account of information, Maynard (1997, 130) claims that «we can only detect what is so». However, it is possible to be mistaken about what is detected by a photograph because a variety of assumptions about the functional relations between the image state and the things photographed, as well as other cognitive and perceptual resources, are deployed in registering putative information as detected.[7] Making detections with photographs involves some risk.

Depiction and detection are, in principle, distinct; neither entails the other. Pure detection occurs when the image supports detection, but not depiction: given the conditions in which the image is used, it

[6] Maynard argues for this point in chapter 6.

[7] On this point see Maynard (1997, 128).

does not prescribe imagined seeing. Pure detection includes radioactive rays, light, and other emissions, and some x-rays. It also includes the detection of various 'channel conditions' causally responsible for how the image looks (film speed, color or black-and-white film stock, depth of field, focal length, shutter speed, point of view, and the like) that are not themselves depicted. Pure depiction occurs when what is depicted is not detected, such as when a man in a red suit is photographically depicted as Santa Claus. Pure detection includes all those photographs that depict *x* (Othello, King Kong, Xanadu, etc.) by photographing *y* (Olivier, a mechanical prop, a desert island, etc.). In none of these cases do we detect what such photographs depict.

Although in principle distinct, in practice depiction and detection generally interact: in many cases, a photo will support both functions. Most photographs are both channels for detecting various features of a given scene (relative illumination, etc.) and a way of depicting that scene. Maynard presents *Backyard* (1932) by Walker Evans as an example. This photo depicts a child as having freckles and also allows for the detection of her freckles. The physical state of the marked surface carries information, and in this case, that information is made accessible through treating the image as a depiction; for Maynard, this involves imagined seeing of the child.

When they coincide, depiction and detection generally aid one another. Maynard cites photo-finish photography as an example of depiction aiding detection; or, as Costello and Phillips (2008, 13) characterize it in their endorsement of Maynard, «the way such pictures look aids the extraction of the sought-after information». I consider photo-finish photography in some detail in the next section because, although Maynard presents it as support for his claim that depiction aids detection, it will help clarify both the limitations of the extent to which depiction aids detection through photography (see also Perini 2012), and, somewhat relatedly, it will offer a first glimpse into the problem of temporality in relation to these two functions and their imagistic realization.

2.1.2 Photo-Finish: A (Problematic) Example of the Depiction-Detection Interaction

Photo-finish cameras were developed during the 1940s and 1950s as a means of regulating the racing industry and reducing cheating. Betting on races became increasingly popular during the middle decades of the twentieth century, and authorities were concerned with improving the probity of racing, which was widely regarded as corrupt. Typically, photo-finish cameras use strip photography (see Vanvolsem 2011)[8], in which a camera is aimed at the finish line from an elevated position in a tower.[9] It captures only the sequence of events at that line in the vertical dimension. Every part of each racer's body is shown as it appeared the moment it crossed the line; anything stationary is represented as a horizontal streak. The horizontal position represents time, and time markings along the bottom of the photo can be used to find the exact crossing time of any racer. The high angle allows judges to see the position of every racer in relation to the others.

[8] Strip photography, also known as slit photography, is a photographic technique for capturing a two-dimensional image as a sequence of one-dimensional images over time, unlike a typical photograph, which captures a single two-dimensional image (the full field) at one point in time. This technique records a moving scene over a period, using a camera that observes a narrow strip rather than the entire field. When a subject moves through this strip at a constant speed, it will appear as a visible object in the final photo. Stationary objects, like the background, remain consistent across the entire image, appearing as stripes along the time axis. Digital sensors capture and arrange these discrete strips of pixels line by line. In film photography, however, the image is produced continuously, resulting in a smooth gradation rather than discrete strips. For more, see Vanvolsem (2011).

[9] You can see plenty of visual examples here: https://en.wikipedia.org/wiki/Strip_photography.

In a conventional photograph, the image shows a variety of locations at a fixed moment in time; strip photography swaps the time and space dimensions, showing a variety of times at a fixed location. The final image often shows a solid white background, which is a continuous scan of the painted finish line. Racers may appear distorted based on the movement of their limbs and heads as they cross the line; limbs are elongated if they remain static or move backward in relation to the slit-shutter, or truncated if they move faster than the film moving past the slit.

Maynard (1999, 133–140) presents a detailed discussion of a photo-finish image from a horse race to support his view that depiction facilitates detection. The photo-finish image contains information about the conditions at a single narrow location over several moments. Photo-finish pictures represent a temporally extended sequence of events at a strictly limited place (the finish line), rather than an extended space at a strictly limited time (that of exposure). However much the photograph may seem to depict the latter, what we detect from it is, in fact, the former: the photograph makes this information accessible by presenting it pictorially. It takes training to extract such information: we are better able to do so intuitively by treating the photo-finish image as though it were a picture, imagining that seeing the photograph is seeing what it seems to depict – a group of horses galloping towards the finish line. For this reason, the speed at which the film moves past the open slit-shutter is artificially set to produce naturalistic-looking images. Were the film to pass the gate faster, this would, in theory, aid detection, since exaggerating extension in time should facilitate easier detection of very small temporal differences. But to the extent that this comes at the cost of prompting imaginings about what we are seeing – imaginings that naturalistic images make possible, such as reading the numbers on the jockeys' shirts – the extraction of information becomes less intuitive.

For Maynard, the upshot is that photo technologies typically produce depictions by means of which we detect and – following Walton –

indirectly see various things and events, thereby enhancing our powers of imagination and perception.[10]

Comprehending the image as a depiction of a single moment in time allows for the extraction of a specific, important piece of information: which horse crossed the finish line first. This information could easily be extracted by taking the image for what it is – a visual representation of a sequence of events at the finish line. So, is the ability to use the image as a depiction to make the same detection really an epistemic advantage? This is unclear, because treating the image as a depiction is misleading in many ways. The photo-finish picture is produced by exposing moving film to a slit, and thus it embodies information about the state of a particular narrow area (the finish line) over time. Naïve viewers will comprehend this photo as a depiction because it looks like a typical snapshot – one in which all of the film is exposed to a whole scene at one moment. Viewed as a depiction, it represents the locations of various horses and riders at a single moment over a relatively broad spatial area. Treated as a depiction, it is largely inaccurate: there was no moment in time when the horses were in those relative spatial positions and configurations. For example, at the moment when the first horse's nose crossed the finish line, the third horse's hooves were not in the depicted position. They reached that position later, when it crossed the finish line. Nevertheless, taken as a depiction, the photograph facilitates the accurate

[10] The same holds true for various types of medical imaging, where the primary aim is to detect information regarding the health of bones, skin tissue, and other internal structures. Here, pictorial presentation aids in the extraction of this information. In the medical context, imaging technologies enable us to indirectly observe the inside of the body by viewing it on a screen, while we imaginatively perceive this indirect observation as if it were direct viewing of what the screen displays. Thus, the depictive function of these imaging technologies enhances our ability to visualize imaginatively, while their detective function expands our perceptual capacity to gain knowledge.

detection of the race winner. But it also facilitates many mistakes – extraction of content from the photo-as-depiction that was not detected by the imaging process and, furthermore, is not accurate.

In certain tightly controlled situations, like the use of photo-finish photography, there is no harm in treating the image as a depiction. That is because it will support the correct detection of the order of horses crossing the finish line, and that is the only informational use to which the image is put. However, that is just one of many potential detections that a viewer could make by taking this image as a depiction. So, as Perini (2012, 153) notes, «this example provides little support for the claim that depiction aids detection in general, that is, even when depiction is inaccurate».

Mistakes in the extraction of information are possible even with everyday photographs, as Maynard (1999, 140) establishes with a hypothetical example «of the snapshot in which someone blinks, where what is recorded on the surface (a blink) may be different from what the picture would have us imagine we are seeing (a person of reduced capacities)». Maynard does not discuss the example further, but, as Perini (2012, 153) notes, «he seems to have in mind a case where there is no visual cue in the photograph that would guide imagining seeing a man during a blink, like blurring around the eyelid». Such a photograph must be made with a very fast shutter speed, at one of the rare moments when an eye is half open. For Maynard, whenever we look at pictures – as depictions – we assume certain functional relations between the subject and the image. In treating the image as a depiction, the viewer generally looks at a photograph in light of a range of channel conditions, rather than the highly specific conditions of very fast shutter speed and timing needed to produce a sharp image of a half-closed eye from a normal subject. In this case, the viewer would be guided to imagine seeing an incapacitated man. The issue is not whether the viewer is correct in taking the photo to depict an incapacitated man. Maynard is concerned with how the photograph is used, and his point is that if it is used as a depiction, a viewer aiming to make

a detection by treating the photograph as a depiction would be misled about what she has detected. «Using photographs as depictions is often a threat to detection because it fosters a way of working with the image that need have no connection to the kind of information it actually presents» (Perini 2012, 153).

In the next section, I try to build upon this problem Maynard faced in light of recent literature on depiction. In particular, I show the need to distinguish, in cases such as the photo-finish picture, between an image object and an image subject. Then, I show that, contrary to what Maynard thought, Walton's theory of depiction is not necessary to understand how we get the image object – the concept of visual games of make-believe and imagining seeing is inadequate to explain pictorial experience per se. However, I argue that it is useful to appeal to the general pretense theory elaborated by Walton to understand how a number of pictorial schemata exploit cognitive and imaginative resources in order to effectively represent various properties of the image subject. This is what happens, I argue, with photo-finish images, but also with streaks and chronophotographs. And, even if this is a common representational practice that exploits various pictorial elements, it is not, strictly speaking, pictorial: in fact, I argue that using depictive elements for detective purposes means using certain elements of the image object as props in a game of make-believe.

2.2 Image Object, Image Subject, and Walton's Pretense Theory

As I have just mentioned, in this section, I elaborate on some of the concepts deployed by Maynard in light of recent literature on depiction. First, I show (3.2.1) that we can better understand the distinction Maynard made between what we imagine we are seeing and what is actually recorded on a surface in light of the (originally Husserlian) distinction between an image object and an image subject. I then (3.2.2) argue that understanding the perception of the image object as

a form of imagining seeing, as Maynard does through his endorsement of Walton's theory of depiction, is mistaken: we do not imagine-seeing the image object; we simply see it. Finally, I argue (3.2.3) that we can use Walton's general pretense theory to understand how what we see in the image – certain elements of the image object – can appropriately sustain the detective function as props in a game of make-believe, allowing us to derive an appropriate image subject. This analysis is important for my purposes because it provides the basis for understanding not only photo-finish images but also streaky images and chronophotographs, two of the primary methods typically considered effective for depicting motion through photographic means.

2.2.1 Image Object, Image Subject and the Standard of Correctness

The discussion about the problematic interplay between depiction and detection in photography makes it clear that it is possible to be mistaken about the actual motion or immobility of the photographed subject matter. This was already anticipated in Chapter 1. There, I discussed the case of a photograph of a singer who was actually moving when the photograph was taken, but in the resulting image, we see her as standing still and making funny faces. In cases like this, we take the photograph to depict a static state of affairs because we cannot recover motion information from how the singer is depicted. On the other hand, when we come to know that the subject in front of the camera was, in fact, in motion, we might take the picture to represent a dynamic state of affairs, even though we cannot perceive it as such. What we see in the picture – what the picture actually encodes and, *strictu sensu*, depicts – is an immobile state of affairs, since postural cues are absent. Yet, after learning what was actually happening when the photograph was taken, we interpret the photograph as referring to a moving subject matter because it is causally related to what was in front of the camera at the time. There are several assumptions at play here, so let's proceed step by step.

To clarify what I mean, it is helpful to make two distinctions: first, between what we see in an image and what such an image is about; second, between what sets the standard of correctness for what a picture is actually about in the case of handmade pictures and in the case of photographs.

Image Object and Image Subject. A picture involves not only (i) a vehicle and (ii) what we see in it, but also (iii) a picture's subject, conceived as what the picture is about. The ambiguity in photographic interpretation makes it evident that we need a distinction not only between (i) and (ii) but also between (ii) and (iii), because these second and third elements clearly differ. The same picture may be, or indeed is, about different things, even if what is seen in it remains the same. In the literature on depiction, this distinction is often used to point out that what is seen *in* the picture can be interpreted as being about different particulars.[11] The third element corresponds to what we take the picture to be about. Indeed, there are cases where one sees the same item in a picture, but the picture's subject differs. For example, in Raphael's *The School of Athens* (1509–1511), one sees, among other things, a long-bearded old man pointing upwards and may interpret him as Plato – likely Raphael's intention – or as Leonardo da Vinci, whom many believe was Raphael's model for the painting (see Voltolini 2018). However, this ambiguity in identifying the picture's subject also extends to the interpretation of the depicted situation, as the photographic examples mentioned earlier show. When we look at the singer's photograph, we see her as static– this is the figurative content of the picture – but we might interpret it as representing either a static situation (if no further external cues guide the interpretation) or a dynamic situation lacking visible dynamic cues (if we know what was happening when the photograph was taken).

[11] See for example Lopes (1996), Hopkins (1998, 2005), Voltolini (2015, 2018).

Following Husserl (2006), I will refer to the second element – what we see in the picture – as the *image object*, and the third element – what the picture is about – as the *image subject*. In doing so, however, I am not endorsing the neo-Husserlian view that picture perception itself is threefold – a view that has seen a contemporary resurgence (e.g., Wiesing 2010; Nanay 2016, 2018; Eldridge 2017).[12] In fact, as Voltolini notes (2018, 91), «Edmund Husserl limited himself to stating that what now amounts to the picture's subject is just a third layer of the picture, over and above the picture's vehicle and the intermediate item». Thus, for Husserl, a picture is three-layered, in that the vehicle, the intermediate item, and the subject must all be considered to understand what a picture overall amounts to.[13] This, I believe, is the right way to account for the complex structure of pictures in their overall reception. However, as far as pictorial experience is concerned, I maintain that the broadly Wollheimian perceptualist framework outlined in Chapters 1 is the correct one: when seeing an image, we see an image object on a marked surface. The image subject is then a further element, an additional layer (see also Voltolini 2018), which can be – but need not be – apprehended and is not, strictly speaking, part of the

[12] For these authors, the experience of a picture involves not only perceiving the picture's vehicle and intermediate item through distinct folds but also typically engaging a third, indirect perceptual fold that encompasses the picture's subject. This subject is accessed either through an additional layer of seeing-in – where, just as the intermediate item is perceived within the vehicle, the subject is perceived within the intermediate item (Brough 2012; Kurg 2012) – or through mental imagery (Nanay 2016, 2018), or a combination of such processes (Eldridge 2017). According to Nanay, there are instances where, if the experiencer does not recognize a subject for the picture, only the first two perceptual folds are engaged. See Nanay (2016, 49–55; 2018).

[13] To be sure, Husserl argued that image consciousness is directed toward all these elements. See, for example, Eldridge (2017). However, the extent to which consciousness of the subject is perceptual for Husserl remains a matter of debate. For further discussion on this point, see Wiesing (2010).

pictorial experience, which remains the experience of seeing an object (the image object) in an appropriately marked vehicle.

Distinguishing the image subject from the image object might sound un-Wollheimian. Wollheim, for instance, would treat cases like the ones described above differently. For example, he argued that a picture of Henry VIII, which someone may mistakenly take as a picture of the British actor Charles Laughton, prompts a distinction between different experiences of seeing-in: a correct experience, where the picture's subject is Henry VIII, and an incorrect experience, where the picture's subject is wrongly identified as the actor.[14] Yet, as Voltolini (2018, 102) claims, «this distinction unduly conflates what must surely be taken apart: the seeing-in experience, which accounts for a picture's figurativity, and the picture's intentionality, which accounts for its subject, or aboutness». I agree with Voltolini, who continues, «Even in this case, despite a change in its aboutness (from Henry VIII to Charles Laughton), what is seen in the picture remains the same general, intermediate item – the face of a fat, bearded adult human male». I believe we can take Wollheim's intuition regarding the correctness and incorrectness of the seeing-in experience at face value and apply it to the relationship between the image object and the image subject – between what we see in the picture and what the picture is about. In this sense, we should say that we can correctly or incorrectly identify what the picture is about.[15] But what sets the standard of correctness?

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[14] See Wollheim (1980, 206).

[15] Nevertheless, as Voltolini (2018, 102) notes «Wollheim himself may have been sensible to the above distinction between different pictorial layers. As a matter of fact, in one of his last papers, he appeals to a distinction being made between what he respectively calls the figurative content and the representational content of a painting. Yet Wollheim considers this to be the distinction between two forms of 'seen-in' contents of a picture. The former, which he calls figurative content, provides the paradigmatic 'seen-in' item of a painting, what is grasped, as he says, through a 'non-abstract' concept:

Two Standards of Correctness. Newall, building on Wollheim, offers a useful answer: «I hold that there are two different standards of interpretation for two different types of pictures. Hand-made, 'manugraphic' pictures, such as paintings, drawings, and traditional prints, have the standard of correctness set by the maker's intention. Photographs, and other photo-based pictures, have their standard of correctness set by a causal relation» (Newall 2011, 56). This distinction allows us to differentiate images produced through photographic means from strictly pictorial images. In the latter case, the artist's hand creates the image, and the subject is mediated by the artist's intentions. In contrast, photographs are linked to their subject by a causal and counterfactual relationship. The standard of correctness for a photograph is set by the presence of the subject in front of the camera when the photograph was taken. A photograph of *X* indicates that *X* was present in front of the camera, and if *X* had not been present, the photograph would not depict it. The standard of correctness is not determined by the photographer's intentions but by what was present in front of the camera.[16] Photographers usually intend to capture the subject that the resulting image depicts, but realizing this intention depends on what is in front of the camera: «The photographic standard of correctness must

'table, map, window, woman'. The latter, which he calls, representational content, provides a nonparadigmatic 'seen-in' item of a painting, something that is not grasped through such a concept. For Wollheim, abstract paintings have only representational content, while figurative paintings have both».

[16] Philosophical discussions of photography often emphasize its causal connection to specific sources, which are both richly and reliably depicted. This distinctive aspect of photography raises questions about its status as a representational art form (Scruton 1981; Friday 2001; Phillips 2009), its potential as a prosthetic extension of human perception (Barthes 1981; Walton 1984; Warburton 1988; Friday 1996; Maynard 1997; Cohen and Meskin 2004), and other unique aspects of its relationship to particular objects (see Costello and Phillips 2008).

be satisfied for the photographer's intention to be realized» (id., 208). Even for photographs, though, this standard of correctness is a convention operating in our society; adopting it allows us to take advantage of photography's most suitable function: its reliable documentary nature, or what Maynard called its detective function. Newall illustrates this point with a thought experiment:

> We can imagine cases where this standard could be rejected. For instance, we can imagine a society that made the standard of correctness for photographs the same as for other pictures: the maker's (the photographer's) intention. In this society, photographers might take photographs at random and file each away according to what it occasions seeing. When the photographer wishes to depict an *X*, they pull a photograph from the relevant file and present it for exhibition, titling it *X*. The photograph's source need not be *X*; it might be *X*, but it could also be a suitably shaped cloud or a stain on a wall – anything capable of occasioning the non-veridical seeing of *X*. Such a use of photographs ignores the fact that photographs, by virtue of being reliable conduits of information about objects in front of the camera, are well suited to function as documents. Thus, we find that wherever photographic pictures are used, it is the photographed item that provides the standard of correctness. If it did not, photographs would be significantly less useful. Adopting this standard of correctness is a condition for taking advantage of that function to which they are best suited (id., 60–61).

In other words, adopting the photographic standard of correctness means exploiting photography's detective function to recover the appropriate reference – from what we see in the picture – whether it is a particular or a state of affairs.

Newall focuses on traditional snapshot photography. With traditional snapshots, using the image object – what we see in the picture – to identify the correct image subject – what the camera actually detect-

ed – is generally unproblematic, although, as the singer's case shows, it can sometimes be misleading. In such cases, knowing what the photograph actually detected is fundamental to correctly identifying its image subject. Additionally, understanding how the photographic process worked is crucial to correctly interpreting the image. This is relatively straightforward with traditional snapshots but becomes more complex as photographic technology advances, even when the causal relationship between the image and its subject remains. This complexity is evident in the case of photo-finish photography, where the image object and image subject clearly diverge, requiring interpretive effort to identify the correct image subject. Similar challenges arise with streaky images and static stroboscopy, as I will show in the following sections.

Before discussing these peculiar photographic techniques, I will first explain why I believe Walton's theory of depiction does not work *qua* theory of depiction (and, hence, why we need to understand the image object not as an imagined-seen object but as 'just' a seen-in object). Second, I will show how Walton's general pretense theory can help explain how a competent viewer can derive the appropriate image subject from the specific photographic image object.

2.2.2 Imagining Seeing the Image Object: On Walton's Theory of Depiction

Walton (1990) presents a theory of depiction that can be understood as further elucidating Wollheim's notion of seeing-in. Walton holds that when we understand a picture, we use the picture as a sort of 'prop' upon which we exercise our visual imagination, such that when we see the picture, that experience make-believedly counts as seeing the picture's subject. Wollheim's seeing-in is thus understood by Walton as an act of the imagination. When we see something in a picture, we are imagining seeing that thing, but simultaneously we are aware of the 'prop's' – that is, the picture's – actual properties. According to Walton, the recognitional fold may be interpreted as involving a particular instance of make-believe. By means of that fold, one make-believes that the perception of the

picture's vehicle, the state one entertains in the configurational fold, is the perception of the picture's subject.[17] For Walton, make-believe can generally be interpreted in terms of prescriptions to imagine, hence as a mixture of normative and mental elements.[18]

I think this characterization of seeing-in as make-believe seeing is problematic, though. «Walton's ambition is to account in pretense-theoretical terms what the twofold experience of seeing-in, which Wollheim took to be a necessary condition of depiction, amounts to. Yet relying on make-believe, hence on imagination, does not account for the genuinely perceptual character of the 'seeing-in' experience. No treatment of imagination in terms of visualization seems to achieve such a purpose» (Voltolini 2013, 43). In fact, a number of criticisms have been raised against it. First of all, there are legitimate doubts about whether visual imagination is an essential feature of picture perception (see, for example, Savile 1986; Newall 2011). Make-believe, as normally understood, typically involves a conscious effort – a suspension of disbelief that may be withheld – which does not typically occur in pictorial experience. If a child comes across a hobby horse, he may or may not choose to 'make-believe' that it is a real horse. In contrast, pictorial understanding is typically irresistible; one cannot normally look at a picture and choose not to understand it (see also Newall 2011).

Furthermore, Voltolini (2013) has persuasively argued against Walton's theory of depiction on both empirical and conceptual grounds.[19] On the one hand, there is much evidence from developmental psy-

[17] Walton (1990, 344, 349; 2002,32; 2008,137).

[18] Walton (1990, 39–41).

[19] I primarily focus on the criticisms raised by Voltolini (2013, 2015), which I find particularly persuasive. For additional critiques, see Wollheim (1998, 2003b), Budd (2008), and Nanay (2004). For Walton's responses to these objections, refer to Walton (2008a, 2008b). For an alternative analysis of *seeing-in* that centers on imagining, see Stock (2008).

chology showing that very young children, still unable to make-believe, can grasp a picture's figurative value. Moreover, it seems that we can perceive things unconsciously in pictures (as in the famous gorilla experiment),but imagining is a conscious mental state. As a result, Walton's theory of depiction seems inadequate from an empirical point of view. On conceptual grounds, then, it has been argued that the concept of a visual game of make-believe cannot capture the experience of seeing-in, because Walton fails to integrate the recognitional and configurational aspects of the experience – or at least fails to integrate them in the right way. In fact, «in order to capture Wollheim's claim that the recognitional fold, hence the whole seeing-in state, is a sort of perceptual state, for Walton the imagination that is involved in a make-believe perception must be given a perceptual flavor as well» (Voltolini 2015, 110). Now, as Voltolini stresses, «the only plausible way to do this is to account for imagination, at least in the case in question, in terms of mental imagery, hence in terms of visualization. All in all, therefore, to make believe that the perception of the picture's vehicle is the perception of the picture's subject entails visualizing that the perception of such a vehicle is the perception of such a subject. As a result, interpreting seeing-in in this way amounts to ascribing two different modes to the two folds» (ibid). Why is that so? On the one hand, the configurational fold of seeing-in is a genuine veridical perception, notably the perception of the picture's vehicle. On the other hand, the recognitional fold of seeing-in merely has a perceptual flavor, as it involves the visualization that the above perception is the perception of the picture's subject. Put in Walton's terms, such visualization ultimately amounts to visualizing of the first perception that its content is different from the content it actually has. Insofar as a perception having a certain content co-varies with its having a certain phenomenal character – the 'what it is like' of such a perception – such visualization also amounts to visualizing that the perception has a different phenomenal character. Yet insofar as both content and phenomenal character are essential for a mental state like perception, visualizing that

a perception has both a different content and a different phenomenal character is to visualize an impossibility. But visualizing an impossibility can hardly have a perceptual flavor, as we can hardly perceive the impossible (ibid., 111).

To be sure, Walton might weaken his claim and limit himself to saying, as he sometimes does, that the relevant make-believe activity involves the perception of the picture's vehicle merely as a prop. «This means that what is really true of the perception of the picture's vehicle determines certain make-believe truths about the perception of the picture's subject. From such a perspective, the perception of the picture's vehicle is no longer make-believedly the perception of the picture's subject. Rather, it simply prompts one to make-believedly perceive such a subject» (ibid.). Yet, as Voltolini points out, once Walton's position is so weakened, the latter make-believe perception may well involve one's visualizing the perception of the picture's subject, though it can no longer provide the mark of figurativity. *Pace* Walton, even the perception of a written text, rather than that of a picture's vehicle, may serve as a prop in a make-believe activity involving one's visualizing the perception of the picture's subject. While reading a verse of the *Iliad*, for example, that verse may prompt us to visualize Achilles killing Hector, just as seeing an ancient Greek vase might induce such a visualization. In either case, what is really true about the perception of what one is facing may determine what is make-believedly true about the perception of what one is not facing. Thus, this way of explaining depiction by better specifying pictorial experience is doomed to fail (ibid.).

These criticisms of Walton's explanation of seeing-in through make-believe are extremely persuasive. We can therefore maintain the broadly Wollheimian framework of pictorial experience I have adopted in the first two chapters without the need to understand seeing-in as an imagined seeing. Getting the image object of a picture is a matter of having a *sui generis* perceptual experience, seeing-in: we see a scene on

a marked surface, but there is no need to imagine that our act of seeing is the seeing of the image object.

And yet, I think Walton's general theory of pretense can be useful for understanding photographs and some of the particular ways they are used to represent temporal properties. In fact, what Walton's make-believe theory can explain is, rather than the depictive way a photograph represents, the interaction between depiction and detection. Let me unpack this suggestion in the next subsection. Then, in 2.4 and 2.5, I will apply it to two kinds of photographs that are usually taken to depict motion: streaky images and chronophotographs.

2.2.3 Detection (Through Depiction): Using Configurations and What We See as Props

What I would like to suggest now is that it is *detection* (in the case of photographs, though this account can apply to certain handmade pictures too), and not depiction, which can actually work through props and pretense. That is, when we use certain depictive characteristics of an image to acquire information detected by the camera, we are in fact playing a game of make-believe. When this happens, I claim, we are using depictive elements as props in a game of make-believe. But playing this game allows us to obtain, *non-depictively*, what an image actually (or probably) represents: it is a way to derive the appropriate image subject – or certain properties of it – from the image object, or certain elements of it. Let me expand on this, beginning with a brief overview of Walton's general pretense theory (PT).

In general, PT's point of departure is the human capacity to imagine things. Sometimes we imagine something without any particular reason. But in some cases, our imagining is prompted by the presence of a particular object, which then functions as a prop. An object becomes a prop due to the imposition of a rule or principle of generation that prescribes what is to be imagined in response to the presence of the object. If someone imagines something because of the presence of a prop, they are engaging in a game of make-believe.

Someone participating in such a game is *pretending*, and 'pretense' is simply a shorthand for describing participation in such a game, with no implication of deception.

PT considers a variety of different props, ranging from novels and movies to paintings, plays, music, and children's games. While we have already seen its shortcomings in explaining depiction *per se*, I will describe it here in general terms. Works of literary fiction, for instance, are regarded as props because they prompt the reader to imagine certain things. By doing so, a work of fiction generates its own game of make-believe, which can be played by a single reader or by a group listening to someone tell the story. Some rules of generation are ad hoc, as when a group of children spontaneously decide that tree stumps are bears and play 'catch the bear.' Other rules are publicly agreed upon and thus relatively stable. Games based on public rules are 'authorized'; those with ad hoc rules are 'unauthorized.' By definition, a prop is a representation if it is used in an authorized game. On this view, stumps are not representations of bears because the rule to regard stumps as bears is ad hoc. By contrast, *Moby-Dick* is a representation because anyone who understands English is invited to imagine its content, and this has been the case since the work was published. In PT, representations are not defined by their relation (e.g., resemblance or denotation) to something beyond themselves; rather, they are objects that serve the social function of being props in authorized games of make-believe.

Props generate fictional truths by virtue of their features and the principles of generation. Fictional truths can be generated directly or indirectly. Directly generated truths are primary, while indirectly generated truths are implied. The intuitive idea is that primary truths follow immediately from the prop, while implied truths result from the application of certain rules of inference. The principles of generation that generate primary truths are called principles of direct generation, while those that generate implied truths are principles of indirect generation. This distinction is evident in literary fiction. For instance, in Melville's *Moby-Dick*, the reader is told that Ishmael

travels in December from Manhattan Island to New Bedford, Massachusetts, to sign up for a whaling voyage. These are primary truths that the reader is mandated to imagine because they are explicitly stated in the text. The reader should also imagine that Ishmael is determined and relentless and that he has a heart and a liver, even though none of this is explicitly stated in the story. These are inferred truths, which readers deduce from the text using their background knowledge of human psychology and anatomy.

While, as we saw earlier, PT does not explain depiction, it does offer the resources to flesh out the idea that certain detective practices in photography resemble using a stump as a prop to imagine a bear – or something like it. Let's explore how this might work in the case of a photo-finish image, before considering streaky images and stroboscopic pictures.

What we properly see in a photo-finish image are various horses and riders at different locations in a single moment across a relatively broad spatial area. This is the image object of the photograph. Naïve viewers will interpret the photo as a typical snapshot – because it looks very much like one – where the entire film is exposed to a whole scene at one moment. Thus, they take the image subject to be just that: a series of horses *tête-à-tête* at the finish line. However, a competent viewer – someone who knows how strip photography works in producing photo-finish photographs (an engineer, a jury member, etc.) – can use the image to extract other information encoded in the photograph. This requires decoding the image in specific ways, treating the image object as standing for something else. When they do this, they use a prop – both as a material configuration (a marked surface, a pattern of light and dark) and as a visible depictum (an element or a series of elements seen inside the pictorial space, the image object or parts of it) – to engage in a game of make-believe.

The photograph, the image object, becomes a prop because a community imposes certain rules – rules that, in the case of mechanically produced images like photo-finish photographs, are partly determined

by technological constraints, such as what the camera can detect and how it does so. These rules, or principles of generation, prescribe what is to be imagined in response to the image object. In this sense, the rules governing the correct interpretation of a photo-finish picture are not ad hoc but publicly agreed upon. This leads to an important distinction: in the case of photo-finish images, two games can be played using the same image object as a prop. Competent viewers play an authorized game based on public rules that drive authorized imagining. Naïve viewers, on the other hand, play an unauthorized game, using a different rule that applies to a different kind of game – one that ties the image object of a snapshot photograph to an actual real-life referent.

For Walton, unauthorized games do not result in representations because a prop is a representation only in an authorized game. However, in the case of photo-finish images, things are different: the game naïve viewers play is not ad hoc, but based on a rule that appropriately applies to a different context – snapshot photography, where, as we have seen in Chapters 1, there is no separation between an image object and an image subject. This is why the images are still considered representations, even though, in the context of interpreting the detected features of a photograph, the game naïve viewers play is unauthorized. In fact, the two types of viewers, by playing different games of make-believe with the same prop, generate different fictional truths about the image subject. For competent viewers of photo-finish images, the image object as a prop generates certain fictional truths by virtue of its visible features combined with specific principles of generation. Certain features of the image object (e.g., the positions of the horses, the background lines) are interpreted using specific rules (e.g., 'the image shows a variety of times at a fixed location'), which generate fictional truths about the actual state of affairs that the camera tracked.

As I mentioned earlier, this framework can be useful not only for explaining photo-finish images but also for two other forms of representing motion through photographs: streaky images and chronophotographs. Before proceeding, I would like to make two final remarks.

First, we should immediately guard against a frequent misconception. Saying that fictions can contain characters and places that do not exist is not tantamount to saying that photographs, paintings (or indeed literary fictions), are plain falsities (for such concerns regarding Walton's original theory applied to photographic images, see Carroll 1995, Lopes 1996, Currie 1995). The fiction view neither claims nor implies that photographic images are untrue fabrications containing no factually correct information about their subjects. Fiction – whether scientific or literary – is not defined by its falsity. Historical fictions like Tolstoy's *War and Peace* contain many true elements, and the fact that a government report may be at variance with fact in some places does not make it fiction. What defines a text as fictional is not its falsity but the attitude the reader is expected to adopt towards it. Readers of a novel are invited to imagine the events and characters described, and they are not meant to take the sentences they read as factual reports, let alone false reports. Imagination is neutral with respect to truth. Nevertheless, literature often provides insight into reality. As we read, we may engage in comparisons between the fictional situations and real-life experiences, learning about the world through fiction. Similarly, in the context of photographic detection, we learn about the real-world situation that a photo-finish image has tracked by examining certain elements of it. Once we think of using depictive elements to support the detective function of photography as akin to fiction, the parallel becomes clearer, prompting us to consider how the 'knowledge transfer' from a fictional scenario to the real world occurs. In the context of mechanically produced light images, this transfer involves taking the fiction to represent the targeted visual array that caused the impression. I will explore this in more detail when we discuss a specific kind of long-exposure photograph in the next section. For now, it is important to note that the fiction view is not committed to the nihilist position that all photographs are falsities disconnected from reality.

Second, it should be clear that this kind of representation is a form of 'mere' representation, not an example of a proper and peculiar kind

of pictorial representation. That is, the way competent viewers extract information – fictional truths – using the image object as a prop is not a type of pictorial interpretation, but rather a particular instance of a broader practice that can occur in various contexts. The only truly depictive form of representation, in my view, is the direct experience of seeing the image object. Keep this in mind as we proceed to discuss streaky images.

2.3 Streaky Images

Perhaps the most obvious way to represent motion in photographs is through the use of long exposure. This results in a blurred, or streaky, image. To produce streaks, long-exposure photography requires motion – a 30-minute exposure of a static object and surroundings would be indistinguishable from a short exposure. Specifically, streaky images can result from two different kinds of movement. On the one hand, a streak can be the photographic result of a moving object tracked by a stationary camera (set with a long exposure). On the other hand, streaks can result from the motion of the camera itself – what are technically called intentional camera movements (ICMs).[20]

There are only two accounts in the literature on depiction that address how streaks represent temporal properties: one by Benovsky (2012) and the other by Kulvicki (2016). Both, however, focus solely on the former kind of streaks, leaving the latter unexplained. In what follows, I mainly focus on Kulvicki's account. His view, though not elaborated within a Maynardian framework like the one outlined above, considers photographs under Haugeland's notion of recording, which is quite similar to Maynard's concept of detection. After discussing Kulvicki's view (2.3.1), I argue that what he considers pictorial

[20] You can see plenty of visual examples here: https://en.wikipedia.org/wiki/Long-exposure_photography.

interpretation is, in fact, not properly depictive (2.3.2), and that we should understand streaks in light of the framework I have elaborated in the previous section (2.3.3). Finally, I extend the Waltonian view by considering particular instances of long-exposure photographs that are artistically significant, arguing that it is the tension between the image object and the image subject that constitutes (part of) their aesthetic value (2.3.4).

2.3.1 Kulvicki on Recording (and Depicting) Temporal Patterns

For Kulvicki (2016, 336), «in addition to being representations, long-exposure photographs are recordings: they witlessly register aspects of scenes in a manner that can be replayed». Kulvicki emphasizes that the notion of recording is a valuable and often neglected tool for investigating representational practices: aspects of what photos record also figure in their representational contents, and this provides a way of approaching the photography of events in time. Kulvicki notes *en passant* (2016, footnote 1) that Maynard, in developing his reflections on detection, is the only one to have made registration central to a discussion of photography. And yet, in developing his own account, Kulvicki does not follow Maynard's concept of detection, though he carefully acknowledges ideas from John Haugeland, which he has adopted and adapted.

Following Haugeland (1998), Kulvicki (2016, 336) understands a recording as «a state of affairs that relates to another in an asymmetric, mindless, replayable fashion». In a subsequent paper, where he specifically distinguishes representations from recordings, he writes that «while representations have an intentional character, recordings are relational. The relation between a recording and what it records is witless, and it allows playback» (Kulvicki 2017, 271). *Witless* means that «the process is causal, and as long as everything is working properly, no wits are required. [...] Wits might be prerequisite to making such machines, but recording processes don't require those wits» (ibid.). «Playback is a witless process whereby that which is recorded can be reproduced» (id. 272). For Haugeland (1998, 180), playback

ideally yields precisely what was recorded, so what gets recorded must be something that can be multiply instantiated – a pattern. Although an object or image is commonly called a 'recording,' a recording is a relation, not a particular kind of object. It is a state of affairs that relates the event it records to a reproduction of that event. Specifically, a recording supports the reproduction of an abstract pattern: it relates one instance of a pattern to another instance of the same pattern.[21] Descartes may be the source of a recording, but it is not possible to record Descartes himself because he is a unique object that cannot be reproduced. However, it is possible to record a pattern of light and dark caused by an object or scene and reproduce that pattern. A photograph of Descartes would reproduce the light and dark pattern recorded when he stood before the camera.

Kulvicki then discusses the distinction between recording and representation. The visible pattern witlessly reproduced by a photographic recording process may be taken up as the intentional content of a representation (for example, a man jumping behind the Gare St. Lazare), but witless recordings can exist independently of representation (such as the temporal aspect of a photo finish), and many representations contain only intentional content without any recorded content (as in paintings, for example). Photography was conceived as a technology for both natural and mechanical reproduction as well as for producing pictorial representations, and, as Maynard extensively showed, this interplay of functions has a complex developmental history. As Wilson (2022) notes, «Kulvicki does not suppose that photographs are fundamentally representational; instead, he has a functional account that explains how some, but not all, photographs acquire intentional content and serve as representations». Haugeland's notion of recording,

[21] Not all abstract patterns can be recorded. «We can record patterns of features: features that can enter into causal relations and thus participate in witless processes» (ibid).

elaborated by Kulvicki, highlights the fact that recording is a mindless way of transducing and reproducing patterns, and photography is, in part, a recording process. In daguerreotypes, for example, «the pattern burned into a sheet of silver records a pattern of light and dark and also serves as a playback of that pattern because it is the pattern of light and dark that was recorded. Just look, and you see, reproduced, the pattern that caused it» (Kulvicki 2017, 272). This two-dimensional abstract pattern of light and dark, witlessly registered, constitutes for Kulvicki the aspect of photographic content that is non-negotiable, as it includes only recorded features of scenes. «We rarely, if ever, interpret photos as representing nothing but what they record, though aspects of what they record always figure in pictorial content,» but «negotiations over pictorial contents are framed by a non-negotiable core, understood in terms of what, minimally, the depicted scene must have been like to produce such a photo».

Focusing on this notion of recording, Kulvicki frames and then answers three questions about streaky images – still images of things in motion that «use surface features usually devoted to recording things in space to record aspects of a temporal pattern» (id., 338). First, what do such photos record about temporal patterns? Second, which aspects of such recordings also show up in photos' representational contents? And third, do these pictures depict, rather than merely represent, such temporal patterns?

Before looking at how he answers these questions, let's first see how he defines a temporal pattern. For Kulvicki, a temporal pattern is an arrangement of features at least partly constituted by the manner in which things happen over time. This can include change, and it is more interesting when it does, but it is not necessary – stillness, after all, is a temporal pattern too. To the first question – what can a photograph record about a temporal pattern? – Kulvicki answers that «streaky photos record 2D aspects of the paths and relative velocities of moving objects by appealing to the length, shape, and transparency of streaks on the picture surface. They might also record aspects

of duration […]. They record nothing about the directions in which things move on their paths» (id., 340). Let me explain and expand on Kulvicki's statement.

First, streaky photos record 2D aspects of the paths of moving objects, as photography in general records 2D aspects of a scene, given its very nature. Second, streaky images register aspects of the relative velocities of moving objects. In general, the length of the path, together with its opacity, does indeed record the object's relative velocity. Two paths of equal length, for example, that differ in opacity indicate that one object spent less time traversing the same distance than the other and thus had less effect on the photosensitive material during the trip. Given what has been said so far, one might conclude that two streaks, one shorter and more opaque than the other, indicate two objects such that one moved slower and over a shorter distance than the other. This is true, as long as we assume that the objects move parallel to the picture plane and do not change in size. Movement in 3D space undermines such rules. Very fast motion away from the viewer makes a much shorter streak than similarly speedy motion parallel to the picture plane. Third, streaky photos indeed record durations and temporal extensions by registering motion over a specific temporal span. Fourth, even if they are oriented spatially, streaky photos do not record the directions in which things move on their paths: spatial orientation is not recruited to record events' temporal directions. Consider two photos of two scenes that differ only in that a ball moves from left to right in one, and right to left in the other. The photos might indicate motion – they are streaky – but they do not have distinctive features corresponding to the different directions in which the ball moved. This fact transcends differences in exposure time. «Direction across space, over time, is lost in the temporal-timeless collapse» (id., 339). So, this is what streaks register about temporal patterns.

As for the second question – what aspects of such recordings show up in photos' representational contents? – Kulvicki points out that, as with other photographs, some but not all of what is recorded shows

up in representational content, and content often outstrips what such photos record. Photos are limited to recording 2D aspects of motion, but the same is true of how ordinary photos record space. All photos, when thought of as pictures, represent much richer scenes than they record. Those richer scenes interact with how streaks are interpreted. In fact, for Kulvicki, streaky photos allow for negotiation in much the same way other pictures do. «The way this works shows how such photos might depict temporally extended episodes. Confining ourselves to the patterns on a picture surface leaves the streaks relatively inarticulate, but they are nevertheless traces of patterns in time. If we are treating such photos as pictures […] we might understand some streaks to represent objects moving in the depicted space, perhaps away from the picture plane» (id., 340). Like other aspects of a photo, streaks can be interpreted as inhabiting a represented 3D space, picking out objects moving in that space. «So, it is not just that photos record such aspects of things in motion. These features seem to work their way into pictorial representational content» (ibid). For Kulvicki, photographs not only record aspects of temporal patterns, but some of these aspects also feature in the representational content of the photograph.

This fact leads Kulvicki to answer the third and final question – do streaky photographs depict temporal patterns? – in the affirmative. For him, streaky photographs can indeed depict temporal patterns, even though the photos themselves are timeless. It is true that these photos need not be interpreted in a temporal way: it would be possible, for instance, to interpret them as a photo of another photo, or as a photo of semitransparent plexiglass extrusions arranged in space and photographed, which produce results strikingly similar to photos of things in motion. In these interpretations, motion and time are excluded and play no role. «Yet, in ordinary practice, these last two interpretations are not salient» (id., 341). However, for Kulvicki, «it helps to notice that they fit the bill as possibilities,» because the alternatives open to interpreters of streaky photos suggest a more general claim about depiction: some pictures call out to be interpreted as representing patterns in

time, and all of them can be interpreted in this manner (ibid). Streaks are important cues for this because in such cases, alternatives to temporal patterns are unappealing as interpretations. And we do not interpret pictures as representing flat patterns, such as other pictures, unless explicitly told to do so. Speedy objects, by contrast, are common and interesting objects for photography. «Pictorial interpretation generally is open to temporal patterns. […] In sum, interpreting streaky photos as pictorial representations of temporally extended episodes is reasonable because doing so fits with how we interpret photos as representing richly detailed, if static, 3D scenes» (id., 342). In a Gombrichian spirit, Kulvicki suggests that «we always augment what a photo records when interpreting it, with the restriction that the augmentation does not conflict with what gets recorded». And for his conclusion, he says: «The upshot is much more general than the focus on streaky photos might suggest. A temporal dimension is always available for the interpretation of pictures, photographic or not, streaky or not. Pictures do not just reduce spatial and chromatic dimensions of appearance, but also – very often – they capture temporal patterns timelessly» (ibid).

I agree with Kulvicki's thorough analysis regarding the first two points: photographs do indeed register aspects of temporal patterns, and some of these aspects can figure in representational content. However, I disagree with his claim that the interpretation leading from the apprehension of streaks in the pictorial space constitutes a properly pictorial interpretation. I will unpack this critique in the next subsection and offer an alternative account, one based on the Maynardian/Waltonian framework elaborated above.

2.3.2 Is This Really Pictorial Interpretation?

Kulvicki's emphasis on registration is very useful for understanding these, and similar, photographic instances. However, it leaves some important questions unresolved. How do we move from the recorded features to their meaning? In other words, how can spectators fully grasp them as representations? What guides their interpretation? And,

crucially, is this truly a pictorial interpretation? It seems that what Kulvicki identifies as pictorial interpretation is not so much on the depictive side of our engagement with images but rather falls within the realm of detection. If this is the case, it would imply that, while streaky images can represent temporal patterns, motion, and change, they don't do so through depiction.

A preliminary observation concerns Kulvicki's overall methodology, which is distinct from that of other philosophers in the debate. As he stresses, «most of what has been said about the representation of time in still pictures proceeds from the top down: how do we experience such photos, and how might time figure in such experiences? How might this or that account of depiction accommodate the depiction of things in time by still photographs? » (id., 336). In contrast, Kulvicki proceeds from the bottom up, focusing on recording, representational content, and temporal events. Nevertheless, he does not offer a clear definition of how depiction qualifies as a special form of representation, even in a loose sense.

Although Kulvicki's approach is enlightening in numerous ways – especially regarding the relationships between recorded features and representational content – it leaves some gaps. Specifically, it's unclear what a proper pictorial interpretation entails or how it might differ from other forms of interpretation, such as linguistic interpretation.[22] Towards the end of his paper, Kulvicki addresses a concern raised by an anonymous reviewer, who notes that «streaky photos certainly have a more conventionalized feel than those that are not, and this might make some worry that these pictures do not depict motion so much as represent it nonpictorially» (id., 344). Kulvicki responds by sug-

[22] For a deeper understanding of Kulvicki's theory of depiction, refer to Kulvicki (2006). Additionally, his latest book, *Modeling the Meaning of Pictures*, offers an original and comprehensive framework that explains how different pictures acquire their unique contents.

gesting that the conventionalized feel might be rooted in historical or perceptual contingencies or in the nature of depiction itself. However, because he does not commit to a specific theory of depiction, it remains difficult to see why this interpretation should count as properly pictorial rather than as a general interpretive practice.

For instance, a bubble chamber records the motion of particles and is often presented as a photograph showing a series of streaks. Is interpreting these particle streaks a pictorial interpretation? It does not seem so. Interpreting such images as the motion of particles is context-dependent and typically requires knowledge of the recording process – physicists familiar with the cause of the streaks interpret them as particle tracks. Meanwhile, naïve viewers might only see an abstract pattern. While streaky images are often less abstract, the interpretation still appears to be contingent upon knowledge of their production. Viewers need to know how these streaks are created to understand them as traces left by light emitted from moving objects onto a film or sensor.

As a counterpoint to concerns about the conventionalized nature of motion marks, Kulvicki cites prehistoric examples, claiming, «there is good evidence that the earliest known examples of pictures, at Chauvet cave, were made with time and motion in mind […] There, the strategy for suggesting time leaned on superimposition, not streaks» (ibid). Yet, while this example shows that motion can indeed be depicted, it does not necessarily prove that streaks are inherently depictive. Additionally, historical evidence suggests that early viewers of long-exposure photographs often interpreted blurry, semitransparent streaks as ghostly apparitions. This seems at odds with the supposed automatic perception involved in depiction.

In *Behind the Gare St. Lazare*, for instance, we don't need to know the photo's production process to see a man jumping over a puddle (as discussed in Chapter 1). With streaky images, however, our immediate perception of the image is quite different from the content we take it to represent. The visual experience of streaks as material elements populating

the pictorial space differs from our interpretation of these streaks as motion trails. This interpretative shift, much like that required with a photo finish image, relies on knowing how the image was produced. The billiard ball streaks are interpreted as motion markers because we understand that they result from tracking a moving object with a long exposure.

Benovsky (2012) seems to suggest otherwise, claiming that streaky images can depict change and temporal extent by allowing us to see the various parts of an object's trajectory. He writes, «When observing the photograph of the man at the train station […] we have a sort of 'helicopter-like' perspective on the space–time trajectory of the man and the train» (Benovsky 2012, 207–208). However, we don't actually see the man's changing position. Rather, what we perceive are streaks that we interpret as motion traces based on our understanding of long-exposure photography.

Consider a more extreme case, such as solargraphy.[23] This technique involves using a fixed pinhole camera to expose photographic paper over a long period, capturing the Sun's path across the sky over months. The resulting streaks, representing days, form an abstract pattern that might require considerable background knowledge to interpret correctly. Without understanding how the image was created, one might struggle to recognize the subject. This case reinforces the notion that such interpretations are heavily reliant on external information.

Thus, while augmenting our understanding of a picture is common, as Gombrich noted, there are clear limits to this augmentation. Much of it can rely on non-depictive elements. For long-exposure images, there are compelling reasons to place the streaks in the realm of non-depictive augmentations. In the following subsections, I will explore how we interpret these images using Walton's pretense theory, as applied to photo finish, and how this framework helps us understand the aesthetic potential of long-exposure photography.

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[23] For an example see https://en.wikipedia.org/wiki/Solarigraphy.

2.3.3 Not Depiction but Pretense. Using the Streaks As Props

What we properly see in a streaky image are various streaks that populate the pictorial space, connecting certain objects to other parts of the pictorial space. This is what the image object of the photograph is. In this sense, the streaks are clearly depicted elements – we see them inside the pictorial space. While it seems more 'natural' (easier, in a way) to interpret them as what they really are – streaks left by a moving object on the film/sensor that detected them – than to interpret, for example, what a photo finish image properly stands for, we have seen that it is *prima facie* not so straightforward to treat this interpretation as a proper pictorial interpretation.

As I have just suggested, streaks seem to lie more on the detective side of photographic imagery: they are the visible effects resulting from the exploitation of a properly photographic technological contingency – exposure time. The camera detects and registers the motion of an object, which, in the imagistic playback medium proper to photography, results in a visible streak. The fact that the competent spectator knows this allows her to use certain elements of the image object – the streaks – as props in a make-believe game. These games are determined by certain principles of generation, understood as rules publicly agreed upon and based on a technological fact: that tracking a moving object with a long exposure leaves certain traces on the film/sensor. Naïve spectators – perhaps those who first encountered blurry daguerreotypes – might have taken the streaks and their transparency to represent ghostly appearances, for example, playing a completely different game. It would be an unauthorized game, to be sure, but still a possible one.

Kulvicki's reviewer noted that streaky photos certainly have a more conventionalized feel than those that are not, and this might lead to the concern that these pictures do not depict motion so much as represent it non-pictorially. Conversely, streaky photos seem much easier to interpret – it seems we do it automatically – than, for example, a photo finish, and this might raise the concern that these pictures, after all, really do depict the motion of their subject matter, i.e., that we really

interpret them pictorially. I think that Walton's pretense theory (PT) has the resources to explain why this is so.

Firstly, the principles of generation seem, today, so internalized as to appear almost imperceptible. We are so accustomed to long-exposure photographs and the rules that guide their reception that we follow these rules and play these imaginative games almost mindlessly. By contrast, photo finish pictures ask us to apply more alien rules, which makes it more difficult to engage in pretense and to arrive at accurate fictional truths concerning the real-world event they tracked. But there is also another reason why streaks make it easier to generate fictional truths concerning their actual image subject. As Kulvicki showed in his thorough examination, streaks allow for the appropriate recording of a great number of aspects, which can then be profitably exploited in the depictive-detective interaction to guide, very effectively, the spectator's imaginings in her (authorized) games of make-believe.

In streaky images, the streaks as depicted elements make it easier to imagine what they stand for – the actual motion of the balls. It becomes easier to follow the rules guiding the game of make-believe and thus to extract the detected information from the *depictum* which encodes it. We can see the totality of the streaks, and from this visual experience, it is easy to imagine that what we are seeing is, in fact, the motion of – the changes undergone by – the depicted object during the interval of exposure time.

All in all, this shows that in streaky images, motion can indeed be part of the overall representational content, but not thanks to a peculiarly pictorial interpretation. Rather, it is due to the fact that they effectively guide the imagining of competent spectators.

In the next subsection, I will consider particular ways in which streaks due to long exposure have been exploited to produce certain kinds of images and effects. This will allow me, on the one hand, to further elucidate my proposal, and on the other, to suggest the aesthetic role that pretense applied to the depictive-detective interaction can play.

2.3.4 The Interplay of Perception and Imagination in the Aesthetic Appeal of Streaky Images

In artistic practices, long exposure and the streaks – or peculiar effects – that result from it seem to be particularly aesthetically interesting.[24] In what follows, I suggest that this is partly because of the interplay between detection and depiction, via pretense.

One way artists have exploited long exposure photography to obtain peculiar effects is through the technique known as light painting. This technique consists of moving a light source while taking a long exposure photograph, thereby 'drawing' something with the light.

Perhaps one of the most famous series of light paintings is Gjon Mili's photographs of Pablo Picasso.[25] In them, we can see Picasso with a light bulb in his hand, having just drawn what looks like an abstracted object – e.g. a centaur. I think part of the aesthetic interest in such pictures derives from the fact that, even if the spectator knows how the picture was produced, they are left undecided about how to interpret what they see. In my view, the image object – what one properly sees in the image – is Picasso standing in a room behind a series of luminescent streaks, curiously composing the messy outline of one of his centaurs. The competent spectator, knowing how such an image is produced, can follow the appropriate principles of generation and engage in make-believe, imagining that the streaks are the traces left on the film by Picasso's movement of the light bulb over a span of time. And yet, the strange, luminescent, almost

[24] In scientific contexts too, the interplay between depiction and detection can be exploited. This makes long-exposure photographs epistemically valuable. Take for example solargraphy: from these images, we can extract different information about the path of the sun in the sky (or, better, about the rotation of the Earth).

[25] See here for visual examples: https://www.life.com/arts-entertainment/behind-the-picture-picasso-draws-with-light/ .

painterly silhouette, behind which we see Picasso, constantly asserts its immanence – a physical existence as a spatial, material object with the same reality as Picasso himself. This tension between the perceptual experience of the light painting as part of the image object and the pretense or imaginative game we play to understand it as an image subject – a recording of an event – seems, to me, to be one of the aspects of our engagement with these photographs that makes them aesthetically valuable.

Another aesthetically interesting use of long-exposure photography is in night photography. In night-time settings, where the lack of light forces longer exposures to retain maximum quality, long-exposure photography is often employed. Increasing ISO sensitivity allows for shorter exposures but reduces image quality by lowering dynamic range and increasing noise. By leaving the camera's shutter open for an extended period, more light is absorbed, creating an exposure that captures the full dynamic range of the camera sensor or film. If the camera remains stationary during the exposure, a vibrant, clear photograph is produced, often capturing the traces of moving objects. This technique is frequently used to capture the streaks left by car lights on a dark road or the trails of insects flying in front of bright light sources.[26]

In the latter case, we marvel at the beautiful and chaotic series of streaks, which are seen as an abstract pattern. At the same time – since we know it is a long-exposure photograph – we are required to imagine the chaotic flight of numerous insects on a dark but brightly illuminated night. Again, I believe the interplay between the depictive and detective elements is an aesthetically valuable aspect of these images.

[26] See here for visual examples: https://en.wikipedia.org/wiki/Night_photography .

Heinrich Heidersberger's *Rythmogram* represents a variation on light paintings that is more difficult to see as an event.[27] Heidersberger began experimenting with luminography – the recording of a light source in motion – in the early 1950s. He was fascinated by the idea of making light itself the object of the photograph. He built a device, which he called a *Rythmograph*, to record traces of light directly on photographic material. Using four harmonically dampened pendulums, Heidersberger created traces of light on photographic material via a mechanically linked mirror and a point source of light. Three-dimensional images are produced by controlling the frequency, phase difference, amplitude, and transmission of the pendulums – two driving the mirror vertically, and two horizontally. He named the resulting pictures rhythmograms.

Heidersberger's rhythmograms have a three-dimensional aspect that makes them harder to interpret as traces of events. Even knowing that the figure above is the result of moving light sources, it is difficult to interpret them that way. Without external cues explicitly telling us that these are the traces of moving light, we tend to view them as beautiful, abstract shapes. And yet, when we know they are traces of motion, the images gain complexity and enhanced aesthetic value, again stemming from the tension between depiction and detection, between seeing and pretending.

Let's consider a few final cases where the moving element during recording was not the tracked object, but the camera itself. In intentional camera movement (ICM), the camera is moved during the exposure. This causes image points to move across the recording medium, producing an apparent streaking effect in the resulting image. The effect depends significantly on the direction and speed of the camera's movement relative to the subject. For example, forward

[27] See here for visual examples: https://www.heidersberger.de/pages/heinrich_heidersberger/photographie/english.html

(or backward) camera movement typically produces streaks that converge at a central point, giving the appearance of a long tunnel. A similar effect can be achieved by changing the focal length of a zoom lens during exposure. Intentional camera movement is, in a sense, the same effect as intentional motion blur: in the former, the camera moves during exposure, while in the latter, the target moves – but both involve relative motion between camera and target, resulting in streaks in the final image.[28]

In these cases, the causal conditions of the photograph's production incorporate the streaks as elements that 'prescribe imaginings' to the competent spectator. In ICM, what we are required to imagine is the motion of the camera itself, not the motion of what it tracked. In this sense, knowledge of the photograph's causal conditions can add an element to the appreciation of the picture: the depictive streaks, which permeate the overall image, guide the imagining of the camera's motion. This interplay between detection and depiction creates an intriguing and aesthetically appealing experience.

Another example of streaks determined by the motion of the frame of reference, rather than the depicted object, is star trail photography (or solarigraphy, as discussed earlier). A star trail photograph uses long exposure to capture the apparent motion of stars in the night sky due to Earth's rotation.[29] This technique shows individual stars as streaks across the image, with longer exposures producing longer arcs. Typical shutter speeds for star trails range from 15 minutes to several hours, though blending multiple frames together is now a more practiced technique for creating these images.

Though these images are streaky, they do not register the motion of the stars themselves. Instead, they capture the motion of the Earth (or

[28] See here for visual examples: https://en.wikipedia.org/wiki/Intentional_camera_movement.

[29] See here for visual examples: https://en.wikipedia.org/wiki/Star_trail.

more precisely, the plane on which the camera is fixed). The abstract circular patterns in these photographs seem to invite the viewer to interpret them as beautiful geometric shapes. However, when we imagine them as representing the apparent motion of stars or the Earth's rotation, the images gain intrigue and awe. Again, it is the interplay between depiction and detection that produces this particular aesthetic effect.

I am not suggesting that these images are aesthetically valuable *only* because of the interplay between depictive and detective elements, between the visual experience of the image object and the imaginative game we play to uncover what it actually detected. I am merely proposing that this interplay may be one element that helps explain why we find these pictures and their experience to be particularly aesthetically interesting.

2.4 Chronophotography and Futurism

Another technique used to represent motion in pictures – both in photographs and paintings, as we will see – is the immobile equivalent of stroboscopic motion. Stroboscopic motion occurs between visual objects that are essentially alike in their appearance and function in the whole field but differ in some perceptual features, such as location, size, or shape. The static result of such an effect derives from the multiple-image technique. I will refer to this schema as *static stroboscopy*.

The multiple-image approach to representing motion emerged only in the late 19th century with the advent of fast film, fast lighting, and the photographic work of Eadweard Muybridge (1830–1904) and Étienne Jules Marey (1830–1904). Muybridge captured single shots in succession, effectively producing a series of static images. Dynamism is then recovered in the final composition, which involves juxtaposing these individual shots in sequence. At the same time, in France, Marey conducted similar studies on movement but developed a different method: *chronophotography*. This technique involves producing photographs that contain various positions of a moving subject, captured in different fractions of time within a single image. This is possible thanks to the regular and continuous opening and

closing of the lens shutter. Chronophotographs depict the same object at multiple locations within the same picture.[30]

Chronophotography clearly influenced Futurists like Giacomo Balla (1871–1958) and other avant-gardists, such as Marcel Duchamp (1887–1968). Instances of this technique can also be found in popular culture, particularly in comics (see McCloud 1997).

In 2.4.1, I briefly review the development and variations of chronophotographs. Then, in 2.4.2, I explore what they can reveal about temporal patterns. In 2.4.3, I argue that their effectiveness stems from a natural cognitive tendency Massironi called *cognitive drag*. However, as I demonstrate in 2.4.4, this does not necessarily mean they are examples of depiction. Instead, we should understand them as another instance of interpretation derived from the interaction between depictive and detective elements, facilitated by *pretense*. Finally, in 2.4.5, I apply my view to Futurists' pictures.

2.4.1 Marey's Chronophotographs as Recordings

In 1878, the world was amazed by the photographs of horses taken by Eadweard Muybridge at Stanford's Palo Alto Stock Farm in California. To take these photographs, Muybridge used a series of 12 to 24 cameras arranged side by side, opposite a reflecting screen. The shutters of the cameras were released by the breaking of attached threads as the horse dashed by. Through this technique, Muybridge captured sets of sequential photographs depicting successive phases of the walk, trot, and gallop.

Over the years, Muybridge continued studying and photographing the movement of various subjects, producing numerous series on animals and human beings in motion. He always presented his subjects as a series of separate photographs, relying on the translational symmetry

[30] See here for visual examples: https://en.wikipedia.org/wiki/Chronophotography#:~:text=Chronophotography%20is%20a%20photographic%20technique,as%20reference%20material%20for%20artists.

of an identical background – typically a gridwork pattern – seen across the separate images.

Muybridge's photographic analysis of movement coincided with the studies of French physiologist Étienne-Jules Marey, who was developing chronophotography. In the late 1850s, Marey's interest in locomotion led him to invent mechanical and pneumatic devices directly attached to his subjects, which activated a pen resting on a band of moving paper to graphically record skeletal and muscle movements. Unlike Muybridge, whose interest was in how movement looked, Marey's aim was to understand how movement worked. His goal was to create lasting images of the mechanics of moving bodies, which he hoped would lead to a better understanding of human locomotion.

This pursuit of a technique that would simultaneously display the relationship of all the body's moving parts in both time and space led Marey to photography. He designed the *fusil photographique* (the photographic gun), a portable camera with a single circular revolving plate on which consecutive exposures were recorded at precise time and distance intervals. Unlike Muybridge's famous series of separate photographs, Marey's technique produced twelve overlapping images on a single photograph. Whereas Muybridge had succeeded in decomposing motion into individual frames, Marey concluded that displaying sequential movements on the same plate would yield more factual information. He began perfecting the decomposition of motion into even thinner slices of time. As Hirsch (2017, 169) explains, «The quest was to picture a body's "all at oneness" – to picture time as a progression of events in which patterns blend and circulate together and can be simultaneously observed». Through this method, Marey created systematic multiple exposures on a single plate, which he called chronophotographs. In essence, chronophotography captures multiple sequential movements of an object and reproduces them on a single image.

While Muybridge employed multiple cameras to record distinct, separate images of successive stages of movement, Marey used just one camera to capture an entire sequence of movement on a single plate.

That's why chronophotographs are the kind of images I am interested in for this section – they reproduce different phases of motion in a single frame. Chronophotographs show the same object at different locations within the same picture. The sequence of locations forms a simple, consistent path, and the internal changes of the object – for example, the changing posture of a leaping athlete – occur gradually. In *Chronophotographic Study of Man Pole Vaulting*, the chronophotographic technique results in a series of images of the same naturalistic and recognizable subject, superimposed and overlapping on the same plate. As Hirsch (2017, 170) notes, «This new way of making pictures re-educated the eye, expanded the visual syntax, and revolutionized the representation of the passage of time».[31]

However, Marey felt that his photographs contained too much information. If the shutter speed was too slow, the images were too blurred to measure; if set too fast, the photographs contained too many overlapping images.

In 1883, Marey explained:

[31] As we will see later, artists studied Marey's and Muybridge's images to represent humans and animals in motion, with their works resonating in later avant-garde movements. Marey's chronophotographs, in particular, significantly influenced the Futurists. Beyond art, Marey's descriptions of human locomotion were also applied to physical training programs and reshaped how industrial work was performed on assembly lines. His techniques played a crucial role in refining efficiency in these settings. Moreover, Marey's cinematic-like camera became a cornerstone of the motion picture industry. Although he never produced moving pictures, Marey's method of recording a subject with one camera from a single vantage point was pre-cinematic in concept. He even created a film projector (1892) to analyze his motion studies. In essence, Marey reinvented the camera, transforming it from a tool that captured a single moment into one that recorded a flow of moments. Both his and Muybridge's work made substantial contributions to the field of motion study and the development of the motion picture. For more on the representation of movement in the late nineteenth century, see Ellenbogen (2010) and Hirsch (2017).

> In this method of photographic analysis, the two elements of movement, time and space, cannot both be estimated perfectly. Knowledge of the positions the body occupies in space requires complete and distinct images, but to obtain such images, a relatively long temporal interval is necessary between successive photographs. However, if the goal is to perfect our understanding of time, the only way to do so is to increase the frequency of images, which forces each to be reduced to mere lines (cited in Douard 1995, 188).

Striving to combine the simplicity and precision of his graphical method with the speed and accuracy of chronophotography, Marey developed what he called *geometric chronophotography*.

> A man dressed entirely in black, and thus invisible against a dead-black background, wears bright points and lines – silver strips attached to his clothing along the axes of his limbs. When this man, so rigged, passes in front of the apparatus, the resulting photographs will produce accurate diagrams, to scale, showing without confusion the posture of the upper and lower arms, thighs, lower legs, and feet at each moment, along with the oscillations of the head and hips (Marey 1902, 323).

Through geometric chronophotography, Marey was able to decompose time into its 'elements.' He created a simplified geometry to reveal how continuous motion is built from a discontinuous series of movements. For Marey, «chronophotography renders visible the normally invisible phases of motion or positions in space the body occupies. The data provided by chronophotography represent the real phases of movement, which persistence of vision represents as continuous duration: the fast shutter speeds decompose movement in a way the eye cannot» (Douard 1995, 195–6).

With Marey's method, the images of various phases of motion sometimes overlapped, but it was easier to see and understand the flow of movement. As Cutting (2002) notes, «Marey's technique was technically simpler than Muybridge's. It was also perceptually much

more successful, at least as suggested by the plethora of imitators. Using a single set of environmental coordinates generated by the still camera, Marey typically superimposed images in a single photograph, a technique that has since been used effectively in both art and science to depict motion».[32]

Despite this, I do not think chronophotographs are proper depictions of motion. In the following section, I argue that, much like with streaks, spectators interpret the static stroboscopic schema in these images as props that prescribe imaginings. Furthermore, I suggest they are 'perceptually much more successful' (as Cutting put it) than other props because of the way they exploit a natural cognitive tendency that Massironi called 'cognitive drag.' But first, let's explore what chronophotographs record about temporal patterns.

2.4.2 Chronophotographs as Discrete Recordings of Temporal Patterns

Let's consider Marey's chronophotographs and examine, in a Kulvickian spirit, what they capture about the photographed event. First, chronophotographs witlessly register the path of the moving object. Unlike long-exposure photography, which results in a single take with a smooth semi-transparent streak, chronophotographs capture different positions of a single moving subject at distinct moments. These varied positions are recorded from the same, unified optical viewpoint, which creates a cohesive pictorial space. Marey found that objects moving quickly could be captured side-by-side on a single plate. This method records the object's path in a discrete form rather than in the continuous manner of long exposure.

Second, chronophotographs register relative velocity and acceleration. Since the shutter exposes the plate at regular time intervals, the depicted object appears differently across the pictorial space. When the object moves rapidly, it covers a greater distance between captures,

[32] See also Braun (1995, xix).

resulting in increased spacing between figures on the plate. This effect is evident in *Pole Vaulting*, where the athlete's positions on the right side – during the run-up to the jump – are spaced farther apart than those on the left, where the athlete is falling to the ground. In geometric chronophotographs, it becomes apparent that different body parts move at varying speeds and times during motion.

Third, like streaky images, stroboscopic pictures do not register directionality, though this can be inferred during interpretation. Fourth, they register duration. Like long-exposure photographs, Marey's chronophotographs depict an object's motion over several seconds by recording its discrete positions at regular intervals – say, every 100 milliseconds. Although viewers cannot determine the exact event duration from the image, it still registers as having occurred over a period.

Despite their effectiveness in conveying an object's overall movement, I argue that chronophotographs do not achieve this through pictorial means alone. Instead, like streaky images, they leverage the image object – what is properly depicted and directly visible – for detective purposes, which require imaginative engagement. Strictly speaking, motion *is* depicted: by tracking the object's movement and rendering each position with snapshot-like clarity, chronophotographs engage our implied motion mechanisms. In *Pole Vaulting*, for example, each snapshot of the athlete can be seen as moving (see Chapter 1).

However, chronophotographs also prompt viewers to mentally integrate each position into an overarching continuous movement. Here, the interplay between depiction and detection is especially effective, as the viewer easily follows the event's progression through the punctuated and discrete positions. I suggest we can explain this effectiveness through one of Massironi's (2001, 199–203) ideas: that static stroboscopy taps into a natural cognitive tendency he termed *cognitive drag*.[33] As Massironi suggested, it seems we have an inherent cognitive tendency to integrate con-

[33] See also Arnheim (1974, 435) for an analysis of this phenomenon.

tinuous information, even when presented in a discrete and sampled form (with some limitations). Our cognitive system finds it easy and straightforward to interpret these series of figures as temporal parts of a single entity and to integrate them into a coherent whole. With a capacity like cognitive drag, we are naturally inclined to merge all disjointed, separate – yet continuous, in many cases – spatial elements presented within the same pictorial space. This enables us to perceive the depicted object as unfolding over time. In doing so, we also imbue the image with a temporal dimension that, given its timeless and static nature and the simultaneous presence of all elements, it otherwise would not have.

This explains the technique's effectiveness, which extends beyond mere habituation to a particular graphic schema. However, a question remains: is this schema a true pictorial representation of motion? I don't believe so. In the next subsection, I will argue that the manner in which chronophotographs are rendered – taking advantage of this automatic cognitive tendency – creates an image whose object, or properly depictive content, functions as a highly effective prop that supports the viewer's imaginative game of make-believe. In chronophotographs, depiction serves detective purposes very efficiently; however, as with streaks, the two functions should be kept distinct.

2.4.3 Dragging Pretense

When looking at a chronophotograph – consider Marey's *Pole Vaulting*, for instance – we see a pictorial scene from a single point of view in linear perspective. In this scene, we observe a man occupying different positions within the pictorial space simultaneously, and we recognize him as the same individual throughout. This is quite an unusual experience, something we could never encounter in real life. As Cutting (2002) points out, we can only see stroboscopically under artificial lighting conditions. Interestingly, raising kittens in a slow-strobe environment disrupts their motion detection systems (Cynader and Cherenko 1976). Although it is now well-established that our eyes may sample the world discretely due to micro-saccadic movements, this discreteness is seamlessly smoothed

over by our visual system, so we never consciously experience or perceive the visual scene as discretely punctuated in time.

Moreover, even in stroboscopic conditions, a moving object appears only in position *s1* at moment *t1*, and then, in the next moment of flashy illumination, in position *s2* at *t2* – never in both *s1* and *s2* at once. Yet, in a chronophotograph, we see just that, as its image object. Naïve viewers might interpret the image as depicting multiple individuals jumping, or as illustrating an impossible state of affairs. However, more plausibly, I suspect that, due to cognitive drag, viewers often interpret it accurately as a depiction of successive positions of the same individual over time. Competent spectators, in particular, almost instinctively interpret the image object – presented all at once – as representing the discrete, sequential positions of a single subject undergoing motion. This automatic interpretation is driven by two main factors. First, we know that the photograph is not a simple snapshot; it is produced by exposing the same plate multiple times at regular intervals. Second, we have a natural cognitive tendency to interpret discrete contiguous samples, presented simultaneously, as the continuous motion of a single object – what Massironi (2001) termed 'cognitive drag.'

The ease with which we extract the correct image subject – what the camera actually detected – should not lead us to conclude that this is a form of pictorial interpretation. Rather, thanks to cognitive drag, it becomes straightforward to use what we properly see in the image – a sequence of men in different positions at the same moment – as a prop in a game of make-believe. We imagine a single individual moving from *s1* to *sn* through *s2*, *s3*, etc., over time. As with streaks, we engage with distinct elements of the image object – in this case, discrete figures instead of continuous streaks – as props under specific interpretative rules. These rules are determined both by how chronophotographs are produced and by conventions established within the interpretative community, as well as by an innate cognitive inclination: cognitive drag.

In sum, I believe we must reject the idea that chronophotographs convey the entirety of a subject's motion in a truly depictive way. Although

they are highly effective at representing such events, this effectiveness does not derive from their pictorial qualities. Like streaky images, chronophotographs employ the image object for detective purposes that engage the viewer's imagination. In doing so, they allow us to pretend we see the continuous motion of a single object across time. The structure of the image object skillfully supports this pretense, driven by cognitive drag.

2.4.4 Futurists Exploitation of the Chronophotographic Schema

Chronophotographs significantly influenced how painters depicted time and space. Initially, the repetitive rhythms and compressed spatial arrangements found in Marey's chronophotography appeared in works by French artists, such as Georges Seurat's final study for *Chahut* (1889) and later in Edgar Degas's *Frieze of Dancers* (c. 1895). However, it was at the beginning of the 20th century that a wave of activity in modern art, influenced by Marey's imagery, surged almost simultaneously. Among the earliest to explore this was František Kupka. His *Woman Picking Flowers* (1909) presents multiple superimposed images of a woman standing up, walking, and bending over, transitioning in color from green to blue, then red, and finally orange. Shortly afterward, Marcel Duchamp created several images with qualities akin to multiple stroboscopic exposures, the most famous being *Nude Descending a Staircase* (1912). This work reveals a dynamic, Cubo-Futurist interpretation of movement, where the abstracted body, fractured into successive planes, seems to descend in a rhythm of limbs and forms repeated along the staircase.

Marey's impact on Italian Futurism is evident in Luigi Russolo's *Plastic Synthesis of the Movements of a Woman* (1912), which superimposes multiple images of a woman in motion, and in Giacomo Balla's paintings. While Kupka, Duchamp, and Russolo experimented briefly with these techniques, Balla consistently engaged with stroboscopic effects. For example, in *A Girl Running on a Balcony* (1912), beyond the mosaic-like paint daubs, Balla composes the image as if captured by a stationary camera, portraying separate moments of action as the girl moves across the space. Balla further elaborated on stroboscopic tech-

niques in works like *Dog on a Leash* (1912). Here, the dog appears with more than four legs, its owner with more than two, and the leash repeats rhythmically, suggesting harmonic motion. This piece differs from Marey's works and Balla's other paintings, as the scene resembles a panning effect in which the camera follows the dog and owner, rendering the background blurred and streaked, reminiscent of a pursuit fixation.

The stroboscopic schema also appears beyond chronophotography and avant-garde painting, notably in comics (see McCloud 1997).[34] There, motion is often conveyed by repeating parts or whole figures to show movement. For example, motion lines offer a simplified static stroboscopic effect, showing an object's previous positions along a path with parallel lines tracing its form (see also Cohn 2013, 47).[35]

In light of these examples, there appear to be at least two types of static stroboscopy. The first type, *optical static stroboscopy*, as seen in Balla's *Dog on a Leash*, aims to replicate the visual impression of an object's indeterminate locations when moving rapidly back and forth along the same path. The second type, *chronographic static stroboscopy*, as in Duchamp's *Nude Descending a Staircase*, does not seek to replicate a visual impression but rather presents motion decomposed into discrete phases. This form diverges significantly from any natural visual experience.

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[34] It appears also in sculpture. As early as 1877, Marey produced a stroboscopic representation of a gull in flight, featuring 34 wings, 17 concatenated bodies, and a single head, capturing the essence of sequential movement in a three-dimensional form. However, it is Umberto Boccioni's work – particularly *Unique Forms of Continuity in Space* (1913) – that epitomizes the sculptural translation of stroboscopic imagery. Boccioni's sculpture captures the continuity of motion through space, seemingly more akin to the flowing trails in long-exposure photographs than to the discrete sampling of chronophotographs or the Futurists' painted works. His approach underscores an interest in the fluidity of movement rather than the segmented rhythm seen in Marey's or the Futurists' portrayals of motion.

[35] Cohn (ibid) calls this form of depiction, 'reduplication'.

LePoidevin (2017) argues that Futurist paintings depict aspects of our experience of motion. However, his experience-based resemblance view falls short, particularly in explaining optical effects like those in Balla's work or comic representations of movement, which rely more on recognition than resemblance. The chronographic stroboscopic schema in *Girl Running on a Balcony* or *Nude Descending a Staircase*, influenced by Marey, cannot be reduced to a rendition of a visual effect and has no direct counterpart in real-life perception. I maintain that the interpretation of such paintings likely draws upon our understanding of chronophotographs. Although there is no detection in the Maynardian sense in paintings, as they lack the mechanical process intrinsic to photography, these works mimic a photographic schema. Our interpretation, especially as competent spectators, partly relies on recognizing this influence. This is one reason for viewing them not as pictorial representations of motion but as props that support imaginative engagement. The effectiveness of this schema stems from cognitive drag, which, as Massironi suggested, is enhanced when elements representing a single object are closely spaced or superimposed. Walton (2008, 171) observes that *Nude Descending a Staircase* is particularly effective in conveying motion. He suggests this success stems from the nature of staircases: «steps – and those taken by a person – are discrete stages, corresponding to the more or less discrete images on the canvas». Walton further notes that while this approach works well for certain types of motion, it may not be as effective for scenes requiring fluidity. He speculates, for instance, that multiple images would likely be less successful at portraying a bicycle smoothly rounding a corner or the continuous motions of a tennis serve; for such cases, blurred images might better capture the sense of smooth motion. My argument is that these techniques work better in some situations and less effectively in others, not because they are instances of depiction – after all, depiction doesn't seem to exist on a sliding scale (an object is either depicted, or it isn't) – but rather because they act as props. These props can stimulate our imaginations with varying degrees of success, depending on the context. In certain cases, such as *Nude Descending a Staircase*, they effectively support our imaginative

engagement. In other scenarios, however, they might fall short of fully conveying the intended motion.

2.5 Conclusion

In this chapter, I have shown that certain pictorial schemata, which might initially appear to depict motion – due to their effectiveness in representing it – are not genuinely depictive. Although these images engage perception – both through experience and recognition – to grasp basic elements, fully understanding their temporal content requires imaginative mechanisms, defined in terms of pretense and make-believe. Whether in photo finish images, streaky photos, chronophotographs, or certain styles of Futurism and Cubism, the spectator must engage in a process that intertwines depictive and detective elements. This interplay is particularly evident in photographically produced images, where it serves as the basis of my analysis. However, handmade pictures are also subject to these dynamics. A competent spectator can engage with certain elements of the image object as props that facilitate specific imaginings, driven by established generative principles. It is easier to engage with some props than others – for instance, interpreting chronophotographs is often more straightforward, in terms of temporality, than engaging with Cubist works. This variability depends on several factors: the structure of the image object, cognitive tendencies, familiarity with the visual schema, knowledge of communal rules, an understanding of photographic technology, and awareness of the artist's intention. Indeed, playing imaginative games with the image object is something we frequently – if not always – do when engaging with pictures. This process enhances our experience of what we see. Although the temporal image subject – our intended content that emerges from this visual engagement – is constrained by the image object (the intermediate, encoded element within the picture), the imaginative way we extract the former from the latter is not a purely pictorial form of interpretation or augmentation. Rather, it is part of a broader array of representational practices, as Walton insightfully suggests in his resourceful book.

Chapter 3.
The Experience of Optical Illusions of Movement[1]

In this chapter I pose the following question: if an illusory impression of movement can be created in a static image – such as in optical illusions like Bridget Riley's *Fall* (1963, Tate, London) or Akiyoshi Kitaoka's *Rotating Snakes Illusion* – does this mean that such images depict movement? This chapter explores two cases of optical illusions of movement, ultimately concluding that one indeed involves the depiction of movement. These optical illusions, even when they do not properly *depict* motion directly, reveal interesting relationships that influence the analysis of depicted movement.[2]

While the declared goal of my analysis is to answer a quite circumscribed question, it is also the occasion to tackle motion-based illusions *tout*

[1] Parts of this chapter were previously published in Marchetti, L. (2024), "E pur si Move! Motion-based Illusions, Perception and Depiction", *Australasian Journal of Philosophy*. DOI: https://doi.org/10.1080/00048402.2024.2416973 . I would like to thank the editors of the *Australasian Journal of Philosophy* for granting permission to reuse material from the manuscript version of the paper.

[2] Two of the most recent attempts to analyze depicted motion in static images – Le Poidevin's [2007] and Aasens' [2020] – laterally consider the issue, even if only for dismissing optical illusions from their analysis. It should be noted that Elpidorou (2016) has argued that an instance of peripheral drift illusion – Kitaoka's *Fall* – is a case of seeing (and depicting) the impossible.

court – to account for the complex visual experiences they elicit and related phenomenology. Moreover, this account has interesting consequences for theorizing depiction and pictorial experience in general. In particular, it constitutes a counterexample to resemblance theories of depiction.

Section 3.1 defines the focus images: the scintillating effects of Op art – exemplified by Riley's *Fall* and Isia Leviant's *Enigma Illusion* – and peripheral drift illusions, such as Kitaoka's *Rotating Snakes*. Section 3.2 explores the concepts of depiction, pictorial experience, and pictorial content, and argues that both *Fall/Enigma* and *Rotating Snakes* elicit pictorial experiences, positioning them as proper pictures. Section 3.3 analyzes how illusory movement is perceived on the surface in *Fall* but appears within the pictorial space in *Rotating Snakes*. Section 3.4 argues that motion can indeed be depicted in static images via illusory motion exploited by peripheral drift illusions. Finally, Sections 3.5 and 3.6 discuss the implications of this analysis on the depiction of illusory effects and on resemblance theories of depiction.[3]

3.1 Two Optical Illusions of Movement: Op Art Scintillating Effects and Peripheral Drift Illusions

Scholars have distinguished two primary types of motion illusions where motion is perceived without actual movement in the stimulus: (a) Op art's scintillating phenomena, as seen in Riley's *Fall* and Leviant's *Enigma Illusion*, and (b) peripheral drift illusions, exemplified by Kitaoka's *Rotating Snakes*.[4]

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[3] You can see *Fall* here: https://www.tate.org.uk/art/artworks/riley-fall-t00616; an instance of *The Enigma Illusion* here: https://www.pnas.org/doi/10.1073/pnas.0510236103; and *Rotating Snakes* here: https://www.ritsumei.ac.jp/~akitaoka/rotsnakee.html.

[4] For a more nuanced taxonomy based on the psychological mechanisms underlying different motion-based illusions see Kitaoka (2017).

Between 1961 and 1964, Riley, a leading figure in Op art, experimented with black-and-white contrasts, later incorporating grey scales. Her *Fall* depicts «a single perpendicular curve repeated to create varying optical frequencies» (Tate Gallery). One of the main illusory effects in *Fall* is the experience of a sensed scintillation, seen as a shimmering or a chaotic vibration elicited by the pattern depicted. A similar effect of illusory motion is visible in another Op-art work: Leviant's *Enigma Illusion*, where the concentric purple rings appear to fill with intense streaming motion.

The second case of optical illusion of movement considered in this chapter is Kitaoka's *Rotating Snakes Illusion* (also Kitaoka, 2017; Kitaoka & Ashida, 2003). This famous image is a paradigmatic and compelling example of automatically moving phenomena – technically known as peripheral drift illusions – in which illusory motion appears in a constant direction, guided by circular patterns. Observers experience the snakes as rotating– some clockwise, others counterclockwise – even though they are stationary. When the observer fixes their gaze, the illusory motion ceases.

Now, since these images generate illusory motion, does this mean they depict motion? I argue that this is indeed the case, but only for *Rotating Snakes*, not for *Fall* or *Enigma*. Nevertheless, examining the latter two reveals interesting relationships with the former. I begin by addressing the nature of pictorial experience and depicted properties, demonstrating why both Riley's and Kitaoka's images can be considered proper pictures, despite their prima facie appearance as abstract compositions.

3.2 Depiction, Pictorial Experience, and Optical Illusions of Movement

What does it mean for something to be depicted? More specifically, what does it mean for properties to be depicted? As we have seen in chapter 1, although there is some disagreement on how to define depiction – and what makes pictorial representations uniquely pictorial – there is a general consensus around the idea of pictorial experience as

'seeing-in'. Here, I will restate the Wollheimian view I endorse in this book and expand on it to address images like *Fall* and *Rotating Snakes* within this framework.

According to Wollheim (1980), when we look at a picture, we see its subject within a marked surface. Wollheim describes this seeing-in experience as having a distinct feature called 'twofoldness': the viewer simultaneously perceives the flat surface of the picture (the 'configurational' aspect) and the subject matter depicted (the 'recognitional' aspect). Here, I refer to the three-dimensional, scene-representing experience elicited by a 2D pictorial surface as the experience of 'pictorial space,' following common usage in art history, aesthetics, and cognitive science (Wölfflin, 1929; Pirenne, 1970; Kubovy, 1986; Rogers, 1995, 2003; Koenderink, 1998, 2012; Hecht et al., 2003; Thompson et al., 2011, chap. 12; Briscoe, 2016). Pictorial space – I maintain following the work of psychologists such as Cutting (2003) and Niederée and Heyer (2003) – comes about via how our visual systems work. This resonates not only with Wollheim's original idea, but also with a number of contemporary seeing-in theorists (see for example Matthen, 2005; Nanay, 2011; Ferretti 2018) to whom pictures somehow evoke perceptual states like those evoked by the depicted objects: part of what it is to be a picture is to be the kind of thing that is apt for bringing about such states. The depictive content – which consists in the properties a picture represents the world as having – is interpreted in perceptualist terms: what is properly *depicted* in a picture has to do with what may be perceived by means of it. Along these lines, I assume here that our experience of seeing something in a picture is a perceptual experience – seeing-in really is seeing the depicted object in a certain way, namely, in the picture – where a perceptual experience is a mental state that consists in perceptually attributing properties to the perceived scene. In these terms, the depictive content of a picture – what is seen in it – is constituted by the properties our visual experience attributes to the pictorial scene. In particular,

I take that a property x is depicted in a picture P if the observer O has the visual experience (or forms visual representations)[5] as of x when looking at S in P. If a property is experienced as a property of the recognitional fold – if it is *seen-in* the apparent 3D space of the picture, i.e. in the pictorial space – then we could legitimately say that this property is *depicted* in that image.

Before proceeding, it is necessary to clarify how I interpret seeing-in as a distinct form of seeing. The most commonsensical use of 'seeing' arguably stems from a causal theory of perception, which poses a challenge for pictorial cases, as many depicted items cannot directly cause anything.[6] Following Newall (2011), who builds on Wollheim, I argue that seeing S in P involves both veridical experience of seeing P and non-veridical experience of seeing S (id. 41).[7] With Newall and after Lewis (1988), I define seeing S as veridical if and only if S is present before the subject's eyes, with a counterfactual dependence on S's presence. If S is absent, or if S does not maintain this counterfactual relationship, the experience is non-veridical. In

[5] I want to emphasize that even if I talk in terms of 'visual' or 'perceptual representations' I am open to these claims being cashed out in anti-representationalist terms (perceptual states 'presenting' or 'being sensitive to' or 'tracking' some properties).

[6] Note that, building on Wollheim, some theories of depiction claim that 'see' should be taken literally for some pictures – for example, and famously, Walton (1984) thinks we literally see through photographs – and other theories for a lot more kinds of pictures (e.g. Lopes 1996). In what follows, as it will soon be clear (see below), I maintain that 'see' in all cases of pictorial experiences should be taken as the veridical seeing of the picture and the non-veridical seeing of what is depicted. I then deal in some more detail with the issue of photographic images later on: see Section 3.5.

[7] See also Voltolini (2015), who has a similar take and argues that the correct way to understand the recognitional fold is as «a kind of *illusory seeing-as,* a *knowingly* non-veridical seeing the picture's vehicle as a certain item» (id. 151).

pictures, a separate item – P, not S – exists before the viewer's eyes, on which the non-veridical perception of S depends. In sum, I conceptualize the experience of seeing pictures as a perceptual experience of seeing-in, involving the veridical experience of a surface (P) and the non-veridical experience of an apparent pictorial space filled with depicted objects (S).

One might wonder whether Wollheim's notion of depicted objects and properties applies to abstract images like those by Riley or Kitaoka. I believe it does. Wollheim has even suggested that abstract paintings can have depictive content. «Abstract art,» he writes, «tends to be an art that is at once representational and abstract. Most abstract paintings display images; or, to put it another way, the experience we are required to have in front of them is certainly one that involves attention to the marked surface, but it is also one that involves an awareness of depth» (1987, 62). Wollheim provides Hans Hoffman's abstract painting *Pompeii* (1959, Tate Gallery, London) as an example, stating that it requires us to see planes of color in relation to one another, even if we cannot easily describe what we see in specific terms (1987, 62). He argues that abstract paintings differ from non-abstract ones in how we conceptualize what we see. With non-abstract paintings, we use figurative concepts like 'boy,' 'dancer,' or 'torso.' In contrast, with abstract paintings, we use concepts like 'irregular solid,' 'sphere,' or 'space' (ibid). Voltolini (2015, 4) also acknowledges that some so-called abstract paintings are figurative, noting that they allow us to trace figure-ground relationships within an apparent pictorial space. He writes: «some so-called abstract paintings are *eo ipso* figurative insofar as certain items can be discerned within them, or at least within parts of them. In some (if not most) abstract paintings, we can trace figure/ground relationships between items effectively located in a space that is not our actual space, but rather the space where we locate the picture's vehicle: an apparent or pictorial space. Accordingly, these paintings somehow present a scene

where particular items interact, just as standard figurative images paradigmatically do».[8]

By this standard, both Op art images – *Fall* and *Enigma* – and *Rotating Snakes* qualify as proper pictures. When observing Riley's *Fall*, we perceive repeated perpendicular curves. Although the upper portion exhibits a relaxed swing, the curve quickly compresses towards the bottom of the canvas. While these lines do not form clear figurative items, they create a sense of depth and define a pictorial space in which the lines exist. Rather than seeing the lines and their undulations as lying flat on the canvas, we interpret them as curving into the depth of the pictorial space – an apparent 3D space distinct from the real space we occupy. Similarly, *Enigma* can be understood as pictorial. The pattern of black radial lines on a white background, intercepted by three bi-colored annuli and a central disk, can be seen as geometric elements inhabiting an apparent space. The black radial lines converge towards the center, retreating into the pictorial space, while the three chromatic rings and the central disk appear in front of the lines. Viewed from a perspective, these rings appear similarly sized yet recede from the observer, creating a sense of depth. Experiencing *Fall* and *Enigma* in this way constitutes a seeing-in experience.

A similar but perhaps more compelling case can be made for *Rotating Snakes*. This image consists of concentric circular patterns. The six central patterns appear in front of twelve other circular patterns, which recede into the pictorial space. Each circular pattern comprises progressively smaller rings, creating a sense of depth, until a black circle, representing a point where no more light is perceivable, emerg-

[8] Newall also considers abstract art as a form of depiction. He suggests that «abstract painting can occasion the non-veridical seeing of a wide range of properties, but it always excludes the recognition of volumetric form» (2011: 174). This implies that while abstract paintings may disrupt the mechanisms responsible for perceiving volumetric form, they still elicit a seeing-in experience.

es. Furthermore, the title of the piece and Kitaoka's own comments suggest the circular patterns may be interpreted as snakes. However, perceiving the circular patterns as snakes is not necessary for seeing the image as a picture; *Rotating Snakes* elicits a seeing-in experience where pictorial space emerges from a marked surface, even if the content consists solely of geometric patterns.

In sum, *Fall*, *Enigma*, and *Rotating Snakes* are proper pictures that elicit seeing-in experiences. Now, do these pictures actually depict motion? To answer this, we first need to understand what appears to move when we observe them.

3.3 Perceiving Optical Illusions of Movement

These images elicit complex perceptual experiences, making it unclear what exactly is perceived as moving in *Fall*, *Enigma*, and *Rotating Snakes*. In this section, I argue that we should consider and analyze these two cases differently: first, I demonstrate that when viewing the scintillating phenomena of Op art, we perceive motion *on* the surface, as a property of a hallucinated, superimposed layer (3.3.1). Then, I argue that when viewing peripheral drift illusions like *Rotating Snakes*, we perceive motion *within* the surface, as a property of the depicted snakes (3.3.2).

3.3.1 Seeing Motion *on* the Surface: Op Art's Effects

Riley described *Fall* as an attempt «to organize a field of visual energy which accumulates until it reaches maximum tension» (Tate Label). Indeed, observers of *Fall* experience scintillation – a shimmering or chaotic vibration that appears detached from the pattern depicted. This effect employs the MacKay Illusion (MacKay, 1957), where simple, repetitive patterns, such as radial lines (MacKay Rays), induce the perception of circular shimmering or illusory motion. Just as with *Fall*, observers of the MacKay Illusion perceive a wave-like movement perpendicular to the lines, inducing scintillation.

Here, I propose that *Fall* and similar images fall into the same category as other illusions that are traditionally challenging to define and have recently been considered more akin to hallucinations than proper illusions, such as the Hermann Grid Illusion.[9] In this illusion, pale grey patches appear at the intersections of white channels formed by closely spaced black squares. As with the scintillation in *Fall*, this phenomenon is difficult to classify. As MacPherson and Batty (2016, 267–268) note, «it is not clear what kind of non-veridical experience one is having – illusory or hallucinatory. Is one inaccurately seeing parts of the white lines as grey at their intersections, thus experiencing an illusion? Or is one hallucinating grey patches at those intersections, due to the grid's interaction with one's visual system?». Brewer (2010) offers a useful classification, categorizing the Hermann Grid as a form of hallucination – a 'mixed perceptual cum hallucinatory experience' where «we see the grid of black squares as a mind-independent direct object of perception supplemented by a systematic hallucination indistinguishable from seeing light grey patches at the intersections of the white channels» (2010, 115).[10]

A similar effect occurs with the BBC Wallboard Illusion.[11] Originating from a chance observation on a wallboard in a BBC studio, staff members observed illusory shadows running up and down blank strips between columns of parallel lines. This illusion is akin to a moving version of the Hermann Grid, where stationary light grey patches appear to

[9] You can see an instance of the Hermann Grid Illusion here: https://en.wikipedia.org/wiki/Grid_illusion.

[10] According to Brewer, similar cases of perceptual cum hallucinatory experiences include afterimages. In the next subsection, I will examine a specific illusion involving afterimages that closely relates to our discussion: the Waterfall Illusion, a case of motion aftereffect.

[11] You can see an instance of the BBC Wallboard illusion here: https://www.scientificamerican.com/article/view-amazing-images-that-seem-to-move/.

move as shadowy patches, representing a mind-independent object (the grid) supplemented by hallucinated, superimposed, moving shadows.

Isia Leviant, an Op artist, unknowingly combined the BBC Wallboard and MacKay Illusions in the *Enigma* illusion (Leviant, 1996). The *Enigma* effect is strongest when fixating on the image's center, as concentric purple rings fill with an intense, streaming motion – an illusory motion that can shift between clockwise and counterclockwise directions. Observers often describe it as 'a feeling of motion' (Hamburger, 2017), or, as Wade (2015) vividly states, «as if millions of tiny and barely visible cars were driving around a track». Wade's description suggests that the motion is seen over the surface, as something superimposed on the image.

If my analysis is correct, *Enigma* should be categorized as a moving version of the Hermann Grid, falling under the perceptual cum hallucinatory experiences outlined by Brewer. This categorization also extends to *Fall*, the BBC Wallboard, and other Op art, as they all involve the perception of a mind-independent object supplemented by a systematic hallucination of a superimposed moving layer.[12, 13]

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[12] In line with my previous arguments, Riley describes the visual research that guided the creation of another of her paintings, *Current* (1964, MoMA) – a development of *Fall* that exploits the same effect – as an attempt to activate the space between the picture's surface and the viewer's eye. She stated, «I wanted the space between the picture plane and the spectator to be active».

[13] While I believe Brewer's description is accurate and provides insight into the illusions under consideration, he does not delve deeply into this type of experience (nor does he claim to). What we need is a more detailed account to address these issues fully. I propose an enhancement to Brewer's account by analyzing these phenomena in terms of a 'transparency effect' (Metelli, 1974; Newall, 2015). In this framework, the superimposed layer is transparent – we can see through it to the depicted pattern that generates it in *Fall*, or to the white background onto which the shadowy patches appear in the BBC Wallboard Illusion. Although a more detailed analysis of this aspect of our experience would be fascinating, it lies beyond the scope of this chapter.

When observing *Enigma*, one can also note another significant illusory effect: the radiating black and white lines appear to vibrate, similar to the visible vibrations observed in the MacKay Illusion. This effect differs from illusions where the motion is part of the pictorial content itself rather than a superimposed layer. In these cases, as I will argue in the next subsection, we experience motion within the surface rather than on it.

3.3.2 Seeing Motion *Within* the Surface: Peripheral Drift Illusions

Peripheral drift illusions, like Kitaoka's *Rotating Snakes*, provide another set of illusions where motion is experienced as part of the depicted object rather than as a separate entity. Here, I argue that these images exemplify cases where motion is integrated into the recognitional fold of our pictorial experience: the motion is experienced as a property of the depicted objects, in this case, the rotating snakes. Phenomenologically, the motion in *Rotating Snakes* is not perceived as separate from the depicted patterns or as a detached, transparent layer. Instead, it is seen as the movement of the patterns themselves, which appear to rotate.[14]

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[14] Recent psychological studies offer three main reasons for considering the illusory motion seen in *Rotating Snakes* as a property attributed to the circular patterns themselves. Although the exact mechanisms underlying this illusion are not fully understood, vision scientists generally agree that several key aspects of the visual system contribute to the phenomenon. These include: differences in the rate at which neurons adapt in the black vs. blue regions and in the white vs. yellow regions; the visual system's decomposition of the image at various scales; and, finally, the presence of large-scale global motion detectors at a secondary stage of processing within the visual system. These detectors are highly sensitive, and even a slight amount of illusory motion at multiple points within the disk can cause the entire disk to appear to rotate (Backus & Oruç, 2005; see also Lombrozo's interview with Backus for NPR; Kitaoka, 2016). These psychological studies support my phenomenological account: the illusory motion processed by the visual system is not an uninstantiated

An alternative interpretation, which seems to contradict my view, has recently emerged in discussions of temporal experience. In this context, *Rotating Snakes* exemplifies a concept proposed by LePoidevin (2007) and later expanded by Arstila (2018): the notion of pure motion phenomenology. This concept suggests that motion can be experienced as part of perception without involving an object that changes location over time. Arstila states, «The waterfall illusion demonstrates that this [pure phenomenology] holds in the case of motion: we do not need to see an object changing its location in a continuous manner as a function of time in order to have experiences of motion. Other well-known motion illusions corroborate the claim. In the rotating snake illusion, for example, a stationary stimulus brings about an experience of movement» (2018, 295).[15] These authors compare the experience of *Rotating Snakes* with that of the Waterfall Illusion, a motion aftereffect where, after watching a stimulus move in one direction for some time, a stationary scene appears to move in the opposite direction.[16] Philosophers of perception describe this as an uninstantiated property, akin to visual blurs, which is presented as 'there is movement going on' (Pautz, 2010, 303).[17] However, if we interpret *Rotating Snakes* as

property or one attributed to a separate layer. Instead, it is directly attributed by our experience to the circular patterns. This is not a detached sense of motion; rather, it is elicited by the specific design of the snakes, which activates at least three distinct mechanisms in our visual system, creating the illusory motion effect.

[15] On pure motion phenomenology and its implications see also Prosser (2016, 124).

[16] See https://www.illusionsindex.org/ir/waterfall-illusion or https://www.youtube.com/watch?v=oNhcpOIQCNs&ab_channel=special4k4 for visual examples.

[17] According to Pautz, the relevant content of a blurry or motion experience is nonpredicational, similar to expressions like 'it's raining.' I would like to

an experience of motion detached from any specific object – a form of pure motion, as Arstila and LePoidevin suggest – then we risk framing the motion as separate from the patterns themselves, as if it were a free-floating property not tied to any particular object.

I contend that this interpretation is incorrect. Contrary to Arstila and LePoidevin's position, our phenomenological experience (supported by psychological evidence) suggests that the motion in *Rotating Snakes* is experienced as part of the depicted objects. The snakes appear to move as if they are genuinely rotating. Although illusory, this motion is not 'pure' in the sense that Arstila and LePoidevin imply. Rather, it includes the perception that the snakes themselves are in motion. While their interpretation may hold for the Waterfall Illusion, it does not adequately capture the experience of *Rotating Snakes*.[18] My account, on the other hand, does.

Before addressing a contrasting view, it is worth clarifying how the experience of motion in *Rotating Snakes* differs from the motion in *Fall*, where motion seems to hover transparently over the objects. While at first glance these might seem similar, they are distinct phenomena. In *Fall*, the motion appears detached from the depicted shapes and is perceived as a superimposed hallucinatory layer. In contrast, in *Rotating Snakes*, the motion is seen as inherent to the depicted objects themselves, the rotating patterns, or snakes.

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highlight Brewer's intriguing and contrasting perspective on the Waterfall Illusion. He suggests viewing it as a «systematic conjunction of degraded acquaintance and hallucinatory superposition» (2011, 117). For a critical review and an original stance on these issues, see also Calabi (manuscript).

[18] There is another, somewhat related, perspective on peripheral drift illusions: Elpidorou (2016, 17) argues that experiencing peripheral drift illusions is akin to 'seeing the impossible'. Even if this view were accurate – and I am not convinced it is, though I will address this in a future paper – it would not undermine my main argument. At most, it would suggest that the content of these images could be contradictory.

In conclusion, experiencing motion in *Rotating Snakes* is not an instance of pure motion, detached from the depicted objects. When the observer's gaze moves over the image and the motion is perceived, it is experienced as the motion of the actual patterns – the circular disks representing rotating snakes.

With these analyses and distinctions, we return to our initial question: do these images actually depict motion? In the next section, I will attempt to answer this.

3.4 Depicting Motion?

For something to be depicted, it must be perceived as a feature of the pictorial content – of the items populating the pictorial space and seen within the surface. In the case of Op Art's scintillating effects, the motion is experienced as the movement of a hallucinated, transparent, superimposed layer, as discussed in 3.3.1. This hallucinated motion does not affect the pictorial content itself: we perceive the image as static, with the pictorial content appearing static as well, while motion is perceived as an overlay. Therefore, in these images, motion is not depicted as part of the pictorial content. However, *Fall*, *Current*, and *Enigma* yield a unique type of pictorial experience. In these cases, we do not undergo the ordinary twofold pictorial experience, but rather a 'threefoldness' experience: (i) the perceptual experience of the marked surface, (ii) the experience of the static scene within the image, and (iii) an additional, hallucinatory experience of a superimposed, transparent moving layer. I propose that we use 'threefoldness' to describe this experience instead of mere twofoldness.[19]

[19] It's important to note that my use of 'threefoldness' differs from the interpretation adopted by 'neo-Husserlian' depiction theorists. For them, the third fold refers to the image's subject (see, for example, Nanay, 2016). In contrast, I define the third fold as the hallucinated, superimposed layer.

Peripheral drift illusions require a different analysis. As I argued in 3.3.2, *Rotating Snakes* exhibits motion within the pictorial content, where the motion is perceived as a property of the depicted snakes. Here, motion is truly depicted within the peripherical pictorial content. When observing the image, we perceive a surface with rotating snakes, which may appear either static or moving based on our gaze. No additional experiential folds are required beyond the recognized pictorial space and the object seen within it. This differs from the unique pictorial experience associated with Op Art illusions.

This interpretation provides a new perspective on how a static image can depict motion. While theorists have largely focused on static images of dynamic scenes or streaky images, as we saw in chapter 1 and 2, the potential for depicting movement through illusory motion has gone unacknowledged. Although certain static images can imply motion and temporal properties through streaks, long exposures, motion lines, or postural cues, none evoke motion-like phenomenology as effectively as *Rotating Snakes*, where the depicted rotation is directly experienced. *Rotating Snakes* depicts motion because it visibly exploits illusory effects to generate this experience.

In the remaining sections of this paper, I explore the implications of this interpretation. In Section 3.5, I examine cases where pictures depict images that themselves elicit illusory effects. Although the topic of depictions within depictions is rarely discussed[20], even in the philosophy of picture perception, understanding instances where images contain illusory effects has significant repercussions for both the depiction of motion and theories of depiction in general. Finally, in Section 3.6, I demonstrate that the conclusions drawn here pose challenges for resemblance theories of depiction.

[20] Exceptions are Kulvicki (2006, ch. 3) and Newall (2011, ch. 5).

3.5 Depicting Illusory Motion?

Consider a scenario where I depict a room with a Riley painting on the far wall. When we observe the depiction, we perceive what I have called hallucinatory effects. Are these effects seen on the surface of the depiction itself, or on the surface of the depicted Riley painting? If they are on the depicted Riley's surface, then they are part of the depictive content, meaning that (illusory) motion is depicted. This raises further questions: are these effects hallucinatory in this case? Does the painting depict a piece that generates illusory patterns, or one that genuinely contains such patterns?

To explore this, let's examine a photograph of Riley standing before one of her paintings.[21] In this photograph, we see Riley in the foreground and, behind her, the depicted painting with the superimposed hallucinatory layer appearing within the pictorial space. Both the painting and the illusory motion it evokes are viewed beside Riley. If so, the hallucinated layer is seen as an effect produced by the depicted painting, not by the abstract lines in the photograph's surface itself. Therefore, I contend that the photograph depicts a painting that generates illusory patterns. The illusory motion appears separate from the depicted painting, but we still experience it as part of the depiction's content. In this instance, we encounter a threefold pictorial experience where the hallucinated layer exists within the pictorial space. Such photographs serve as cases where an image accurately depicts an illusory effect, with the hallucinated layer becoming part of the depictive content.

This intricate case calls for a deeper analysis of photographic pictorial space and the experience of seeing within it. As described earlier, seeing S in P entails a veridical experience of P and a non-veridical

[21] You can see the photograph here: https://www.theguardian.com/theobserver/2019/may/18/observer-archive-bridget-riley-25-may-1969.

experience of S. In this case, the non-veridical experience arises from observing Riley's painting via the photograph, wherein we undergo an illusory experience inside the photograph's depicted space. In this regard, both photographs and handmade images function similarly: through either medium, we perceive a pictorial space with depicted objects. Here, Riley's *Fall* and its hallucinatory layer are both part of the visual experience within the photograph. The same would hold for a painting of a painting of *Fall*, provided it elicited identical motion-illusion effects as the photograph.

This interpretive complexity extends to other illusions like the Hermann Grid or the BBC Wallboard Illusion. Imagine a photograph of the BBC studio walls covered with the Wallboard pattern. We perceive illusory patches moving along the wallboard's surface. Are these patches part of the photograph's content or real shadows? I propose that interpretation can vary, depending on factors like the artist's intention, the viewer's ability to recognize illusory motion, and the communicative context. For example, if the photograph is titled *A Weird Motion-Illusion on a BBC Studio Wall*, viewers may perceive the patches as illusory. Alternatively, if it is labeled *Moving Shadows in My Office*, they may interpret them as real shadows. The determination of content here is thus indeterminate and reliant on interpretative factors.

To clarify this point, I distinguish three components in interpreting a picture: (i) the vehicle, (ii) what we see in it, and (iii) the picture's subject, or what it is about. Ambiguity around hallucinatory effects highlights the need to differentiate not only between (i) and (ii) but also between (ii) and (iii). This distinction allows for cases where the same image may be about different subjects based on interpretation, as seen in *The School of Athens* by Raphael, where the figure pointing upwards could be interpreted as Plato or as Leonardo da Vinci, based on the observer's context (Voltolini, 2018).[22] One

[22] See also chapter 2.

might question whether such interpretative flexibility applies to photographs, given the causal link between the photograph and its subject. Photographs typically have a more rigid subject matter due to their causal dependence on the scene in front of the camera (Newall, 2011). However, interpretative flexibility can still exist. Photographers can guide viewers toward certain interpretations through titles or context. For instance, naming the photograph of the BBC studio in a way that emphasizes illusion could direct interpretation towards perceiving the patches as illusory.

A similar issue arises with *Rotating Snakes*. While I have argued that the snakes are depicted as moving, placing them within a depicted room introduces another possibility: they could be depicted as merely evoking an illusory impression of motion. This raises the question of what would determine the correct interpretation. As with the previous case, I contend that the content is inherently indeterminate. The observer must resolve the content from these competing interpretations, influenced by factors such as interpretative visual habits, background knowledge, authorial intention, communicative context, and more. These elements collectively guide the observer's interpretation and determine whether the motion is perceived as an actual depiction or an illusion.

Although limited attention has been given to the depiction of illusory effects[23], this is an area ripe for exploration. Uncovering how different properties – temporal, spatial, chromatic – can be depicted through illusionary effects offers valuable insights into perception, depiction, and pictorial experience. In the final section, I argue that depicting motion through illusory effects challenges resemblance theories of depiction.

[23] An exception is Newall (2010), who talks about the depiction of and through subjective effects – among which he tackles shape illusions such as the *Café Wallboard*.

3.6 A Worry for Resemblance Accounts of Depiction

Experiential accounts of depiction, such as Wollheim's seeing-in theory (1987) and Nanay's contemporary development (2011), naturally accommodate my proposal. These theories, which frame pictorial experience as seeing-in, offer a flexible framework for interpreting depiction. Although I describe pictorial experience as a twofold process, my argument about depicted motion in peripheral drift illusions could also fit within the alternative theoretical framework of seeing-as (Gombrich, 1960). For the purposes of this chapter, I remain neutral on whether we simultaneously represent surface and scene properties (seeing-in) or oscillate between them (seeing-as).

Some theorists have critiqued experiential accounts of depiction – particularly Wollheim's – for failing to adequately address the constraints that a surface places on the objects it encodes. These constraints are intended to more precisely define the nature of depiction (see, for example, Newall, 2003). Resemblance theories represent an alternative approach that seeks to address these constraints more explicitly. Resemblance theories posit that pictures not only resemble their subject matter but depict it at least partially due to this resemblance (Hyman, 2006; Abell, 2009). Such theories require certain resemblances between the pictures and their subject matter to exist. According to this view, depicted motion would depend on actual motion within the marked surface. This requirement is implicit rather than explicit in resemblance theories, as they often do not consider the depiction of motion.[24] For example,

[24] In particular, consider Abell's (2009) theory – which is the one I will focus on in this section. Abell does not actually specify particular respects of resemblance required for depiction of particular features. It seems reasonable to assume that actual movement would be required on such an account to depict movement on her account – what else would serve this purpose on a resemblance account? And yet, it is true that this is an assumption, albeit, I think, a reasonable one.

Currie (1995) argues that films can depict motion while static images cannot.[25] Similarly, Abell (2010, 278) claims that while a still image might depict a single moment in time and may suggest preceding or succeeding events, it cannot depict events as occurring sequentially over time. However, both Currie and Abell focus on ordinary static images. What happens when we consider the depiction of motion through peripheral drift illusions? Can resemblance theories account for these types of depiction? This question challenges the conventional limits of resemblance theories, as it suggests that static images can evoke a sense of motion even without actual movement on the surface.

Let's consider whether Abell's theory, one of the most detailed resemblance accounts, can account for illusory motion. According to Abell (2009, 217), a marked surface depicts a as P if and only if:

(1) its maker intended both that it resemble a in certain visible respects and intended that it thereby bring a as P to viewers' minds and that it do so in part because viewers recognize this intention;
(2) it resembles a in the relevant respect(s);
(3) Condition 2 holds because condition 1 does;
(4) The respect(s) in which it (counterfactually) resembles a as P jointly capture the overall appearance of a as P, so as to distinguish it from objects for which it would not ordinarily be mistaken in appearance.[26]

Is this account able to accommodate motion depiction via optical illusions (or via the depiction of illusory motion, as argued in Section 3.5)? In order to see if that is the case, we should substitute *a* with

[25] It could be argued, though, that film images do not actually move either. Currie has a response to this, defending a resemblance view: see his *Image and Mind*, ch. 3.

[26] This is a simplified version of Abell's (very detailed) conditions. See Abell (2009, 217) for the full-fledged version.

motion in Abell's definition and see if *Rotating Snakes* meets the four conditions as far as depicted motion is concerned. In the case of *Rotating Snakes* condition 1 does not stand: his maker, Kitaoka, did not intend the picture to resemble the moving scene (if he did, he failed); in fact, the picture does not move. And even if Kitaoka intended for *Rotating Snakes* to evoke a sense of motion in viewers' minds – as can be easily confirmed by visiting his website (see also Kitaoka, 2003, 2017) – he did not aim for the image itself, the vehicle, to literally resemble motion. For the picture to resemble actual motion, he would have needed to create a video version of the scene rather than a static image. Condition 2 specifies that the surface must resemble what it depicts in relevant respects, and Condition 4 adds that these respects should jointly capture the depicted object's overall appearance, distinguishing it from objects that it would not typically be mistaken for. Thus, for *Rotating Snakes*, the surface would need to resemble motion in relevant respects, capturing the overall appearance of the motion to differentiate it from non-moving objects or objects moving differently. However, if resemblance is sought between the marked surface and the depicted object, Abell's theory struggles to account for *Rotating Snakes* and motion depiction through illusory effects. How could a static surface resemble a moving object if we are looking for objective resemblances between them? Metaphysically, this seems impossible.

By confining depiction to objective similarities between surface and depicted objects, without incorporating experiential factors and the role of the visual system, such an account is inadequate for cases like these. In *Rotating Snakes*, the illusory motion arises from the arrangement, color, and structure of the snaky circular patterns on the surface. These design elements elicit motion responses from the viewer, but this constraint operates at the level of experience rather than the physical configuration. Thus, if any resemblance exists, it lies between how we experience the configuration and the depicted motion – not in the configuration itself. Consequently, Abell's theory faces similar challenges when accounting for illusory effects, as discussed in Section 3.5.

Two potential solutions are available for Abell – or any objective resemblance theorist – in response to these challenges. First, they could deny that *Rotating Snakes* or other cases involving illusory effects are genuine examples of depiction. However, this approach dismisses actual instances of depiction and the experienced properties within pictures to uphold the theory. This seems counterintuitive, as a theory should accommodate real cases rather than exclude them. Alternatively, Abell could modify her theory to account for these cases by replacing *resembles* with *experienced as resembling*. However, this adjustment shifts the theory away from objective resemblance and moves it toward a model that depends on an experienced relationship between surface and content, similar to accounts by Peacocke (1987) or Hopkins (1998).

Two objections could be raised by Abell or other resemblance theorists. First, they might argue that there exists a subtle resemblance that underpins depiction in *Rotating Snakes*. They might claim that the motion impression depends on saccadic eye movement relative to the picture. However, I do not think this objection is viable. Saccadic motion occurs universally in picture perception and in all visual experiences, yet it does not consistently lead to illusory motion. Additionally, psychological studies indicate that several correlated factors within our visual system contribute to motion illusions, with saccadic motion being only one among many. It is therefore insufficient to argue that saccadic motion alone accounts for illusory motion in these images. The visual system's complexity is mirrored in how it processes pictures, particularly those eliciting illusions. Consequently, experiential theories offer a more comprehensive explanation of depiction, particularly for properties perceived through illusion-inducing patterns, like the motion in static circles.

The second objection might propose that we consider a picture with non-moving shapes that shares the same occlusion and color properties as *Rotating Snakes*. The resemblance theorist could argue that this alternative image, though identical in appearance, would elicit the same illusory motion, suggesting that *Rotating Snakes* itself does not truly

depict motion – it merely evokes the impression of it. However, this reasoning is somewhat stipulative. Removing motion from the indiscernible version of *Rotating Snakes* is an ad hoc adjustment: why should the color of the snakes be recognized as a depicted property while their motion is not? Both are visual properties. As I have argued, motion in *Rotating Snakes* is a property experienced in a manner akin to the shapes and colors, which objective resemblance theorists accept as depicted properties and explain through resemblance. Here, the objection selectively designates certain properties as depictive based on an objective resemblance framework. But, as noted earlier, resemblance should account for why we see what we see in pictures – not dictate it. Furthermore, according to Condition 1 of Abell's theory, the creator intends the image to resemble *a* in visible respects and to evoke *a* as P in viewers' minds through this resemblance. This applies to *Rotating Snakes*, as Kitaoka intended to depict rotating snakes, bringing motion to viewers' minds through visible cues, even though these cues don't constitute objective resemblances. Thus, the burden of proof lies on the objectors to explain why motion should not be considered a depicted property, while other purely visual properties like color are. Ultimately, *Rotating Snakes* fulfills the criteria of intentionality and viewer recognition set by Abell, but within an experiential framework rather than an objective one.

In sum, resemblance theories like Abell's require certain resemblances between pictures and their subject matter to hold true. However, in *Rotating Snakes*, the snakes appear to move despite no actual motion taking place. This illustrates a limitation of resemblance theories, as they struggle to account for the depiction of motion in such cases. Peripheral drift illusions, therefore, serve as counterexamples to objective resemblance theories of depiction: static images can depict properties like motion without actually instantiating them within their surfaces.

In conclusion, resemblance accounts face significant challenges in accommodating the depiction of properties that rely on illusory ef-

fects. By contrast, the seeing-in theory – both in its original form and in contemporary iterations – can effectively explain such cases. It recognizes that illusioned or hallucinated properties are seen within the picture, which aligns with the experiences discussed here. Seeing-in remains the more effective approach for understanding depiction, pictorial experience, and the diverse ways that pictures represent properties. Its flexibility makes it well-suited to account for all forms of depiction, including those involving illusory effects.

3.7 Conclusion

In this chapter, I examined two cases of optical illusions of movement – Op Art scintillating effects and peripheral drift illusions – and concluded that only the latter directly involves the depiction of movement. Although Op Art scintillating effects do not depict motion directly, they can contribute to the depiction of motion when situated within a pictorial space, as seen in cases like the BBC Wallboard Illusion, which can be used to depict running shadows. I also demonstrated that both types of optical illusions pose challenges for resemblance theories of depiction.

Clearly, further exploration in this area is needed, as optical illusions have received limited attention from philosophers studying depiction. However, I hope this chapter has illustrated that, despite the complexities and challenges inherent in analyzing these phenomena, dedicating philosophical inquiry to them is indeed a valuable and promising endeavor.

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Perché il tempo ci sfugge
Ma il segno del tempo rimane.[1]
(Baustelle, Le Rane)[2]

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[1] 'Because time slips away from us / and yet its mark remains'.

[2] Baustelle (2010). Le rane. In *I mistici dell'occidente*, New York: Warner Atlantic.

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Collana ***Filosofia Analitica / Analythic Philosophy***

1. Luca Marchetti, *Depicting Motion in Static Images. A Philosophical Inquiry*, 2025; e-ISBN (pdf) 978-88-3618-319-7.

Luca Marchetti obtained his PhD in Philosophy from the University of Milan in 2022 and is currently a Post-doc on the ERC project "PEA – The Philosophy of Experiential Artifacts" at the University of Genoa (PI: Enrico Terrone). His research lies at the intersection of philosophy of mind and aesthetics, with a focus on visual representation, phenomenology, and the cognitive sciences of pictorial and virtual reality experience. He has published in international journals such as *The British Journal of Aesthetics* and *Australasian Journal of Philosophy*.

This publication originates from and develops the author's doctoral thesis. The topic it addresses – the depiction of motion in static images – implicitly runs through the entire tradition of aesthetics and the psychology of art, yet it has never been subjected to a systematic and rigorous analysis. This work aims to fill that gap. Across its three chapters, the author examines the nature of various static images that are commonly regarded as effective in suggesting motion: are these truly pictorial representations – that is, depictions – of such a property? The analysis of these images – from photographs capturing people in the midst of dynamic actions to Futurist paintings, from long-exposure photography to optical illusions of movement – not only allows this question to be addressed but also provides insights into the possibilities and limits of depiction, as well as the theories that attempt to account for it.

In copertina:
Étienne-Jules Marey,
Chronophotograph of a Flying Heron (c. 1883–87),
Cleveland Museum of Art

e-ISBN: 978-88-3618-319-7