

WASHINGTON UNIVERSITY IN ST. LOUIS

Department of Philosophy
Program in Philosophy-Neuroscience-Psychology

Dissertation Examination Committee:

Casey O'Callaghan, Chair

Rebecca Copenhaver

John Heil

Ron Mallon

Jeff Zacks

Event Perception

by

Emily Prychitko

A dissertation presented to
The Graduate School
of Washington University in
partial fulfillment of the
requirements for the degree
of Doctor of Philosophy

May 2021
St. Louis, Missouri

© 2021, Emily Prychitko

Table of Contents

Acknowledgements	iii
Abstract	iv
1 Investigating Event Perception	1
1.1 Do we perceive events?	3
1.2 How does event perception relate to other perceptual phenomena?	12
1.3 Investigating Event Perception	15
References	18
2 Perceiving Events	20
2.1 The Phenomenon	21
2.2 Perceiving Events	25
2.3 The Possibility of Event Perception	51
References	58
3 Event Representations	62
3.1 Identity	63
3.2 Temporal Boundness	78
3.3 Future Directions	91
References	95

Acknowledgements

My deepest thanks go to the Original WashU Mind and Perception Group, consisting of Casey O'Callaghan, James Gullledge, and Ben Henke. Without their continuous engagement, feedback, and support over the years, neither this project nor any of my philosophical feats would have been possible. Thanks to Ben and James for being right by my side throughout every single juncture in my graduate career and for always being happy to help me along. I am deeply grateful as well to my dissertation committee, Casey O'Callaghan, Jeff Zacks, John Heil, Ron Mallon, and Becko Copenhaver. Their many bouts of detailed feedback pushed this project forward tremendously. Special thanks to Jeff, for introducing me to event perception and for doing so much of the work that makes it an interesting topic to begin with; to John, for inspiring me to stick to my heart in philosophy and to pursue only what I find fruitful; and especially to Casey, whose clear, tight, and insightful work I've always tried to model my own work on, and it is because of the great amount of energy he has put into helping me develop as a philosopher that I've gotten better at doing so. Thanks to the Department of Philosophy at Washington University in St. Louis, including the faculty and graduate students at large, for enabling me to study philosophy in a friendly, supportive environment.

Emily Prychitko

Washington University in St. Louis

May 2021

ABSTRACT OF THE DISSERTATION

Event Perception
by
Emily Prychitko

Doctor of Philosophy in Philosophy-Neuroscience-Psychology
Washington University in St. Louis, 2021

Professor Casey O'Callaghan, Chair

We seem to perceive events, like songs playing, thunderstorms, and people having conversations.

Extensive empirical research suggests that we indeed perceive events. Yet the philosophy of perception has not addressed event perception much at all. I lay out goals and methods for a fruitful philosophical investigation of event perception, then pursue that investigation. Primarily on the basis of the empirical evidence, I argue that we perceive events across the senses, and that event representations are a unique type of perceptual representation. In doing so, I address concerns about event perception as such, relative to object and property perception. I argue, furthermore, that event representations are *sui generis*, and that we typically perceptually attribute temporal boundness only to events. I end by noting potential directions for future work on event perception.

1 Investigating Event Perception

It seems that humans perceive events frequently. We seem to see cars moving from one location to another, commercials playing, people having conversations. We seem to hear songs playing, phones ringing, footsteps approaching. We seem to feel breezes blowing, massages, the washing of our hands. We furthermore seem to be able to form beliefs about and act on the basis of the events we apparently perceive. When we hear the phone ringing, we may in effect believe that someone is calling us and, accordingly, answer the phone.

Empirical psychology provides further reason to think that we indeed perceive events. Behavioral, psychological, and neural indices show that we parse ongoing perceptual scenes into discrete events (Zacks et al. 2007; Radvansky and Zacks 2017). For example, when shown a movie, participants mark when one event depicted in the movie has ended and another has begun reliably (Zacks et al. 2007). Where participants place these marks affects what they remember from the movie and how accurate their memory of the movie is (Radvansky and Zacks 2017). These marks are correlated with spikes in the activity of certain neural regions, which occur even when participants are not instructed to mark the boundaries between successive events (Zacks et al. 2010).

More work is required to establish that we in fact perceive events, and that event perception isn't just a special case of object or property perception. But the existence of the psychological literature on event perception in addition to the intuitive case for event perception is reason to investigate the matter more thoroughly.

The philosophy of perception, however, has not addressed event perception much at all. It tends to focus on our perception of objects and properties. For instance, discussions about illusion, hallucination, and veridical perception are most often cast in terms of (non-)veridically perceiving an object as having certain properties (e.g., Brewer 2008; Fish 2010; Crane 2006). Discussions about which contents we perceptually represent are most often about which objects and properties we represent, and what the structures of those representations are (e.g., Siegel 2006; Block 2014; Green 2018).

There has been some talk of event perception in the philosophy of perception, but it would benefit from pursuing a more directed approach to event perception as such. For instance, some have argued that we perceive objects and properties, and because events are just another kind of particular that we are presented with in our environment, we also perceive events (Burge 2010; Schellenberg 2018, 2016). Yet there are reasons to doubt that events are just as perceptible as objects and properties, since events appear to have distinctive temporal features that are not obviously perceptible (e.g., James 1886), and a common metaphysical view is that events are just objects and properties in the world (Kim 1976). Some have claimed that we perceptually discriminate events in addition to objects and properties (Schellenberg 2018, 2016), but it has yet to be explored which exact discriminatory capacities we have with respect to events. Some have claimed that event perception and object perception differ in important ways (Burge 2010), but what exactly these differences come to is unclear. Resolving these and other issues relevant to event perception can be aided by engaging with the decades-long empirical literature on event perception, which has not yet been incorporated into the philosophical talk of event perception.

In this chapter, I will point to a number of aspects of the existing philosophical talk about event perception that can be improved upon, and I will suggest how to do so. By offering a set of

goals and methods, I hope to take steps towards creating a more directed, fruitful philosophical investigation of event perception.

1.1 Do we perceive events?

An inquiry into event perception should first and foremost attempt to answer the question of whether we ever perceive events. Some philosophers have claimed that we do, without giving an argument that is very specific to event perception (Burge 2010; Schellenberg 2018, 2016; Soteriou 2010). For instance, Burge and Schellenberg focus on perception of objects and property-instances in their projects. Their motivation for admitting perception of events is that events are just another kind of particular (in addition to objects and property-instances) that we are presented with in our environment, so given that we perceive objects and property-instances, we also perceive events (e.g., Burge 2010, pp. 32, 39-40, 84; Schellenberg 2018, pp. 15, 16, 27; Schellenberg 2016, pp. 27, 29, 38). Soteriou assumes that we have perceptual experiences as of events in addition to objects and properties (2010, p. 226), then goes on to investigate the phenomenal character of those perceptual experiences.

The quickness of these moves would not be particularly problematic if perception of events, relative to perception of objects and properties, did not appear to raise any distinctive issues. Yet it seems there are special problems of event perception. For one thing, events appear to have certain features that objects and properties do not have, like beginning, unfolding across time, and ending. Whether those features are perceptible is an issue that must be explored in its own right, before we can claim justifiably that we perceive events.

In fact, there are reasons to positively doubt that we perceive events, even after granting that we perceive objects and properties. A common metaphysical view about events is that events reduce to other kinds (e.g., Kim 1976; Lewis 1986). Suppose, for instance, that events are,

fundamentally, nothing but objects and properties in the world. One possibility is that we perceptually represent events to be something other than mere objects and properties. If so, it could be that all of our perceptual representations as of events are inaccurate, since events just are objects and properties, so we never perceive events veridically. Another possibility is that we perceptually represent events to indeed be sets of objects and properties. In this case, it could be that our perceptual representations as of events are sometimes accurate, but that perceiving or perceptually representing events is not interestingly different than perceiving or perceptually representing objects and properties; in fact, the former may simply reduce to the latter. It may be faulty, then, to talk about perceiving or perceptually representing events *in addition to* objects and properties.

This is a line of doubt that a proponent of event perception should at least contend with. Another doubt about event perception stems from the view that events essentially take time to unfold; an event, unlike an object, does not exist fully in a single moment. Suppose we have listened to a song. It may be impossible for us to have perceived the song itself. At any moment during which the song was playing, we were not perceiving the entire song, of course; we were at most perceiving a single temporal part of it, while the entire song consists in all of its temporal parts. At any moment, we could not perceive the temporal parts of it that had already occurred or had yet to occur; we could at best *remember* the parts that had already passed and *expect* those that had yet to come, but remembering and expecting are cognitive phenomena, not perceptual phenomena. Thus, the thought goes, we could not have perceived the song itself, but only temporal parts of it.

There is, in fact, an entire literature on precisely this puzzle of ‘temporal perception’, which includes, but is not limited to, event perception. The puzzle is how to reconcile the apparent facts that we can perceive temporal features (like duration, order, beginning and ending, etc.) and that

perception is limited to what exists in this very moment, rather than what has passed or what will come (e.g., James 1886; LePoidevin 2004; Hoerl 2013; Phillips 2014).

To claim justifiably that we perceive (or perceptually represent) events, we must give an argument that avoids or, minimally, contends with objections like these, which cast doubt on the occurrence of event perception, at least in addition to object and property perception. It is not sufficient to assume that events, being simply another type of particular in the world, are just as perceptible as objects and properties. The fact that events apparently have interesting temporal features that distinguish them from objects and properties, and the commonness of the view that events are not a fundamental metaphysical kind, demand a more nuanced approach to the phenomenon of event perception. It would be a step forward to make explicit the various features of the events whose perceptibility is being considered, and develop an argument for event perception that respects any relevant differences between events, objects, and properties.

A good example of such a nuanced approach to event perception is the philosophical literature on auditory perception. The common view in that literature is that what we hear are sounds, and sounds are events (O'Callaghan 2007; Casati and Dokic 1994). Many relevant issues have been explored extensively, such as what the features of sounds are (O'Callaghan 2007), why sounds are events instead of objects or properties (O'Callaghan 2007; Nudds 2015), what the part-whole relationship between multiple sounds is (Matthen 2010; Nudds 2010), and how sounds are perceptually represented (Nudds 2015).

Perhaps the existence of a strong, independent case for auditory event perception can justify the occasional claims that we perceive events. Perhaps the work on auditory event perception has tackled the problems unique to event perception sufficiently to warrant the claims that events, like objects and properties, are particulars that we can perceive. There is, after all, a strong case for object perception in the literature (e.g., Clark 2004; Burge 2010; Brewer 2007; Cohen 2004),

so not everyone who claims that we perceive objects in addition to properties must present their own case for it. Perhaps the same goes for claiming that we perceive events in addition to objects and properties.

It would be perfectly acceptable to refer to the literature on auditory perception to justify the claims that we *hear* events, or we perceive events *auditorily*. But it seems like those who claim that we perceive events as well as objects and properties sometimes intend to maintain a stronger claim. For instance, Burge (2010), Schellenberg (2018, 2016), and Soteriou (2010) all claim to be developing projects about perception in general, rather than just audition. Burge and Schellenberg talk extensively about vision in particular, but also make mention of other senses, like audition and touch. Neither Burge, Schellenberg, nor Soteriou say explicitly that their claims about event perception are restricted to auditory event perception. They are suggesting, then, if not actively maintaining, that we perceive events in senses *other than* just audition, like vision, or touch, etc.

Even if the existing arguments in favor of auditory event perception are successful, however, they cannot be used to support the claim that we perceive events through multiple different senses, rather than just through audition. At least, not without further work. For one thing, it is faulty to infer that just because a type of item is perceptible through one sense that it is thereby perceptible through other senses (O'Callaghan 2019). It is clear, for instance, that certain properties are perceptible only via a certain sense, like color for vision and pitch for audition.

Furthermore, several of the existing arguments for auditory event perception are premised on there being significant *differences* between the items targeted in audition and the items targeted in vision (O'Callaghan 2007, 2008). One reason to think that the items targeted in audition are events, rather than objects, is that we cannot *hear* the spatial organization of objects (such as their spatial boundaries, spatial parts, or spatial continuity despite occlusion), but we can *see* this spatial

organization. Perceiving spatial organization is essential to perceiving *objects*, while perceiving temporal organization (such as an item's beginning, unfolding, and ending) is essential to perceiving *events*. And we indeed *hear* the temporal organization of events (see O'Callaghan 2008, pp. 816-824).

The *differences* between the items of audition and the items of vision motivate the view that we perceive events auditorily. We cannot, then, treat the arguments for auditory event perception as supporting *visual* (or tactile, or multisensory, etc.) event perception. If we perceive objects through a given modality – which, I'll assume, we do at least through vision, touch, and multisensory perception –, then it remains an open question whether we *also* perceive events through that modality. Even if the arguments for auditory event perception are successful, they do not establish that we perceive events through the modalities that we perceive objects by means of, since they treat the fact that hearing sounds does not meet the requirements for object perception as *a reason for thinking* that we hear events. It has yet to be explored philosophically whether we perceive events through the modalities that we perceive objects by means of, and, if so, whether our perceptual representations of events are reducible to our perceptual representations of objects in these modalities. These are issues that ought to be addressed in an investigation of event perception.

New arguments are needed, then, to establish that we perceive events through senses other than just audition. One method of argumentation would proceed sense by sense, establishing that we perceive events in vision, then establishing that we perceive events in touch, etc. A different method would approach event perception sense-neutrally, wherein the arguments for event perception would apply to whichever modalities we perceive events by means of. This method would be more general than the sense-by-sense method, since it would abstract from the particularities of any unisensory, or the multisensory, form of event perception. It would leave

open questions about potential *differences* between the various forms of event perception. Either method would be a promising way to argue for event perception across the senses (i.e., in senses other than just audition).

While developing a case for or against event perception across the senses, it would be helpful to get clear on what event perception, rather than object or property perception, consists in or requires. Schellenberg, for instance, has suggested that when perceiving, we “discriminate and single out particulars” (e.g., 2018, p. 34; 2016, p. 36), and the relevant particulars are sometimes events. What it means to ‘discriminate events’ is not immediately obvious, as philosophers use ‘discriminate’ in a number of different ways. Using different meanings of ‘discriminate’ from the literature, to ‘discriminate events’ might mean to discriminate events from a background (O’Callaghan 2008; Green 2019), or to discriminate different events from each other across time (LePoidevin 2004; Butterfill 2009), or to discriminate events from objects (Burge 2010), or to discriminate different types of events (Butterfill 2009), or to discriminate events that have different arrangements of the same features in a scene (Clark 2004). The various interpretations of the claim that we discriminate events have different truth conditions, so clarification is important.

It is a task in its own right to discover which particular discriminatory capacities we have with respect to events, if any. Consider, for instance, the ability to discriminate particulars of a given type in a scene, like discriminating and singling out an instance of red (Schellenberg 2018, p. 26; 2016, p. 37). If we are similarly able to discriminate *events* of a given type in a scene (Schellenberg 2018, p. 35), a pressing question is what the relevant types of events are. That is, among all of the events in the world, which are the ones that we can discriminate in a scene? Can we discriminate weddings, conversations, elections, and wars? Or only very basic events, like an object moving, changing color, or breaking apart? Can we discriminate long events, like calendar years, seasons,

and semesters, or only short events, like songs, handshakes, and commercials? Can we discriminate slow-paced events, like tomatoes ripening and people growing taller, or only faster-paced events, like cars driving down the street or people going for walks? These are some of questions that we should attempt to answer in an investigation of event perception, insofar as discrimination of events in a scene is relevant to event perception.

Consider, as well, the ability to discriminate particulars of a given type from particulars of another type, such as our ability to discriminate red from blue (Schellenberg 2018, p. 2; 2016, p. 36). Having this discriminatory capacity with respect to events could mean that we discriminate events from objects and properties. Whether we can in fact tell events apart from mere objects and properties in the same perceptual scene must be investigated. Alternatively, having this discriminatory capacity with respect to events could mean that we discriminate different types of events from each other. Is our discriminatory capacity fine-grained enough for us to tell that a movie is different than a commercial, or that one person's singing is different than another's, or that baking a cake is different than baking cookies? Maintaining that we can discriminate different types of events from each other will require going into some detail about how fine-tuned our discriminatory capacities are with respect to event types.

Discovering which events are discriminable in a scene and which are not, whether events are discriminable from objects and properties in a scene, and which events are discriminable from each other are just some of the issues that ought to be explored in an investigation of event perception, granting that discrimination is relevant to perception. Each of these particular issues demands attention in its own right, for each is relevant to determining whether we perceive events and what event perception amounts to.

A philosophical investigation of event perception would also benefit from incorporating the decades-long empirical literature on event perception. It contains valuable information about

how we perceive events – how we perceptually individuate events, which features we perceptually attribute to events, how we perceptually represent events, how event perception differs from object perception, etc. The literature does not completely answer many of the questions that ought to be asked in a philosophical investigation of event perception, but it is nevertheless an excellent source of evidence. For example, it supports the claim that we perceive events, but it is not obvious that the literature establishes that claim decisively. Much of the evidence that has been gathered is behavioral, and given the many intermediary steps between perception and behavior, we cannot simply assume that the behaviors that correspond with *presentation* of events are indicative of *perception* of those events. If we wish to make claims about event perception, we ought not merely point to the empirical literature on event perception, then, but engage with it. Because the literature contains relevant information about event perception and rules out many plausible claims about event perception, it should be employed when arguing for and disambiguating claims about event perception in philosophy.

While the questions of whether we discriminate and perceive events are important for a discussion of event perception, an equally important question is what it even means to say that we perceive events. More specifically, which events in the world are the candidates for ‘event perception’? Are movies, waves rolling in, lights turning on, acts of vengeance, beeps, deceptive cadences in music, traffic jams, explosions, seasons, construction of buildings, books sitting on shelves, the ripening of fruits, taps on the shoulder, and climate change all possible targets of event perception? To talk about ‘event perception’ meaningfully, we must stipulate the domain of events in the world whose perceptibility is being considered, as well as offer reasons to think that everything within that domain is indeed an event. Otherwise, it will be unclear why ‘event perception’ is so-called, and what its intended scope is.

Just as well, we ought to be able to rule out, right from the start, some of the apparent perceptual phenomena that do not count as ‘event perception’, and rule in some of the apparent perceptual phenomena that do count. Are instances of apparently perceiving an apple sitting on a table, a song playing, a fan blowing, a light flickering, and an insulting remark candidates for ‘event perception’, or not? What about instances of apparently perceiving the first few seconds of a commercial, the browning of leaves throughout fall, a cat entering the living room, or the sequence ‘cat enters living room, TV turns off, phone rings’? Again, to begin to discuss ‘event perception’ meaningfully, we must point to some of the apparent perceptual phenomena that are clear candidates for ‘event perception’ and some of the phenomena that are not candidates at all. There will surely be many tricky cases that cannot be labelled right from the start, and will instead have to be addressed after a better conception of what event perception consists in has been developed.

To even say, then, that we ‘perceive events’ (or that we do not), and for this to be a meaningful statement, we must clarify our domain, both on the perceptual side of things and on the outside world side of things, at least to some degree. Without this initial work, any claim about our (not) ‘perceiving events’ will remain vague.

To move the existing philosophical talk about event perception forward, then, it would be helpful to address the special problems posed by event perception (compared to object and property perception), to argue for or against event perception across the senses, to get clear on which discriminatory capacities we do or do not have with respect to events, to incorporate the empirical literature on event perception, and to do some ground-clearing work about the intended scope of ‘event perception’.

1.2 How does event perception relate to other perceptual phenomena?

An investigation of event perception would do well to address not only the question of whether we perceive events, but also the question of how event perception relates to other perceptual phenomena that philosophers are interested in. A significant question is what the relation is between event perception and object perception. Some questionable claims have been made about this relation. For instance, Burge (2010) says that we perceptually discriminate objects from events thanks to the fact that our perceptual tracking of objects differs from our perceptual tracking of events (e.g., p. 459). For Burge, perceptual tracking is simply perceptual reidentification of an item across time. Burge says that with respect to tracking objects, “The tracking must be linked to certain perceptual anticipations – particularly those regarding maintenance of integrity of boundaries” (p. 459), and, “Bodies are perceptually distinguishable partly and fundamentally through their continuity of boundary integrity over time” (p. 199). He does not say anything positive about how we track events, but we can infer that he thinks it does not involve perceptual anticipations about the maintenance of spatial boundaries.

It is unclear whether the relevant spatial boundaries whose maintenance we do *not* anticipate while tracking events are the spatial boundaries of the event itself, or the spatial boundaries of the objects that participate in the event. Suppose that Burge means the latter. Suppose as well that we perceive events, and that it is true that perceptual tracking of objects involves anticipations about the maintenance of their spatial boundaries. If we indeed expect objects to retain their boundaries in normal cases of object perception, it seems we would just as well expect this when perceiving any events that have objects as participants. That is, for instance, when perceiving a person doing jumping jacks, we expect their body to maintain its rigidity and cohesiveness; we would be surprised if it turned into a liquid or disintegrated. Furthermore, this expectation seems important for tracking the event of the person doing jumping jacks over time. If, after a few

jumping jacks, the person's body turned into a liquid or disintegrated, we would likely perceptually register that the event of the person doing jumping jacks has ended. There is, after all, no person doing jumping jacks any longer, and this is salient. It is plausible, then, that perceptually tracking events *does* involve expectations that the objects that participate in the events will retain their spatial boundaries over time.

But suppose instead that Burge means that perceptual tracking of events does not involve the expectation that *the event's* spatial boundaries will remain the same. A plausible first pass as to what the perceived spatial boundaries of events are is that they are just the perceived spatial boundaries of the objects participating in the event. This means that the event of the person doing jumping jacks has precisely the perceived spatial boundaries of the person's body. If this is so, then our expecting the event's spatial boundaries to remain the same seems important for our tracking the event. If the person's body turns to liquid, then the event's spatial boundaries have suddenly changed, in a surprising way. We plausibly would not have expected the event to suddenly change its spatial boundaries in such a dramatic way, and we plausibly would cease to reidentify the event of the person doing jumping jacks. So, under a prima facie plausible view of what the perceived spatial boundaries of an event are, it seems that our anticipating those boundaries to remain the same over time is important for our reidentifying the event.

Under two natural interpretations of the claim that perceptually tracking events does not involve anticipating the maintenance of spatial boundaries, then, we have reason to think the claim is false. This is not to say that the claim is not true under other legitimate interpretations, but that there is room to clarify how, exactly, event perception relates to object perception.

Similarly, there are several phenomena that philosophers discuss or take for granted, whose relations to event perception have yet to be explored in depth. Perception of causation and perception of action, which are more controversial phenomena, seem like natural candidates for

event perception. Insofar as causation is a relation between events, it is plausible that every instance of perception of causation is an instance of event perception. And insofar as all actions are events, it is plausible that every instance of perception of action is also an instance of event perception.

Perception of motion, perception of change, and even simply perception of objects, which are less controversial phenomena, are also candidates for event perception. Any instance of an object moving from one place to another is either itself an event or is part of a larger event, so perceiving motion might always involve perceiving some event. Any instance of an object changing its properties may also be an event itself or a part of a larger event, in which case any instance of perception of change may be an instance of event perception. Depending on the metaphysics of objects and events, object perception might itself require, or be a form of, event perception. For instance, if the mere persistence of an object across time is an event, then every instance of perceiving an object across time may be an instance of event perception. Or, if events are identical to instantiations of properties by objects at a time (Kim 1976), then whenever we perceive an object (which always involves our perceptually attributing properties to the object), we may be perceiving some event.

Event perception may be much more prevalent than philosophers have recognized. Given that the dominant view in the philosophy of perception is that we perceive objects and properties, if event perception is just as prevalent as object perception, then event perception is a topic that demands careful attention. Even more so, if object perception is itself a *form of* event perception, rather than vice versa. In any case, the mere fact that it is *plausible* that perception of motion, change, and objects are always or often instances of event perception is pressing reason to investigate event perception further.

Discovering the relations between event perception and other perceptual phenomena that philosophers are interested in would, then, be valuable. Even if it turns out that event perception never occurs, but that some of these phenomena always or sometimes rely on, or are just a form of, event perception, these phenomena may not be as prevalent as we have thought. Or, if event perception underlies all object perception, then we had best figure out whether all object perception reduces to event perception, for talk of object perception in philosophy may have to be recast in terms of event perception. In any case, it would be informative to discover the conditions of existence for event perception, the general differences between event perception and other perceptual phenomena, and whether any of the other phenomena reduce to event perception or vice versa. These issues have yet to be explored.

1.3 Investigating Event Perception

There is, then, room to improve upon the existing philosophical talk about event perception. Engaging with objections that threaten event perception (even without threatening object and property perception) would help clarify what is distinctive to event perception and what it would take to perceive events in addition to objects and properties. Arguing for or against event perception across the senses would go beyond the existing work on auditory event perception and illuminate the relationship between event perception and object perception in a given modality. Discovering which particular discriminatory capacities we have with respect to events would help clarify what is distinctive to event perception and how extensive and fine-tuned event perception is. Incorporating the empirical literature on event perception would provide evidence for or against various potential views about whether we perceive events, what event perception involves, how we perceptually represent events, and the like. Clarifying the intended meaning and domain of ‘event perception’ would provide a foundation for pursuing the topic in a directed

fashion. Discovering the relationship between event perception and object perception would help clarify what is distinctive to event perception and whether event perception is, e.g., more fundamental than object perception. Discovering the relationships between event perception and perception of causation, action, motion, change, and the persistence of objects would clarify the extent of event perception and may provide (additional) conditions of existence for these various phenomena.

Two goals can form the backbone of a more intentional, careful investigation of event perception. The primary goal would be to discover whether we perceive events. Relevant issues would include whether we discriminate events (from certain other items), which events in the world are candidates for event perception and which are not, which perceptual phenomena are candidates for event perception and which are not, and what distinguishes events from objects and properties. The secondary goal would be to discover the relations between event perception and other perceptual phenomena, such as object perception, motion perception, perception of causation, etc. Relevant issues would include how we perceptually represent events, how we perceptually represent objects (or various other items), and whether perceptual representations of events reduce to perceptual representations of objects (or various other items) or vice versa.

A set of methods would help to achieve these goals. First, an investigation of event perception ought to make use of the empirical literature on event perception. Because it has information that will help philosophers answer questions about event perception, it ought to be used to both constrain and guide the philosophical conversation. Second, an investigation of event perception, if it is to go beyond the existing work on auditory event perception, should approach event perception in either a sense-by-sense manner (tailoring arguments for or against event perception for each sense) or a sense-neutral manner (abstracting from the particularities of any sense that is

a candidate for event perception and arguing for or against event perception in a way that applies to all of those senses).

An investigation that is geared at discovering whether we perceive events and what the relationships are between event perception and other perceptual phenomena, and that makes use of the empirical literature and addresses event perception across the senses, will improve upon the current philosophical talk about event perception. It will be more fruitful and directed than making occasional claims about event perception here and there, and it will respect what is distinctive to event perception. It will also make progress on the overall philosophical project of discovering what types of items we perceptually represent and what the relations between those items are. For these reasons, such an investigation ought to be undertaken.

References

- Block, N. (2014). Seeing-As in the Light of Vision Science. *Philosophy and Phenomenological Research*, 89(3), 560–572.
- Brewer, B. (2008). How to Account for Illusion. In A. Haddock & F. Macpherson (Eds.), *Disjunctivism: Perception, Action, Knowledge*. Oxford: Oxford.
- Brewer, B. (2007). Perception and Its Objects. *Philosophical Studies*, 132, 87–97.
- Burge, T. (2010). *Origins of Objectivity*. Oxford: Oxford University Press.
- Butterfill, S. (2009). Seeing Causing and Hearing Gestures. *The Philosophical Quarterly*, 59(236), 405–428.
- Casati, R., & Dokic, J. (1994). *La Philosophie du Son*. Nimes: Editions Jacqueline Chambon.
- Clark, A. (2004). Feature-Placing and Proto-Objects. *Philosophical Psychology*, 17(4), 443–469.
- Cohen, J. (2004). Objects, Places, and Perception. *Philosophical Psychology*, 17(4), 471–495.
- Crane, T. (2006). Is There a Perceptual Relation? In T. Gendler & J. Hawthorne (Eds.), *Perceptual Experience*. Oxford: Oxford University Press.
- Fish, W. (2010). *Philosophy of Perception: A Contemporary Introduction*. New York: Routledge.
- Green, E. J. (2019). A Theory of Perceptual Objects. *Philosophy and Phenomenological Research*, 99(3), 663–693.
- Green, E. J. (2018). What Do Object Files Pick Out? *Philosophy of Science*, 85(2), 177–200.
- Hoerl, C. (2013). “A Succession of Feelings, in and of Itself, Is Not a Feeling of Succession.” *Mind*, 122(486), 373–417.
- James, W. (1886). The Perception of Time. *The Journal of Speculative Philosophy*, 20(4), 374–407.
- Kim, J. (1976). Events as Property Exemplifications. In M. Brand & D. Walton (Eds.), *Action Theory* (pp. 310–326). Dordrecht: D. Reidel.
- LePoidevin, R. (2004). A Puzzle concerning Time Perception. *Synthese*, 142(1), 109–142.
- Lewis, D. (1986). *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- Matthen, M. (2010). On the Diversity of Auditory Objects. *Review of Philosophy and Psychology*, 1, 63–89.

- Nudds, M. (2015). Audition. In M. Mohan (Ed.), *The Oxford Handbook of Philosophy of Perception* (pp. 274–293). Oxford: Oxford University Press.
- Nudds, M. (2010). What Are Auditory Objects? *Review of Philosophy and Psychology*, 1, 105–122.
- O’Callaghan, C. (2019). *A Multisensory Philosophy of Perception*. Oxford: Oxford University Press.
- O’Callaghan, C. (2008). Object Perception: Vision and Audition. *Philosophy Compass*, 3(4), 803–829.
- O’Callaghan, C. (2007). *Sounds*. Oxford: Oxford University Press.
- Phillips, I. (2014). The Temporal Structure of Experience. In D. Lloyd & V. Arstila (Eds.), *Subjective Time: The Philosophy, Psychology, and Neuroscience of Temporality* (pp. 139–158). Cambridge: MIT Press.
- Radvansky, G. A., & Zacks, J. M. (2017). Event Boundaries in Memory and Cognition. *Current Opinion in Behavioral Sciences*, 17, 133–140.
- Schellenberg, S. (2018). *The Unity of Perception*. Oxford: Oxford University Press.
- Schellenberg, S. (2016). Perceptual Particularity. *Philosophy and Phenomenological Research*, 93(1), 25–54.
- Siegel, S. (2006). How Does Visual Phenomenology Constrain Object-Seeing? *Australasian Journal of Philosophy*, 84(3), 429–441.
- Soteriou, M. (2010). Perceiving Events. *Philosophical Explorations*, 13(3), 223–241.
- Zacks, J. M., Speer, N. K., Swallow, K. M., Braver, T. S., & Reynolds, J. R. (2007). Event Perception: A Mind/Brain Perspective. *Psychological Bulletin*, 133(2), 273–293.
- Zacks, J. M., Speer, N. K., Swallow, K. M., & Maley, C. J. (2010). The Brain’s Cutting-Room Floor: Segmentation of Narrative Cinema. *Frontiers in Human Neuroscience*, 4(168), 1–15.

2 Perceiving Events

It seems that we perceive events through vision (such as seeing the rain fall), audition (hearing a song), touch (feeling a massage), and multisensory perception (perceiving a baseball game).

Indeed, philosophers have argued extensively that we perceive events through audition (e.g., O’Callaghan 2007), have claimed generically that we perceive events (Burge 2010; Schellenberg 2018, 2016; Soteriou 2010), and have suggested that we perceive events through senses other than just audition (Burge 2010; Schellenberg 2018). Furthermore, psychologists have gathered evidence which suggests that we perceive events frequently through vision, audition, and multisensory perception (e.g., Zacks et al. 2007).

But there are reasons to doubt that we perceive events. First, in the philosophy of perception, we currently only have *prima facie* reason to think that we perceive events through senses other than just audition. This is because the only thorough arguments for event perception have been offered specifically with respect to auditory event perception, and they are premised on the claim that audition is not sensitive to the internal spatial structure of objects, unlike, e.g., vision. There is a standing question, then, whether we perceive events in modalities through which we perceive objects and their spatial organization (which, I’ll assume, include at least vision, touch, and multisensory perception). To claim justifiably that we perceive events in modalities other than just audition – or that we perceive events, without relativizing that claim to audition alone –, new arguments are needed.

Second, there are reasons to deny the possibility of event perception, regardless of modality. For instance, suppose events are not a fundamental metaphysical kind (e.g., Kim 1976; Lewis

1986; Horgan 1978), but objects and properties are. In this case, we may not be able to perceptually discriminate events from objects and properties, since we are never presented with any (fundamental) events in the world, as opposed to (fundamental) objects and properties. Event perception might itself be a form of object and property perception, since all events would just be sets of objects and properties in the world. Another concern about event perception is that we cannot perceive events in full, but merely temporal parts of them. Given that an event takes time to unfold, at any moment, it has temporal parts that have already passed and/or have yet to take place. It seems we cannot perceive the past nor the future, so it seems we can at most perceive temporal parts of events. In order to claim justifiably that we perceive events, these objections must be contended with.

I will give an argument for event perception that addresses these doubts. I will approach event perception sense-neutrally, such that what I say is intended to apply to any modalities through which we might perceive events. I will also make use of the empirical work on event perception, which has not yet been incorporated into the philosophical talk of event perception.

2.1 The Phenomenon

A good anchor for a philosophical discussion of event perception is the phenomenon that psychologists call ‘event perception’ (e.g., Zacks et al. 2007; Richmond and Zacks 2017; Zacks, Tversky, and Iyer 2001). This is perception of such things as people doing the dishes, exercising, or watering plants; thunderstorms, leaves falling off of trees, or birds flying; songs playing, movies playing, or baseball games taking place. The targets of this perceptual phenomenon are things in the world that have the canonical features of ordinary events. They typically take time to unfold, they have a beginning and end, they are not too long nor short temporally to be observed casually (i.e., without special equipment), they are not too big nor small spatially to be observed

casually, they have objects and/or properties as participants, and they involve noticeable changes across time.

There are two major benefits of focusing on what psychologists call ‘event perception’. The first is that it matches what is likely the intuitive conception of ‘event perception’, since the relevant ‘events’ are simply the things in the world with the canonical features of ordinary events. The second is that there is plenty of empirical work on precisely this phenomenon, so further theoretical work on event perception can be guided by empirical evidence. Henceforth, ‘event perception’ will refer to the phenomenon that psychologists have labeled ‘event perception’.

The events that are the target of event perception are different entities than the objects that are the target of what psychologists often call ‘object perception’ (e.g., Spelke 1990; Peterson 2001). ‘Object perception’ refers to perception of things in the world that have the canonical features of ordinary objects. They are typically three-dimensional, they are spatially bound, they bear properties, they aren’t too big nor small to be observed casually. Cups, cats, trees, pencils, cars, and so on count as objects.

Objects are sometimes characterized as differing from events in that they do not appear to take time to unfold (e.g., O’Callaghan 2008; O’Callaghan 2011a). Objects seem to be fully present at any moment, while it seems only a part of an event can be fully present at any moment. Also unlike events, objects do not have a beginning and end that we typically observe. While any object comes into being and ceases to be at certain points in time, we usually do not observe these moments, while we frequently do observe the moments at which an event begins and ends. This is because many of the events we observe have shorter lifespans than most of the objects we observe.

Both events and objects differ from the targets of what might be called ‘property perception’, which is perception of the properties that individuals (like objects or events) bear. Perceptible

properties include size, shape, color, texture, pitch, temperature, and so on. Psychologists tend to refer to what I'm calling 'properties' as 'features' (e.g., Treisman 1998), but I reserve 'features' for *any* type of item that an individual can bear (which, as we will see, can be other individuals). Unlike objects and events, properties are not feature-bearing individuals; properties do not bear other properties. Properties are instead (at least some of) the features that are bound to individuals.

With our initial characterization of event perception, we can distinguish event perception from certain phenomena that it might be confused with. First, perceiving an event is different from the mere event of perceiving, or the mere having of a perceptual episode. A perceptual episode is itself an event. It begins at some point in time, takes time to occur, and ends at some other point. But we can undergo the event of perceiving without perceiving any event in the world. For example, we may have a perceptual experience of 'a brown book' from $t1$ to $t2$. Although this perceptual episode is itself an event, we perceived no event during the episode. 'A brown book', in an arbitrary timeframe, is not a thing in the world with the canonical features of ordinary events. It does not begin, unfold, and end.

Second, perceiving an event is different from sensing the 'passing of time'. We might judge that time has passed even if we perceived no event. If we perceive 'a brown book' for an extended period of time, we might be able to tell that we had perceived it for five seconds, or a minute, etc. But we have perceived no event. We have merely made a judgment about the duration of our experience or of something in the world.

Third, perceiving an event is different from mere 'temporal perception' or 'temporal consciousness' (James 1886; Gibson 1975; Chuard 2011; Dainton 2008). Temporal perception or consciousness involves experiencing one thing as following another in time, or experiencing a thing as lasting across time, or experiencing a thing as changing over time, etc. An instance of

temporal perception or consciousness need not involve perception of any event in the world. It may consist in no perceptual experience at all (such as experiencing one thought as following another), or in a perceptual experience of unchanging objects with temporal properties (such as a duration).

Fourth, perceiving an event is different from having a mere series of perceptual episodes. Many philosophers have recognized similar points (see Hoerl 2013). We might perceive ‘a brown book’, then turn our head and perceive ‘an open window’, then turn our head and perceive ‘a bare wall’. But ‘a brown book, then an open window, then a bare wall’ is not an event in the world. Even if we wanted to individuate perceptual episodes such that they could include representations of different objects and properties across time, this would not be identical to event perception. Perceiving one object after another is not in itself perceiving an event.

An investigation of event perception will be faulty if it fails to appreciate the differences between event perception and the event of perceiving, the sense of the passing of time, temporal perception or consciousness, and having a series of perceptual episodes.

The question of this chapter is whether we perceive events. Surely, if we do, we can perceive only events that fall within a certain range. Some ordinary events, like the season of winter, a presidential election, the ripening of a bunch of bananas, and an act of vengeance, are too long, too abstract, too slow-paced, or too social for us to *perceive* (at least, to perceive in full, or as such) (see, e.g., Gibson 2015, pp. 6-7). Perception of an event would have to be more direct or immediate. The same goes, of course, for object and property perception. We cannot perceive (fully, or as such) objects like the Pacific Ocean, the government, or a betrayed friend, nor properties like weighing exactly 355 grams, being built in 1900, or being existential. There are limits to our perceptual capacities. One challenge for an investigation of event perception (or

object or property perception), then, is to determine where the line falls between the ordinary events (or objects or properties) that we can and cannot perceive.

Just as well, our initial characterization of event perception will get us only so far in an investigation of event perception. There are bound to be tricky cases where it is not clear whether or not they count as event perception, perhaps because their targets are not obviously items in the world with the canonical features of ordinary events, or perhaps because they are not obviously perceptual (rather than cognitive) phenomena. Additional theoretical work will be essential for dealing with such cases.

2.2 Perceiving Events

To perceive events, we must have a type of perceptual representation that is differentially sensitive to events (rather than mere objects or properties) and tracks events across time. That is, the representation would have to be tokened frequently by events and tokened infrequently by mere objects or properties (i.e., objects or properties not participating in any event), and the representation would have to be updated as the events change. Such a representation would respond to events either as though they are individuals, or as though they are properties. If, for instance, our perceptual system treats the event of a conversation between two people as an individual, it treats the conversation itself as a unit that bears perceptible features, namely, the objects (the people) and properties (their shapes and so on) that participate in the conversation. If our perceptual system instead treats the conversation as a property (like ‘is conversing’), then it treats it as the sort of thing that some individual (like the group of people) bears.

I will argue that we perceive events and that our event representations construe events as individuals. Both intuitive and empirical evidence supports these claims.

A perceptual representation as of an individual (like an object) is a perceptual representation as of a discrete feature-bearing unit (see O’Callaghan 2016, Clark 2004, and Cohen 2004 for similar characterizations). Several factors are indicative of our perceptual system treating some type of item in the world as an individual. One factor is attributing perceptible features to the item (Clark 2000). An object, for instance, is perceptually represented as having a certain color, shape, size, and so on at any moment.

Another factor is treating the item as persisting across time, despite certain perceptible changes (Cohen 2004). These changes may be due to changes in the item itself, such as our perceiving a lightbulb as persisting even as it changes from being off to being on (thus changing its brightness, color, etc.). These changes may instead be due to changes in the environment in which we are perceiving the item, such as our perceiving a tree as persisting even as a wind causes its leaves to rustle. These changes may also be the result of changes in ourselves with respect to the item, such as our perceiving a couch as persisting even if we close our eyes for a few seconds; despite the couch temporarily ‘disappearing’ from us, our perceptual system treats the couch-before-closed-eyes as the same item as the couch-after-closed-eyes.

Yet another factor is discriminating the item from other individuals or properties in a scene (Siegel 2006; Batty 2011; O’Callaghan 2016). This is a matter of demarcating the boundaries of the item from the rest of the scene. We see, for instance, that an apple is different from the table it sits on, the wall behind it, and so on. We attribute boundaries to the apple which mark where the apple’s own perceptible properties lie, as opposed to the properties of everything else in the scene.

A final factor is individuating multiple tokens of the same type of item at a time (O’Callaghan 2016). We can, for instance, discriminate the many objects that are presented to us

simultaneously in a scene. Our perceptual system does not mush together all items of a given type in a scene, but often represents them as being distinct from each other.

As such, if our perceptual system attributes perceptible features to an item, treats the item as persisting across time, discriminates the item from the rest of a scene, and individuates multiple tokens of that type of item at a time, then our perceptual system treats that item as an individual. The joint satisfaction of these factors establishes that the item is treated as a discrete feature-bearing unit.

Our perceptual system engages in all of these behaviors with respect to events. There is intuitive evidence for this being so. First, we can discriminate an event from the rest of a scene. We can perceive, for instance, that the playing of a movie in a living room includes the TV, the images it depicts, and the sounds it makes, but it does not include a nearby floor lamp and its properties, nor an artwork on the wall and its properties. We recognize that many objects and properties in the scene are not features of the playing of the movie, even though they are presented to us simultaneously.

Second, we attribute features to an event. Not only can we tell that the playing of the movie is different than the floor lamp and its properties, but we furthermore treat the playing of the movie as having a certain set of objects and properties as participants (again, the TV, its images, its sounds, etc.) at any time. We do not attribute the features of the movie playing to the floor lamp.

Third, we treat an event as persisting over time. Despite the many changes of features that the playing of the movie undergoes, we can tell that it is still the same playing of the movie. Just as well, if we briefly leave, then re-enter, the room, we can tell that the same playing of the movie as before is taking place. We recognize that events persist across time, even when they change many of their features.

Fourth, we individuate multiple simultaneous events. We can tell that the playing of the movie is distinct from a simultaneous conversation between people in the room, or the blowing of a fan in the room, or the playing of another movie on a nearby laptop. We usually do not get confused about which features belong to which events.

Thus, intuitive evidence suggests that we indeed perceive events and that our perceptual system treats events as individuals. Empirical evidence supports these claims as well. Specifically, the psychology of event perception suggests that we have a certain type of perceptual representation (or, more neutrally, psychological state), which can be characterized functionally. I will argue that when we are presented with an event (one that falls within the to-be-determined range of perceptible events), we usually token this state, which produces a typical set of behavioral, neural, and psychological effects. These effects show that (among other things) we perceptually treat events as individuals.

The typical experiment on event perception presents subjects with a movie, usually depicting people engaged in everyday activities, like washing the dishes or making the bed. In some experiments, subjects are asked to press a button when they feel that one event has ended and another has begun (e.g., Newton 1973; Zacks et al. 2006). In other experiments, subjects watch the movies passively, perhaps while their brains are being scanned (e.g., Magliano and Zacks 2011). After viewing a movie, subjects might complete a memory task about what they just watched (e.g., Swallow et al. 2009).

These experiments have shown that we are sensitive to the beginnings and ends of the successive events that we are presented with. Some of the evidence is behavioral. When subjects are asked to press a button when they feel one meaningful unit of activity has ended and another has begun (henceforth the ‘segmentation task’), they do so reliably, both intra- and

intersubjectively (Zacks et al. 2007). This remains true even when subjects segment the same movies over a year apart (Speer et al. 2003).

The reliability of the results of the segmentation task is reason to think that subjects are indeed responding to the boundaries between successive events – that is, to the points at which the items in the world with the canonical features of ordinary events begin and end. Because the events that are relevant to event perception are just ordinary events, we would expect a good amount of consensus as to where subjects parse events in an ongoing scene, and that is what we find. The fact that subjects are in many cases asked to pick out the beginnings and ends of ‘meaningful units of activity’, rather than events per se, is not particularly problematic. Because the subjects are watching movies, the ordinary events that are depicted in the movies just are the meaningful units of activity in the movies. That is especially clear in the movies depicting people engaged in ordinary activities.

There is further reason for thinking that in the segmentation task, subjects are indeed responding to the boundaries between successive events. It turns out that the points that subjects mark as event boundaries in a movie correspond, to varying degrees, with movements of objects, spatial or temporal discontinuities in the scene, changes in people’s interactions with objects (such as picking an object up), changes in the number of people present, changes in people’s interactions with each other (such as beginning a conversation), and changes in people’s goals (such as beginning a new goal-directed activity) in the movie (Zacks, Speer, and Reynolds 2009; Zacks 2004; Zacks et al. 2006; Magliano et al. 2001). Furthermore, the greater number of these changes in features that occur simultaneously, the more likely subjects are to mark that point as an event boundary (Zacks, Speer, and Reynolds 2009). In addition, neural responses to changes in these features account for a portion of the neural responses to event boundaries, suggesting

that neural responses to event boundaries are mediated by registering changes in these features (Zacks et al. 2010).

These are precisely the sorts of features we would expect subjects to be responsive to when marking the boundaries between successive events in movies. Changes in the objects and properties that participate in an event are indeed relevant to changes in the event, and salient, simultaneous changes in a number of those objects and properties tend to mark a beginning or end of an event in the world.

There is neural evidence for our sensitivity to the boundaries between successive events as well. The points that subjects mark as event boundaries in the segmentation task significantly align with transient responses in various neural regions. Zacks, Braver, et al. (2001) recorded subjects' fMRI data as they watched movies passively, without completing any task. Next, the subjects' fMRI data were again recorded as they watched the same movies while doing the segmentation task. It turned out that the points that subjects identified as event boundaries significantly aligned with the transient neural responses (particularly, in the posterior cortex and the right frontal cortex) that occurred during both the active and passive viewings.

Zacks et al. (2010), Zacks et al. (2006), and Speer et al. (2003) found the same results with respect to a number of other neural regions. In the first session of the Speer et al. study, subjects watched movies passively, then watched the same movies while doing the segmentation task. Subjects' fMRI data were recorded during both the passive and active viewings. This was then repeated in a second session, which occurred over a year after the first session. The event boundaries that the subjects identified during the first session significantly aligned not only with the transient neural responses in the first session (during both passive and active viewings), but also with the transient neural responses in the second session (during both passive and active viewings). That is to say that there were selective neural responses during passively-viewed

movies which significantly aligned with the points that subjects had identified as event boundaries over a year earlier.

The results from the fMRI studies give further reason to think that we are sensitive to the boundaries between successive events. Not only do we reliably mark off the boundaries between successive events when asked, but our brains respond transiently to these boundaries naturally (that is, even when we are not asked to do any task).

There is also psychological evidence for our sensitivity to the boundaries between successive events. Various studies have shown that the beginnings and ends of events, as opposed to the insides of events (i.e., what happens *between* the beginning and end of any event), are psychologically significant. Newtson and Engquist (1976) showed subjects portions of movies. The subjects were then shown frames that came from either the portion of the movie that they just watched, or from the portion that they hadn't watched. For each frame, subjects were asked to identify whether or not it came from the portion of the movie they watched. It turned out that subjects were significantly better at accurately judging whether or not the frame came from the portion of the movie they watched if the frame came from a point that had been identified as an *event boundary* (by a different set of subjects who did the segmentation task). If, instead, the frame *did not* come from a point that had been identified as an event boundary – so, it depicted the *inside* of some event –, subjects were significantly worse at accurately judging whether or not that frame came from the portion of the movie they had just watched. The subjects, then, were better at recognizing event boundaries from the movies than non-boundaries.

A similar effect was found by Swallow et al. (2009). They showed subjects movies that were regularly interrupted by recognition tasks. Most of the recognition tasks asked subjects to identify which object on the screen (out of two) appeared in the portion of the movie they just watched. Each time, an object that actually appeared in the movie five seconds before the recognition task

began, and an object of a different type that did not appear in the latest portion of the movie, were displayed. The result was that subjects were significantly better at recognizing the objects that were present during an event boundary in the latest portion of the movie, as opposed to the objects that were present during no event boundary (i.e., only in the inside of some event) in the latest portion of the movie. The event boundaries had been identified by a different group of subjects. So, objects are more likely to be recognized if they are present during the beginning or end of an event, instead of present merely *within* some event.

Similarly, Boltz (1992) showed subjects movies that were occasionally interrupted by commercials. For each movie, all of the commercials occurred either at event boundaries or at non-boundaries in the movie. The event boundaries had been identified by a different group of subjects. Afterward, the subjects completed three tasks. One was a recall task, in which they were asked to describe the major events that happened in the movie. One was a recognition task, in which they were shown short clips that were either from the movie they watched, or from a movie they hadn't watched but that had some of the same characters and settings. They were asked to identify which clips came from the movie they watched. The final task was a temporal order task. They were shown two short clips that came from the movie, and were asked to identify which came first in the movie. All three tasks revealed a significant effect of commercial location. Specifically, subjects did significantly better on each of the tasks for the movies in which the commercials occurred during event boundaries, than for the movies in which the commercials occurred during non-boundaries.

The results of these studies give further support for our sensitivity to the boundaries between successive events. They show that we are psychologically sensitive to the difference between the beginnings and ends, as opposed to the insides, of the events that we are presented with. In general, our memory of the beginnings and ends of events is better than our memory of the

insides of events, and our memory of large events (like full movies) is better if interruptions occur at the beginnings and ends, rather than at the insides, of constituent events.

The empirical evidence, then, shows that we are behaviorally, neurally, and psychologically sensitive to the beginnings and ends of events. We can tell when an event has begun or ended, and we can tell when two successive events are different from each other. This is to say that we can discriminate events from the rest of an ongoing scene *temporally* (since we register the temporal boundaries of the events that occur in a scene), and that we can discriminate successive events.

A plausible interpretation of our behavioral, neural, and psychological sensitivity to event boundaries is just that we are *perceptually* sensitive to these boundaries, and we are perceptually sensitive to them because we perceive events (and being sensitive to events' boundaries is part of perceiving events). The behavioral, neural, and psychological responses may very well be effects or constituents of our perceiving events.

Importantly, the evidence presented thus far does not warrant this conclusion on its own. The fact that we are behaviorally, neurally, and psychologically sensitive to event boundaries does not necessarily mean that our perceptual system treats events as individuals. It is possible that our sensitivity to event boundaries is due simply to our ability to perceptually register salient changes in a scene, and event boundaries tend to be points of salient change. As long as we have a 'salient change detector', we probably can respond reliably to the boundaries between successive events behaviorally, neurally, and psychologically. We need not treat that which happens between any pair of salient changes as a unit in its own right that begins and ends when those salient changes occur.

This being so, to establish that we treat events as individuals, we need further evidence that shows that the criteria for individualhood are met. Granting that we discriminate events from the

rest of a scene temporally and that we discriminate successive events, it must still be shown that we treat events as persisting, attribute features to events, and discriminate multiple simultaneous events. If these criteria are met, it would mean that we treat a given event as a unit, which packages up *certain* objects and properties in a scene, but not others. It would establish that our sensitivity to event boundaries is not simply a matter of salient change detection, but of actual event perception.

Various studies suggest that we treat events as persisting across time. This has been demonstrated in experiments on the relationship between event boundaries and cuts in movies. Cuts are changes in the viewer's perspective relative to the environment depicted in the movie. For instance, the front of a person may be shown, then after a cut, their back may be shown, or the front of the person they are talking to. Even though cuts are fairly salient changes in movies – they sometimes present us with a brand new set of objects and properties in a given scene –, it turns out that the occurrence of a cut does not suffice for subjects to mark a boundary between successive events (Schwan et al. 2000; Zacks et al. 2010; Zacks, Speer, and Reynolds 2009). Schwan et al. had one group of subjects identify the event boundaries in movies. The experimenters then edited the movies by placing cuts either at some of the identified event boundaries, or at some non-boundaries. A different set of subjects then did the segmentation task on the edited movies. Whether the cuts had occurred during event boundaries or non-boundaries in the movies had no effect on the number of event boundaries the subjects marked, and the cuts that occurred at non-boundaries did not make the subjects any more likely to mark an event boundary. Similarly, Zacks, Speer, and Reynolds (2009) and Zacks et al. (2010) found that cuts did not themselves result in subjects marking boundaries between successive events.

This means that cuts, despite being fairly salient changes, are not relevant to where we identify the beginnings and ends of successive events to be. The fact that subjects were not any

more likely to mark event boundaries at cuts shows that, presumably, they recognized whether the event before the cut and the event after the cut were identical. If the events were identical, subjects did not mark an event boundary. This means that subjects were able to treat events as persisting across time, despite changes in their perspective relative to the events. This is a hallmark of treating an item as an individual. Not all perceptible changes are taken to mark the existence of a new, different individual than before.

Further evidence supports the claim that we treat events as persisting. Zacks (2004) showed subjects an animation of shapes moving constantly and smoothly. Despite the fact that the shapes were perceptibly changing their locations during the entire animation, the subjects did not mark a new event boundary upon each slight movement. Instead, they marked event boundaries every several seconds, even when asked to mark whenever the *smallest* meaningful event ended and another began. This suggests that the subjects perceptually grouped a set of features across time as belonging to a *single* ongoing event, even though some of those features were changing constantly across time.

Just as well, as already noted, a set of studies has shown that certain types of changes in events' features correspond with the points that subjects mark as event boundaries in movies to different degrees. Changes in the characters or objects present and the actions done by characters are most strongly correlated with event boundaries, while changes in the spatiotemporal setting are least strongly correlated (Zacks, Speer, and Reynolds 2009; Magliano et al. 2001). This is to say that despite being presented with perceptible changes in features that are relevant to events, such as the event's spatiotemporal location, subjects do not always mark the ending of the current event and the beginning of another, but sometimes treat the current event as persisting.

The evidence, then, shows that we treat events as persisting across time. It is unlikely that our sensitivity to event boundaries is due simply to our perceptual system registering change in an

ongoing scene. Many salient perceptible changes occur in a scene – including changes in events themselves and changes in our perspective relative to events – that do not result in our identifying event boundaries. We do not take just any perceptible change to mark the end of the current event and the beginning of another. Instead, we treat events as persisting across time.

But perhaps our segmentation behavior – marking event boundaries reliably, and not with just any salient change in a scene – can be as it is without our having a rich representation of any given event. That is, perhaps we are simply able to individuate events well. We can tell successive events apart from each other. We can tell when one ends and another begins. We don't treat just any salient change in a perceptual scene as indicating that a given event has ended, but only some. We are good at telling which salient changes in a scene are relevant to the beginnings and ends of events and which are not, so we are good at individuating events.

Individuating events well is more minimal than treating events as individuals. If we treat events as individuals, there is an important sense in which we bind together certain features in the scene and register them as a cohesive unit, by attributing that set of features to a particular event. We need not do this to individuate events well; all we need to do is detect whether enough of the relevant sorts of changes occur in a scene simultaneously. In order to establish that we treat events as individuals, and do not merely individuate them well, I still must show that we positively attribute a discrete set of features in a scene to a given event. This would mean that we represent each *individual* event that we detect in a scene with some detail.

We need additional evidence to show that we attribute features to a given event. Various studies on event completion suggest that we can attribute certain features of an event that we *missed* to the event. Strickland and Keil (2011) showed subjects videos of people launching objects, like kicking a ball or using a slingshot. In some of the videos, the crucial moments of launching – like the person's foot making contact with the ball, or the person's hand letting go of

the taut slingshot – were omitted. Among the videos with the crucial moments of launching missing, the first clip (leading up to the crucial moment) was followed by a second clip, which fell into one of three classes. First, the second clip may have depicted the rest of the scene, which was causally related to the scene depicted in the first clip. E.g., if the first clip showed someone about to kick a ball, the second clip would show the ball rolling across the ground. Second, the second clip may have depicted an irrelevant scene. E.g., the first clip of someone about to kick a ball might be followed by an unrelated scene of people jogging. Third, the second clip may have depicted the rest of the scene, but in a jumbled fashion. E.g., the second clip would show the ball rolling across the ground, but playing in reverse (so the ball comes closer to the kicker over time).

After watching each video (some with the crucial moments of launching, some without), subjects were shown several images and were asked to identify whether each image came from the video. An image of the crucial moment of launching was included every time. It turned out that for the videos with the crucial moments of launching missing, subjects were significantly more likely to *falsely* identify the image of the crucial moment as having appeared in the video, if the second clip had depicted the rest of the scene (which was causally related to what was depicted in the first clip), than if the second clip had depicted an unrelated scene or a causally related but jumbled scene. That is, when the first and second clips were causally and temporally contiguous (apart from missing the crucial moment of launching), subjects were much more likely to take themselves to have seen the crucial moment, than when the first and second clips were not causally and temporally contiguous – even though the subjects had in fact not seen the crucial moment of launching.

Similar results were found by Brockhoff et al. (2016), who showed subjects – soccer novices, soccer players, and expert soccer referees – videos of soccer games. Each short video included or excluded the crucial moment of contact between a player and the ball. In the videos excluding

the crucial moment, the second clip depicted either the rest of the scene or an unrelated scene in the soccer game. Just as Strickland and Keil had found, subjects were significantly more likely to falsely indicate that they had seen the (missing) crucial moment of contact if the second clip depicted the rest of the scene, rather than an unrelated scene. This was so for soccer novices, players, and expert referees alike. In a second experiment, Brockhoff et al. explicitly asked subjects whether or not the moment of contact was shown, instead of having them identify whether particular images were present in the video. The same results were found: subjects were significantly more likely to say that the moment of contact was shown for the videos in which the moment of contact was missing but the second clip depicted the rest of the scene, than if the second clip depicted an unrelated scene.

Papenmeier et al. (2019) used roughly the same experimental design as in Brockhoff et al.'s second experiment. Under one condition, they asked subjects whether or not the moment of contact had been shown in the video they watched. Under another condition, though, they asked subjects to press a button when the moment of contact was shown, as the video was playing. Surprisingly, even in the latter condition, subjects were significantly more likely to *mistakenly* mark the presence of the crucial moment of contact for the videos in which the second clip depicted the rest of the scene, rather than an unrelated scene. In another experiment, Papenmeier et al. had subjects do the segmentation task on the videos. They found that subjects were marginally more likely to mark a boundary between successive events for videos in which the moment of contact was omitted and the second clip showed an unrelated scene, than if the second clip showed the rest of the scene.

These studies give strong evidence in support of event completion. When crucial moments of an event are not shown, subjects are more likely to indicate that they in fact saw those crucial moments, when the second clip depicts the rest of the scene rather than an unrelated scene. A

plausible explanation of these results is that in the videos missing the crucial moments but showing the rest of the scene, subjects are effectively ‘filling in’ the information that they had missed. Because there was in fact a causal and temporal link between the events depicted in the first and second clips, subjects attributed the missing link – the crucial moment of contact – to the event that was depicted. That is, plausibly, they recognized that the event in the first clip and the event in the second clip were the same event, and that the crucial moment of contact was also part of the same event (namely, the part that occurred between what was depicted in the first and second clips).

But in the videos in which the crucial moment of contact was missing and the second clip depicted an *unrelated* scene, subjects (plausibly) recognized that the event in the first clip and the event in the second clip were not the same event. The crucial moment of contact, then, would not have explained the relationship between what was depicted in the first and second clips; its presence would not have made the first and second clips causally and temporally contiguous, since the first and second clips depicted scenes that simply weren’t causally and temporally contiguous (even if the crucial moment was inserted between them). As a result, subjects were much more likely to falsely report that they had seen the crucial moment of contact for the videos in which the second clip showed the rest of the scene, rather than an unrelated scene. They filled in the missing information when it clearly would have fit the gap between the first and second clips.

Notice that the phenomenon of event completion is more rich than the phenomenon of treating an event as persisting across time. It is not merely the case that we recognize that a given event persists even when certain salient perceptible changes occur, such as changes in the event itself or in our perspective relative to it. It is furthermore the case that we actually attribute to the event information that we had missed. That is, when we miss some of the features of an event

(such as the critical moment of contact), not only can we recognize whether the event has persisted, but if it has, we can also attribute the features we had missed to the event. We recognize that the event has a particular set of features that we were not presented with, and we furthermore are prone to mistakenly take ourselves to have perceived that set of features.

The evidence in favor of event completion, then, points towards our ability to attribute features to an event. It appears that we can treat an event as *having* a certain set of features, even if we are not presented with all of those features. Event completion cannot be accounted for by our ability to individuate events alone. Even if we respond to the beginnings and ends of successive events reliably, this is not sufficient for our tendency to mistakenly take ourselves to have perceived missing features of an event when the second clip depicts the rest of the scene as opposed to an unrelated scene. While we are presumably recognizing whether or not the event depicted in the first clip persists through the second clip – which can be accounted for by individuation –, that is not all that we are doing. We are also filling in missing information. We are attributing the information we missed to the event in the cases where the event persisted across the two clips, as indicated by our tendency to err.

Event completion thus gives reason to think that we attribute features to events. If we can attribute features of an event that we've missed to the event, we can likely attribute features of an event that we didn't miss to the event. That is, if we can attribute the crucial moment of contact – the person's foot touching the ball, e.g. –, which we were not even presented with, to the event of the person kicking the ball across the field, surely we can also attribute the person running towards the ball and the ball flying across the field (or, more strictly, the objects and properties associated with those sub-events), which we were presented with, to the event. The thought, then, is that as we are presented with an event, we are attributing to it the features of it that we are

presented with, and sometimes even the features of it that we have missed. We perceptually treat the event as *having* a set of features (objects, properties, and/or sub-events).

Thus, there is reason to think that we perceptually attribute features to events. Not only do we individuate events, but we also ‘identify’ them, in the sense that we treat them as *having* certain features. We treat some of the features in a scene as *participating in* an event, as the event is unfolding.

But, it’s possible that we perceptually attribute features to the successive events that we individuate in a scene in a very coarse way. It could be that we attribute literally all of the perceptible features in a scene to any event that we have individuated. That is, suppose that as we are looking outside our window, we perceptually register times $t1$ and $t2$ as the beginning and end of a child doing a cartwheel outside. Suppose we did so by responding to the right kinds of salient changes in the scene (like abrupt changes in the child’s position), so $t1$ and $t2$ were in fact the beginning and end of the child’s cartwheel. Granting that we perceptually attribute features to the event of the child’s cartwheel – in addition to registering its beginning and end and treating it as persisting across time – is consistent with our attributing *all* of the perceptible features in the scene between $t1$ and $t2$ to the event of the child’s cartwheel. For all I’ve shown thus far, it’s possible that we perceptually attribute all of the cars, buildings, animals, etc. and their properties that we perceive in the scene to the event of the child’s cartwheel.

Perceptually treating an event as an individual requires our attributing a *discrete set* of features in the scene to the event, rather than *all* of the features in the scene. Ideally, we would carve out *only* the objects and properties that are participating in the event, and treat them as features of the event. In the cartwheel case, we would thus attribute the child and their properties to the event, but not the nearby cars, buildings, animals, etc. and their properties. If we always attribute

all of the features in a scene to any event that we discriminate, then ‘perceiving an event’ would look more like ‘perceiving a scene within a particular timeframe’.

What is needed is evidence that we perceptually attribute only a discrete set of features in a scene to a given event. Evidence that we can individuate simultaneous but distinct events would do the trick, since it would show that we treat one event as having a *certain set of features* in the scene, and another event as having *a different set of features* in the scene, within the same timeframe (or at least in overlapping timeframes).

There is indeed evidence that we individuate simultaneous events. Bregman and Dannenbring (1973) played subjects two sequences of tones. Each sequence followed either the pattern ‘H₁, L₁, H₂, L₂’ or the pattern ‘H₁, L₂, H₂, L₁’, where H is a relatively high pitch and L is a relatively low pitch, 1 is slightly lower than 2, and the perceived difference between H₁ and H₂ is the same as that between L₁ and L₂. The difference between the two patterns, then, is whether the pitch difference between each H-L pair in the pattern remains the same or varies. In the first pattern, it remains the same (since the H₁-L₁ difference is the same as the H₂-L₂ difference), while in the second, it varies (since the H₁-L₂ difference is smaller than the H₂-L₁ difference). If the pitch difference remains the same between each H-L pair, then L₁ comes before L₂ in the sequence; otherwise, L₂ comes before L₁.

The experimenters played subjects one sequence, then another, which may or may not have followed the same pattern. Subjects were asked whether the order of the tones in the two sequences was the same. Across trials, the amount of time that each tone was presented for varied (so, sometimes the tones in the sequence proceeded each other quickly), and whether or not a full or partial glissando connecting the subsequent tones varied (so, sometimes a descending series of tones was heard between each H-L pair and an ascending series of tones was heard between each L-H pair).

Both the variations in time and in the presence of a glissando had a significant effect on subjects' performance. Subjects were worse at identifying whether the temporal order of the tones in the two sequences was the same if there was neither a full nor partial glissando connecting subsequent tones, or if the tones in the pattern proceeded quickly. Bregman and Dannenbring suggest that in such cases, subjects were segmenting the high tones into a separate auditory stream from the low tones. That is, thanks in part to the fact that the high tones were not connected to the low tones via glissandos, or that the sequences proceeded quickly, the H₁-H₂ part of the pattern was more likely to be heard as distinct from the L₁-L₂ part of the pattern. This would explain the subjects' worse performance on identifying whether the order of the tones in the two sequences was the same. Whether the subjects are presented with the 'H₁, L₁, H₂, L₂' pattern or the 'H₁, L₂, H₂, L₁' pattern will not make a difference to them, if they are indeed grouping together the Hs and the Ls into separate streams; they will simply be hearing 'H₁, H₂' and 'L₂, L₁' patterns playing simultaneously. The *relative* order of the particular H tones and L tones in the pattern, then, will not be discriminated, so subjects will be worse at identifying whether the temporal order of the tones in the two sequences is the same.

On the other hand, when each H-L and L-H pair is connected by a full or partial glissando, or when the tones proceed each other more slowly, subjects are more likely to hear the pattern as a *single* auditory stream. They do not break the 'H₁, L₁, H₂, L₂' pattern, for instance, into separate 'H₁, H₂' and 'L₁, L₂' patterns, but they hear it as a single pattern in its own right. They are thus better at identifying the relative order of the H and L tones. When a sequence is heard as a single auditory stream, the difference between the 'H₁, L₁, H₂, L₂' pattern and the 'H₁, L₂, H₂, L₁' pattern is detected. But when a sequence is heard as two separate auditory streams, the difference between the patterns is not detected.

In a second experiment, Bregman and Dannenbring played subjects one sequence and simply asked them whether it sounded like one or two auditory streams. This verified the interpretation of the finding from the first experiment. Subjects were much more likely to say that a sequence sounded like two auditory streams when the tones were not connected by glissandos or proceeded each other quickly.

This, then, is evidence that we can perceive multiple distinct events simultaneously. Positing that subjects are breaking a given pattern up into separate ‘H₁, H₂’ and ‘L₁, L₂’ streams explains why they are worse at judging the temporal order of tones when they proceed quickly or are not connected by glissandos. They are hearing the ‘H₁, H₂’ stream as distinct from the ‘L₁, L₂’ stream. It is fair to say, then, that their perceptual system treats the string of Hs as a separate event from the string of Ls, even though both events are unfolding simultaneously.

Our ability to individuate simultaneous events suggests that we perceptually attribute a *discrete* set of features in a scene to a given event. In this case, the subjects were attributing only the *high* tones to one event, and only the *low* tones to a separate event, even though the high tone event and the low tone event were unfolding in the same scene within the same timeframe. Thus, we do not perceptually attribute all of the perceptible features in a scene to a single event, but only a particular set of those features. This is what enables us to discriminate multiple simultaneous events.

I have argued that our perceptual system engages in behaviors that indicate that it treats events as individuals: it discriminates events from the rest of a scene, treats events as persisting across time, attributes features to events, and discriminates simultaneous events. We perceptually treat an event as a discrete *unit* in an ongoing perceptual scene that bears a discrete set of features (objects and properties) in the scene. This is to say, then, that we have perceptual representations of events, which construe events as individuals. The many behavioral, neural, and psychological

effects discovered in the empirical research on event perception can be seen as effects or constituents of these event representations. Tokening an event representation produces those effects.

Here, then, is the picture I have sketched so far. Say we are presented with an event, like a person doing the dishes, so we token a perceptual representation of that event. The representation will construe the event of the person doing the dishes as an individual, that is, as a discrete unit in the scene with a particular set of features. It is thanks to our perceptually treating the event of the person doing the dishes as an individual that we can discriminate it from the rest of a scene temporally (so, we can perceptually register when the person starts and stops doing the dishes); that we can treat the event of the person doing the dishes as persisting across time (even though we'll perceive changes in where the dishes are, which one the person is holding, what the person's bodily position is, and so on across time); that we can attribute a set of features to the event of the person doing the dishes (like the person, the dishes, and their shapes, colors, sizes, and locations); and that we can discriminate the event of the person doing the dishes from other events in the scene (like a different person making a sandwich nearby). Our tokening a perceptual representation of the person doing the dishes produces the behavioral, neural, and psychological effects that are associated with event perception (like remembering the person starting and stopping doing the dishes better than washing each dish, showing the transient neural responses when the person starts and stops doing the dishes, and so on).

But in order for event representations to be properly so-called, it must be the case that they are differentially sensitive to events, rather than mere objects or properties (that are not participating in any perceptible event). That is, event representations must be tokened frequently by events in the world, and must be tokened infrequently by mere objects or properties in the

world. This would show that event representations are sensitive to the presence of *events*, relative to non-events.

We know from the empirical research that event representations are in fact tokened by events frequently. When subjects are presented with movies, which are events themselves and consist in smaller events, they token event representations, as indicated by the behavioral, neural, and psychological effects shown in the empirical research. Subjects are indeed responding to items in the world that have the canonical features of events.

As far as we currently have reason to believe, event representations are tokened infrequently by mere objects or properties. It would be surprising to discover that when presenting subjects with a set of objects or properties that are not participating in any event (such as an unchanging image of a cat, or a red splotch), subjects would reliably mark points at which ‘one meaningful unit of activity has ended and another has begun’, as they do when presented with events in movies. None of the features indicating a change of events would be presented to them, so there’s no reason to think that they would segment any events reliably. It would just as well be surprising to find that the neural and psychological markers of being presented with the beginning and end, as opposed to the insides, of an event would appear in the subject, given that the images on the screen would not be unfolding across time in any meaningful way.

It appears, then, that event representations are tokened frequently by events in the world, and tokened infrequently by mere objects or properties in the world. But for event representations to be properly so-called, it must also be the case that they track events across time. That is, frequently, when presented with a new event in the world, we token a new event representation, and only infrequently, when not presented with a new event in the world (but, instead, an event that is persisting), we token a new event representation. This would show that token event

representations are swapped in a way that usually corresponds to actual changes of events in the world.

Indeed, it seems that event representations track events across time. We know from the empirical research that, frequently, subjects token a new event representation when presented with a new event in a movie, since they reliably show the behavioral, neural, and psychological effects of tokening a new representation at the boundaries between successive events. And, as far as we have currently reason to believe, subjects infrequently token a new event representation when not presented with a change of events. This is suggested by the fact that subjects segment events reliably, and in a way that accords with the sorts of changes in a scene that are in fact indicative of a change of events.

Because event representations are usually tokened by events in the world, and new event representations are usually tokened by new events in the world, event representations are properly so-called. We perceive events, thanks to our event representations.

Several factors point towards event representations indeed being *perceptual*, rather than cognitive. As already discussed, our perceptual systems appear to segment events ‘naturally’, or unprompted. While watching movies, subjects’ brains showed reliable transient responses at the points that the subjects would *later* identify as event boundaries. That is, the transient neural responses that occurred while subjects watched movies passively (that is, without being instructed to complete any task) corresponded to the points that subjects *afterward* marked as event boundaries in those movies during the segmentation task (Zacks et al. 2001; Zacks et al. 2010; Zacks et al. 2006; Speer et al. 2003).

The behavioral evidence gathered in the segmentation task is susceptible to the objection that subjects are simply judging, post-perceptually, that a given event has ended and another has begun. They can do so reliably even if they don’t actually perceive events. The psychological

evidence gathered in memory tasks is susceptible to the objection that subjects are simply judging or (mis)remembering that they had perceived events, and here too, the psychological effects may be reliable even if subjects didn't actually perceive any events. The neural evidence is less susceptible to these objections. This is because the transient neural responses occur *live*, while subjects are watching movies; they likely are not simply a matter of subjects *remembering* the events in the movies. They also occur *unprompted*, while subjects are simply watching movies passively, and even when subjects are not aware that event perception is being studied; they likely are not just a matter of subjects *judging* that certain events have occurred. The neural evidence is thus a good indication that we indeed *perceive* events as a scene unfolds.

There is further evidence that event representations are perceptual, not merely cognitive. Ten- to eleven-month-old infants appear to segment perceptual scenes into discrete events. Baldwin et al. (2001) showed infants a short movie of people engaging in an everyday activity, until the infants were familiarized with it. The infants were then shown a version of the movie that included a brief pause. The pause occurred either at an event boundary (e.g., the person grasps a towel, just before putting it on a towel rack) or during the inside of some event (e.g., the person is moving their arm towards a towel to grasp it). The result was that the infants looked at the 'interrupted' (latter) version of the movie significantly longer than both the version that they had become familiar with and the 'completed' (former) version of the movie.

The infants, then, behaved as though they found a pause during the inside of an event more novel than a pause at the end of an event in the movie. This suggests that, like adults, infants can discriminate the beginnings and ends of events. They can tell when an event has begun or ended, and when an event is still unfolding. The fact that *infants* appear to parse an ongoing scene into discrete events ought to be treated similarly to the evidence for infants parsing a scene into

discrete objects; it should be taken to point towards this behavior being *perceptual* (see, e.g., Burge 2010, pp. 300-312; Quilty-Dunn 2020; Green 2019).

Another piece of evidence suggests that our sensitivity to the beginnings and ends of events is indeed perceptual. The better a subject's 'segmentation ability' – that is, the more the points that they mark as event boundaries during the segmentation task align with the points marked by other subjects in the sample –, the better their memory of the movie they had watched (Kurby and Zacks 2018). Sargent et al. (2013) discovered that this relationship is not accounted for by general cognitive capacities, such as working memory, executive function, episodic memory, and general knowledge. Instead, it is *uniquely* accounted for by segmentation ability itself. That is, it appears that the reason that subjects with better segmentation ability remember movies better is due simply to the fact that those subjects have better segmentation ability, and *not* because they're better at remembering in general, or that they know more about the world in general. This suggests that segmentation ability is a wholly *perceptual* capacity.

For these reasons, event perception is indeed a *perceptual* activity. This is not to say that cognitive factors cannot play a role in event perception. When observing human activities, the goals and activity types play into how we individuate those events. It is likely that information about goals and activity types is represented cognitively, rather than perceptually, so it is likely that cognition influences our individuation of events. Saying that event perception is genuinely perceptual is also not to say that we do not engage in event cognition, wherein we use *cognitive* representations of events. We most likely do; we seem to be able to think about, analyze, make judgments about, and make inferences on the basis of events. Where exactly the line falls between event perception and event cognition (or, just as well, perceptual vs. cognitive representations of events) will be partly an empirical matter.

The fact that we have event representations does not imply we always represent events accurately. It is only in veridical cases of event perception that we in fact token an event representation when presented with an event, and update it when the event we're presented with changes. In non-veridical cases, we might token an event representation when we are not presented with an event (but instead, say, a set of unchanging objects and properties), or token a new representation even when we're not presented with a new event. To figure out what exactly goes wrong in non-veridical cases, we would need to determine what the accuracy conditions are for event representations.

Importantly, to say that we perceive events (or that we have perceptual representations of events) is not to say that event perception is irreducible (or that our event representations are irreducible to our object and property representations). All I've argued is that we have a unique type of perceptual representation, one that is differentially sensitive to events, rather than mere objects or properties. It is a live possibility that token event representations are nothing more than certain combinations of token object and property representations. For instance, suppose we have an event representation of a person dancing. It is possible that our event representation is nothing over and above a set of token object and property representations that collectively pick out the event of the person dancing in the world – namely, our representations of the person (object) and their shape, size, bodily positions, and so on (properties) across time. Because every event we perceive has at least some objects or properties as participants, it is possible that any token event representation consists in nothing but the set of object and property representations that track those particular objects and properties across time. So, while we can legitimately talk about event representations – because our perceptual system does discriminate events from non-events and track events across time –, those representations might be token-identical to object and property representations.

2.3 The Possibility of Event Perception

I have argued that we perceive events. Yet there are reasons to deny the possibility of event perception. Suppose, for instance, that events are not a fundamental metaphysical kind (e.g., Kim 1976; Lewis 1986; Horgan 1978). Suppose that the only fundamental metaphysical kinds are objects and properties. One might think that, in this case, we cannot be differentially sensitive to events *as opposed to* objects and properties, since there are no fundamental events, in addition to fundamental objects and properties, in the world. Differential sensitivity to some kind of item in the world requires it to be a fundamental metaphysical kind, because the fundamental metaphysical kinds just are the kinds of item in the world that we are presented with. Insofar as differential sensitivity to events, as opposed to objects and properties, is required for perception of events, we cannot perceive events, the thought goes.

I maintain, however, that we are differentially sensitive to *ordinary* events, as opposed to *ordinary* objects and properties. This is so even if ordinary events do not count as a fundamental metaphysical kind themselves, or even if they do not consist in fundamental events (as opposed to fundamental objects and properties). As the empirical work on event perception suggests, we have a unique type of perceptual representation that is differentially sensitive to things in the world with the canonical features of ordinary events (beginning and ending, unfolding over time, having objects and properties as participants, etc.). There are indeed things in the world that have the canonical features of ordinary events. Our perceptual system treats those things as certain type of individual, and it treats that type of individual differently than it treats ordinary objects and properties.

Whether or not there is a fundamental metaphysical kind ‘ordinary event’ does not make a difference to how our perceptual system carves up types of items in the world. Our perceptual system probably categorizes items in a way that is useful to us as biological creatures, rather than

in a way that reflects fundamental metaphysical truths. Just as well, even if there is *no* fundamental metaphysical kind ‘event’ that all ordinary events reduce to, our perceptual system nevertheless treats ordinary events differently than it treats ordinary objects and properties. Because we are differentially sensitive to ordinary events, as opposed ordinary objects and properties, we perceive ordinary events.

But there is another worry about event perception stemming from the metaphysical status of ordinary events. Suppose again that the only fundamental metaphysical kinds are objects and properties. One might grant that perception of ordinary events occurs (since it does not require there to be any fundamental events), yet deny that event perception is interestingly different than object and property perception. If ordinary events are sets of objects and properties fundamentally, then all event perception just is object and property perception. That is, whenever we are perceiving an ordinary event, we are perceiving what is ultimately just a set of objects and properties in the world. Because event perception, object perception, and property perception are all directed at (only) objects and properties in the world, there is no reason – and it is misleading – to distinguish event perception from object and property perception, since they are not interestingly different, the thought goes.

What makes event perception interestingly different than object and property perception, I maintain, is that our perceptual system responds to ordinary events differently than it responds to ordinary objects and properties. This is so whether or not ordinary events ultimately reduce to objects and properties in the world. When presented with an ordinary event, as opposed to a mere ordinary object or property, we show a distinctive set of behavioral, neural, and psychological effects. We token a unique type of perceptual representation. We usually don’t token that type of perceptual representation when presented with a mere ordinary object or property. Furthermore, not all cases of ordinary object and property perception are cases of

ordinary event perception. We can perceive mere ordinary objects and properties, without perceiving them to participate in any ordinary event. It is fair and interesting, then, to treat event perception as a phenomenon that is distinct from object and property perception, because we perceptually treat (ordinary) events differently than we perceptually treat (ordinary) objects and properties.

Another pressing doubt about the possibility of event perception stems from the puzzle of ‘temporal perception’ (e.g., James 1886; LePoidevin 2004; Hoerl 2013; Phillips 2014). While ‘temporal perception’ is not limited to event perception, we can formulate the puzzle in terms of event perception: perceiving an event requires perceiving that event at a given moment. Suppose an event occurs from $t1$ through $t2$, and we perceive it from beginning to end. This requires our perceiving the event at $t1$, and at $t2$. But the full event does not exist at any one moment; only a temporal part of the event exists at $t1$, and at $t2$. This means that we actually cannot perceive *the event* at $t1$, nor at $t2$; we can at most perceive *a temporal part* of the event at $t1$, and at $t2$. The event itself – the full event – is not available to us perceptually at $t1$ nor at $t2$. This is because our perception is limited to that which is present at a given moment, and because the full event simply does not exist at a given moment. Because all that we perceive moment by moment is a temporal part of the event, we never perceive the full event itself.

The immediate consequence is that we can at most *cognize* events, rather than perceive them. Even though we can perceive each of the temporal parts of an event serially, this is not sufficient for perceiving the full event. At best, after having perceived each of the temporal parts of an event, we can *cognize* that all of those temporal parts belonged to a single event. Or, even as the event is unfolding, we can *remember* that we have perceived certain temporal parts of it, and we can *expect* that we’re going to perceive other temporal parts of it. But remembering, expecting, and the like are cognitive activities, not perceptual activities. Because our perceptual capacities

are limited to targeting that which is *present* in our environment at any moment, we cannot truly *perceive* events (nor any items that take time to unfold).

As I see it, this formulation of the puzzle of temporal perception demands answers to two questions: how it is that we can perceive an event given that we can perceive only that which is immediately (i.e., at this very moment) present to us, and how it is that we can perceive an event given that events do not fully exist at any one moment. These questions are importantly different, as will become clear.

The first question rests on a false assumption. The assumption is that we can perceive only that which is immediately present to us. I take this to be an assumption about something like perceptual (or phenomenal) experience: we can perceive only a temporal part of an event at any one time, since our perceptual/phenomenal experience is as of a still, unchanging environment at any single moment.

If we grant that we perceive objects (as is the common view), however, this assumption must be rejected (see, e.g., O’Callaghan 2011b). There is an obvious sense in which our perceptual experience of an object at any one moment is limited to *the parts of the object that we happen to be perceiving at that moment*. If, at *t1*, we are viewing a TV head-on, there is a sense in which we only perceptually experience the front surface of the TV; we do not perceptually experience the back surface of the TV, nor the bottom surface. This goes for any three-dimensional object that we perceive. Our perceptual experience of an object at any one moment includes only *some* of the object’s outer parts or surfaces.

(This is not meant to be a controversial claim. If putting it in terms of ‘perceptual experience’ sounds controversial, other terms will do – that which we ‘phenomenally experience’ at a moment, that which is ‘phenomenally available’ to us at a moment, that which is ‘perceptually accessible’ to us at a moment, that which is ‘directly perceptible’ at a moment, etc.)

Despite the fact that at any moment, we can perceptually experience only some parts of an object, we can nevertheless *perceive the object* at any one moment. Even when we experience only the front of the TV, we're still perceiving and perceptually representing the TV itself, of which the front is only one part. We still perceptually treat the TV as an individual, which has features that we are not currently experiencing, such as its back surface. We act as though this is true – we would be surprised to find that, as we explore the TV, it is simply a façade.

Given that this is the ordinary view about object perception, we ought to say the same thing about event perception. Even though we can perceptually experience only a temporal part of an event at any moment, we can nevertheless perceive the event (that contains this temporal part) at any moment. That is, for instance, at any moment during which we are listening to a song, we are indeed *perceiving the song*, even though we are perceptually experiencing only a temporal part of it. The fact that we can experience only a temporal part of an event at a moment does not preclude our perceiving the event that partly consists in that temporal part, just as experiencing only a spatial part of an object at a moment does not preclude our perceiving the object that *has* that spatial part. Events pose no *special* problem in this regard.

But the second question raised in the puzzle of temporal perception suggests a different sense in which events may pose a special problem. The question, again, is how it is that we can perceive an event given that events do not fully exist at any one moment. Notice that there may be a relevant difference between events and objects here. Let's grant that while objects exist fully in a moment, events necessarily take time to unfold. The worry is that for us to perceive some item at a given time, that item must exist in the world at that time. If that item does not exist – but, say, only a *part* of it exists –, then we cannot perceive that item at that time. Because an event (in full) does not exist at a given moment, we cannot perceive that event at a moment. And because an event does not exist fully at *any* moment during which it is unfolding, we cannot

perceive the event at *any* moment during its lifespan, so we can never actually perceive the event. This is not a problem with object perception, since objects exist fully in a moment. We can perceive an object at any moment in its lifespan because the object is an item in the world that exists at any one of those moments. We cannot perceive an event at any moment in its lifespan because the event is not an item in the world that exists at any one of those moments.

Though this is a more pressing objection to event perception, it too rests on a false assumption. The assumption is that whether an item fully exists at any one moment or takes time to unfold makes a difference to our perception of it. For either type of item, we simply perceptually experience *parts* of it at a time, and it takes us time to perceive *more* parts of it. Consider again looking at the front surface at a TV at a moment. For us to see the back surface of the TV, our perspective relative to the TV will have to change, which will take time. Either we'll have to move in the environment to be able to perceptually experience the back surface, or the TV will have to rotate so that we can perceptually experience the back surface. In either case, it will take time for us to perceptually experience all of the outer parts of the TV, or, indeed, any part of it that we have not yet experienced.

The same exact phenomenon occurs with event perception. It of course takes time for us to perceptually experience more and more features of an event, just as it takes time for us to perceptually experience more and more features of an object. This being so, it does not matter that an object exists fully in a moment while an event does not – we will perceptually experience either individual bit by bit, across time. Even if events did exist fully in a moment, it would make no difference perceptually. Just as with objects, we'd still perceptually experience the various features of the event across time, not all at once.

We can thus perceive a given event at any moment during which it is unfolding, just as we can perceive a given object at any moment during which we are presented with only a few of its

parts. Whether an individual exists fully at a moment or not makes no difference to how we will perceptually experience it moment by moment. Because we can perceive an event (like a song) at any moment during which it is unfolding (like at the start of its chorus) – that is, because we can perceive the *individual* at any moment –, we can perceive events.

I have argued that we perceive events, and that we have event representations. Event representations are perceptual representations of a unique type of individual, namely, an event (rather than an object). Our event representations are differentially sensitive to and track events (rather than mere objects and properties) across time, so they are properly so-called.

Furthermore, we have event representations and perceive events even if events are not a fundamental metaphysical kind, and despite the fact that, unlike objects, events take time to unfold.

References

- Baldwin, D. A., Baird, J. A., Saylor, M. M., & Clark, M. A. (2001). Infants Parse Dynamic Action. *Child Development, 72*(3), 708–717.
- Batty, C. (2011). Smelling Lessons. *Philosophical Studies, 153*, 161–174.
- Boltz, M. (1992). Temporal Accent Structure and the Remembering of Filmed Narratives. *Journal of Experimental Psychology: Human Perception and Performance, 18*(1), 90–105.
- Bregman, A. S., & Dannenbring, G. L. (1973). The Effect of Continuity on Auditory Stream Segregation. *Perception & Psychophysics, 13*(2), 308–312.
- Brockhoff, A., Huff, M., Maurer, A., & Papenmeier, F. (2016). Seeing the Unseen? Illusory Causal Filling in FIFA Referees, Players, and Novices. *Cognitive Research: Principles and Implications, 1*(7), 1–12.
- Burge, T. (2010). *Origins of Objectivity*. Oxford: Oxford University Press.
- Chuard, P. (2011). Temporal Experiences and Their Parts. *Philosophers' Imprint, 11*(11), 1–26.
- Clark, A. (2004). Feature-Placing and Proto-Objects. *Philosophical Psychology, 17*(4), 443–469.
- Clark, A. (2000). *A Theory of Sentience*. Oxford: Oxford University Press.
- Cohen, J. (2004). Objects, Places, and Perception. *Philosophical Psychology, 17*(4), 471–495.
- Dainton, B. (2008). Sensing Change. *Philosophical Issues, 18*, 362–384.
- Gibson, J. J. (2015). *The Ecological Approach to Visual Perception: Classic Edition*. New York: Psychology Press.
- Gibson, J. J. (1975). Events Are Perceivable but Time Is Not. In J. T. Fraser & N. Lawrence (Eds.), *The Study of Time II: Proceedings of the Second Conference of the International Society for the Study of Time* (pp. 295–301). New York: Springer-Verlag.
- Green, E. J. (2019). A Theory of Perceptual Objects. *Philosophy and Phenomenological Research, 99*(3), 663–693.
- Hoerl, C. (2013). “A Succession of Feelings, in and of Itself, Is Not a Feeling of Succession.” *Mind, 122*(486), 373–417.
- Horgan, T. (1978). The Case Against Events. *The Philosophical Review, 87*(1), 28–47. James, W. (1886). The Perception of Time. *The Journal of Speculative Philosophy, 20*(4), 374–407.
- James, W. (1886). The Perception of Time. *The Journal of Speculative Philosophy, 20*(4), 374–407.

- Kim, J. (1976). Events as Property Exemplifications. In M. Brand & D. Walton (Eds.), *Action Theory* (pp. 310-326). Dordrecht: D. Reidel.
- Kurby, C. A., & Zacks, J. M. (2018). Preserved Neural Event Segmentation in Healthy Older Adults. *Psychology and Aging, 33*(2), 232–245.
- LePoidevin, R. (2004). A Puzzle concerning Time Perception. *Synthese, 142*(1), 109–142.
- Lewis, D. (1986). *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- Magliano, J. P., Miller, J., & Zwaan, R. A. (2001). Indexing Space and Time in Film Understanding. *Applied Cognitive Psychology, 15*, 533–545.
- Magliano, J. P., & Zacks, J. M. (2011). The Impact of Continuity Editing in Narrative Film on Event Segmentation. *Cognitive Science, 35*(8), 1489–1517.
- Newton, D. (1973). Attribution and the Unit of Perception of Ongoing Behavior. *Journal of Personality and Social Psychology, 28*(1), 28–38.
- Newton, D., & Engquist, G. (1976). The Perceptual Organization of Ongoing Behavior. *Journal of Experimental Social Psychology, 12*, 436–450.
- O’Callaghan, C. (2016). Objects for Multisensory Perception. *Philosophical Studies, 173*(5), 1269–1289.
- O’Callaghan, C. (2011a). Hearing Properties, Effects or Parts? *Proceedings of the Aristotelian Society, 111*, 375–405.
- O’Callaghan, C. (2011b). Lessons from Beyond Vision (Sounds and Audition). *Philosophical Studies, 153*(1), 143–160.
- O’Callaghan, C. (2008). Object Perception: Vision and Audition. *Philosophy Compass, 3*(4), 803–829.
- O’Callaghan, C. (2007). *Sounds*. Oxford: Oxford University Press.
- Papenmeier, F., Brockhoff, A., & Huff, M. (2019). Filling the Gap despite Full Attention: The Role of Fast Backward Inferences for Event Completion. *Cognitive Research: Principles and Implications, 4*(3), 1–17.
- Peterson, M. (2001). Object Perception. In E. B. Goldstein (Ed.), *Blackwell Handbook of Sensation and Perception* (pp. 168–203). Malden: Blackwell.
- Phillips, I. (2014). The Temporal Structure of Experience. In D. Lloyd & V. Arstila (Eds.), *Subjective Time: The Philosophy, Psychology, and Neuroscience of Temporality* (pp. 139–158). Cambridge: MIT Press.

- Quilty-Dunn, J. (2020). Concepts and Predication from Perception to Cognition. *Philosophical Issues*, 30(1), 273–292.
- Richmond, L. L., & Zacks, J. M. (2017). Constructing Experience: Event Models from Perception to Action. *Trends in Cognitive Sciences*, 21(12), 962–980.
- Sargent, J. Q., Zacks, J. M., Hambrick, D. Z., Zacks, R. T., Kurby, C. A., Bailey, H. R., Eisenberg, M. L., Beck, T. M. (2013). Event Segmentation Ability Uniquely Predicts Event Memory. *Cognition*, 129, 241–255.
- Schellenberg, S. (2018). *The Unity of Perception*. Oxford: Oxford University Press.
- Schellenberg, S. (2016). Perceptual Particularity. *Philosophy and Phenomenological Research*, 93(1), 25–54.
- Schwan, S., Garsoffky, B., & Hesse, F. W. (2000). Do Film Cuts Facilitate the Perceptual and Cognitive Organization of Activity Sequences? *Memory and Cognition*, 28(2), 214–223.
- Siegel, S. (2006). How Does Visual Phenomenology Constrain Object-Seeing? *Australasian Journal of Philosophy*, 84(3), 429–441.
- Soteriou, M. (2010). Perceiving Events. *Philosophical Explorations*, 13(3), 223–241.
- Speer, N. K., Swallow, K. M., & Zacks, J. M. (2003). Activation of Human Motion Processing Areas during Event Perception. *Cognitive, Affective and Behavioral Neuroscience*, 3(4), 335–345.
- Spelke, E. S. (1990). Principles of Object Perception. *Cognitive Science*, 14(1), 29–56.
- Strickland, B., & Keil, F. (2011). Event Completion: Event Based Inferences Distort Memory in a Matter of Seconds. *Cognition*, 121(3), 409–415.
- Swallow, M. K., Jeffrey, Z. M., & Richard, A. A. (2009). Event Boundaries in Perception Affect Memory Encoding and Updating. *Journal of Experimental Psychology: General*, 138(2), 236–257.
- Treisman, A. (1998). Feature Binding, Attention and Object Perception. *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences*, 353(1373), 1295–1306.
- Zacks, J. M. (2004). Using Movement and Intentions to Understand Simple Events. *Cognitive Science*, 28, 979–1008.
- Zacks, J. M., Braver, T. S., Sheridan, M. A., Donaldson, D. I., Snyder, A. Z., Ollinger, J. M., Buckner, R. L., & Raichle, M. E. (2001). Human Brain Activity Time-Locked to Perceptual Event Boundaries. *Nature: Neuroscience*, 4(6), 651–655.
- Zacks, J. M., Speer, N. K., & Reynolds, J. R. (2009). Segmentation in Reading and Film Comprehension. *Journal of Experimental Psychology: General*, 138(2), 307–327.

- Zacks, J. M., Speer, N. K., Swallow, K. M., Braver, T. S., & Reynolds, J. R. (2007). Event Perception: A Mind/Brain Perspective. *Psychological Bulletin*, *133*(2), 273–293.
- Zacks, J. M., Speer, N. K., Swallow, K. M., & Maley, C. J. (2010). The Brain's Cutting-Room Floor: Segmentation of Narrative Cinema. *Frontiers in Human Neuroscience*, *4*(168), 1–15.
- Zacks, J. M., Swallow, K. M., Vettel, J. M., & McAvoy, M. P. (2006). Visual Motion and the Neural Correlates of Event Perception. *Brain Research*, *1076*, 150–162.
- Zacks, J. M., Tversky, B., & Iyer, G. K. (2001). Perceiving, Remembering, and Communicating Structure in Events. *Journal of Experimental Psychology: General*, *130*(1), 29–58.

3 Event Representations

Intuitive and empirical evidence suggests that we perceive events, like watching a TV show, hearing a song, or feeling the rain fall. When presented with an item in the world that has the canonical features of events – such as beginning and ending, unfolding across time, and having objects and properties as participants –, we often token a perceptual representation of an event. This event representation depicts the event in the world as an individual to which particular features (objects and properties) are attributed.

Granting that we perceive events and have event representations, a significant question is how event representations relate to other perceptual representations. For example, since we perceptually attribute at least some objects or properties to every event, any token event representation may or may not be identical to a set of token object and property representations. A common view is that a perceptual representation of an individual, like an object, is not identical to the set of features that are bound to it, since in order for us to perceive the set of features as features of the same thing, the representation of the individual must be over and above the representations of the features (Clark 2000, 2004; Cohen 2004; Jackson 1975). The same may go for event representations, since they too are representations of individuals. If so, this may threaten the dominant view in the philosophy of perception that we have (only) object and property representations.

Another issue is whether there is a type of property that we typically perceptually attribute to events but not to objects. Given, for instance, that events in the world can be slow-paced while objects in the world cannot be, perhaps we can bind a representation of the property of ‘being

slow-paced' to event representations but not to object representations (at least not typically). There may be an entire assortment of perceptible properties that are typically attributed only to events. This would be interesting because it may suggest that there is a dimension along which perceptible properties vary beyond the 'high level vs. low level' dimension (e.g., Siegel 2006; Bayne 2009; Fish 2013; Montague 2017). Perceptible properties may be more variegated than has been recognized due to the focus on a single type of individual that we perceive.

I will discuss the ways in which I take event representations to be related to other types of perceptual representation. In particular, I will argue that event representations are not token-identical to sets of object or property representations, and that we typically perceptually attribute the property of temporal boundness to events, but not to objects.

3.1 Identity

The fact that we *have* a certain type of perceptual representation does not imply that it is over and above other types of perceptual representation. Suppose we have a type of perceptual representation that is differentially sensitive to and tracks faces over time. Frequently, face representations are tokened when presented with faces, and rarely are they tokened when not presented with faces. Frequently, a given face representation is updated as a presented face undergoes perceptible changes and is swapped when presented with a different face. Face representations are a different type of representation than (mere) object or property representations, since they are not differentially sensitive to, nor do they track, just any object or property.

Even if this is so, it does not mean that face representations are over and above object and property representations. In particular, token face representations may be identical to token object representations, meaning our perceptual system treats faces just as a specific sort of object.

Or, token face representations may be identical to token property representations, meaning our perceptual system treats faces just as a certain sort of property (see, e.g., Block 2014). In these cases, since token face representations would be identical to token object or property representations, they would not be sui generis representations. They would not be over and above token object or property representations.

The same goes for event representations. Just because we have a type of representation that is differentially sensitive to and tracks events over time does not mean that event representations are over and above object and property representations. I will suggest, however, that event representations are indeed over and above object and property representations; token event representations are not identical to (sets of) token object or property representations, but are instead sui generis representations. For instance, when perceiving a person talking, our token event representation is as of ‘a person talking’. This representation is over and above our representations of the person and their properties; it is that which *binds* those representations, enabling us to perceive the person and their properties as participants of the event of the person talking. For any event that we perceptually represent, our event representation is as of the event itself. Our perceptually attributing objects and properties to the events amounts to our event representation binding our representations of those objects and properties. I will show how the view that event representations are sui generis does a better job of explaining event perception than various potential views according to which event representations are identical to token object or property representations.

One potential view is that token event representations are nothing but sets of token property representations. In particular, a token event representation is identical to the set of token representations of the properties that we perceptually attribute to the event. When perceiving a person talking, we may attribute to that event such properties as the colors, shapes, sizes,

textures, and so on of the person's body and the pitches, volumes, and timbres of the sounds they are making. On this view, our representation of the person talking just is the set of representations of the colors, shapes, pitches, and so on that we attribute to the event of the person talking. Assuming the set can be temporally ordered, perceptually representing a token event comes down to representing some properties at t_1 , then some (perhaps different) properties at t_2 , and so on, for precisely as long as we represent the event.

This view may appeal to those who have doubts about the occurrence of 'temporal perception', that is, perception of temporal properties such as duration, change, simultaneity, etc. (see, e.g., Reid 1855; James 1886; Dainton 2008; LePoidevin 2004). One might maintain that perception is limited to what is immediately present (rather than to what *was* or *will be* present), so only properties – not individuals, which persist across time – are directly perceptible. Yet one may grant that individuals, like objects and events, are *indirectly* or *mediately* perceptible, thanks to our perceiving properties moment by moment. So, one may maintain that any perceptual representation of an individual, which is differentially sensitive to and tracks a type of individual in the world, is token-identical to a set of property representations.

This view may appeal as well to those who are interested in maintaining a sparse taxonomy of perceptual representations (e.g., Tye 1984). One may treat property representations as the only fundamental representation-type and all other representation-types as nothing but various arrangements of property representations. The idea would be that a certain set of property representations is tokened frequently when presented with a certain individual, and rarely when not presented with that individual. Perceiving the individual to change would amount to tokening different property representations in the set over time. Perceiving a new individual would amount to tokening a new set of property representations.

There is a major problem with the view that event representations are token-identical to sets of property representations. If we want to admit that when perceiving an event, we're perceiving at least one individual – the event itself, and/or any of the objects that we perceptually attribute to the event –, we cannot maintain that token event representations are simply sets of token property representations. Because we perceptually attribute at least one object to most (if not all) of the events that we perceive, I'll start by establishing that object representations are not themselves token-identical to sets of property representations.

As the 'many properties problem' (Jackson 1975) goes, perceiving (or perceptually representing) 'red square and blue circle' is discriminable from perceiving 'red circle and blue square'. Yet the properties perceived in both situations are the same – red, square, blue, and circular. Because the situations are discriminable, we must be perceiving (perceptually representing) something other than just the four properties. Admitting perceptible spatial relations won't help. Even if the first situation is such that the red square is 'to the left of' the blue circle, and the second is such that the red circle is 'to the left of' the blue square, 'to the left of' is just an additional perceptible property that remains the same in the two situations, so it won't explain our ability to discriminate them.

What is required for the discriminability of the situations is our attributing particular *subsets* of the four properties to distinct *individuals* in each situation. That is, in the first situation, we attribute 'red' and 'square' to a single individual, and 'blue' and 'circular' to a different individual. This enables us to perceive *one item* as being *both* red and square, and *another item* as being *both* blue and circular. In the second situation, we must attribute 'red' and 'circular' to a single individual, and 'blue' and 'square' to another. Because we are representing four distinct individuals across the two situations, the situations are discriminable.

The many properties problem shows that in order to perceive an item as having multiple properties, we must perceptually represent an individual that *binds* or *bears* those properties (Clark 2000, 2004; Cohen 2004; O’Callaghan 2008; Batty 2010). In order for the representation of the individual to do the necessary binding work, it cannot itself be token-identical to a set of property representations. It must be over and above the property representations.

In most cases of event perception, wherein we perceptually attribute at least one object to the event, then, the event representation is not token-identical to a set of property representations. This is because the object representations themselves are not token-identical to sets of property representations, but are over and above them. Because we perceptually attribute those objects to the event, the token event representation itself is not *just* a set of token property representations.

On the view that event representations are *sui generis*, the fact that we perceptually attribute at least one object to most of the events that we perceive is easily accounted for. In fact, it is built into the view that token event representations are themselves individuals to which token representations of features – including objects and properties – can be bound. This remains so once we grant that token object representations are over and above sets of token property representations, since objects are just one of the sorts of features that we can perceptually attribute to events.

Another potential view is that event representations are token-identical to single, rich property representations (rather than to sets of property representations). On this view, perceptually representing the event of a person talking just is perceptually representing the property ‘is a person talking’. The property itself may be thought to unfold over time or to be instantiated moment by moment. Importantly, on this view, the property representation would not be bound to an event representation – we would not perceptually attribute ‘is a person talking’ to a perceptible event. Instead, the property representation ‘is a person talking’ would be

token-identical to our event representation of the person talking. In other words, there would be nothing more to our representing this event than our representing the property ‘is a person talking’.

This view may appeal to those who wish to keep a sparse taxonomy of perceptual representations, since again, all representations could come down to property representations. A potential benefit of this view over the view that event representations are token-identical to sets of property representations is that there is no binding work to worry about. That is, because a token event representation is just a *single* property representation on this view, it may be that no individual over and above that property representation need be posited, since the many properties problem is a problem only when we perceive a single item to have *multiple* properties. The richness of a property like ‘is a person talking’ could do away with the problem of binding our representations of all of the properties of the person and of the sounds they make, since all of those properties would be encompassed by our representation of the single, rich property.

There are problems with the view that any event representation is token-identical to a single, rich property representation. The first is that it misconstrues event representations as property representations, when they are in fact individual representations. Like object representations, event representations are as of items that bear perceptible features, persist across time, are discriminable from other items in a scene, and are discriminable from each other in a scene. As argued in Chapter 2, we know this on the basis of the empirical work on event perception. If event representations were token-identical to rich property representations, they at least would not be able to bear features, since property representations do not themselves bear features. But, as argued in Chapter 2, in order to account for phenomena like event completion (Strickland and Keil 2011; Brockhoff et al. 2016; Papenmeier et al. 2019), we should posit that we attribute

objects and properties to events themselves. This requires event representations to be as of individuals, rather than properties.

This means, then, that event representations are not token-identical to property representations at all. If our event representation of a person talking were itself just a representation as of the rich property ‘is a person talking’, then our event representation would not *bind* any object or property representations (such as representations of the person and their properties), since property representations are not the kind of thing that bind other representations. We thus would not perceptually represent the event of the person talking to be an item that bears features. Yet the empirical evidence suggests that we do perceptually represent events to be items that bear features. So, we must posit that event representations are neither type- nor token-identical to property representations. Property representations are not the right kind of thing to do the work that event representations do in event perception.

A second, related problem is that if our event representation of a person talking is itself just a representation of the rich property ‘is a person talking’, there is no room for object representations to play a significant role in event perception. When perceiving the event of a person talking, we in fact token our object representation of ‘a person’. On the view in question, though, this object representation is doing no work in our perceptual representation of the event of the person talking, since our representation of the event is said to be just a representation of a property. It would be odd to say that we attribute the property ‘is a person talking’ to the object ‘a person’, since ‘a person is a person talking’ is redundant. And in any case, this is not the correct direction of attribution for event perception. The empirical evidence suggests that when perceiving events, we attribute properties and objects *to events*, but if our event representation of a person talking is token-identical to the property ‘is a person talking’, and we perceptually attribute this to the object ‘a person’, then we have perceptually attributed an event *to an object*.

This is inconsistent with what the empirical research on event perception suggests is the norm for event perception. (Of course, attributing a property to an object is not unusual in event perception. What would be unusual in this case would be attributing the *event* to the object.) Notice, for that matter, that on this view, we do not attribute ‘is a person talking’ to *an event*, since on this view, our representation of the event is simply token-identical to ‘is a person talking’.

Thus, the view that event representations are token-identical to single, rich property representations will not do. It is inconsistent with the empirical facts that event representations are representations as of individuals (rather than properties), and that we perceptually attribute objects and properties to *events* (rather than attributing events to *objects*). Alternatively, the view that event representations are sui generis accommodates these facts. Maintaining that our event representation of a person talking is a sui generis event representation as of ‘a person talking’ rightfully construes the event representation as an individual representation. The event representation is thus capable of binding the relevant object and property representations. This view, for the same reason, fits the fact that we perceptually attribute objects and properties to events. The event representation is the thing that binds the information about the objects and properties that we attribute to the event, enabling us to perceive those objects and properties as participating in that event.

It is not the case, then, that any event representation is token-identical to a single, rich property representation. Nor is any event representation token-identical to a set of property representations. Yet there are various potential views according to which any event representation is token-identical to an object representation.

One potential view is that an event representation is token-identical to an object representation (or a set of object representations) within a particular timeframe. The thought is that representing the event of a person talking as occurring from $t1$ until $t3$ would be nothing

more than representing the object ‘a person’ from $t1$ until $t3$. We would perceive the event to have precisely the properties that we perceptually attribute to the person during that timeframe, since our object representation of the person would itself bind our representations of the properties that we attribute to the person. If, afterward, we don’t perceive the person to participate in any event from $t4$ to $t5$, then our representation of the person would not count as an event representation in that timeframe. It’s only when we perceive the person to participate in some event that the representation of the person is token-identical to an event representation, on this view. This may be explained by the claim that, on some occasions, the properties that we perceive the person to have are indicative of their participating in an event (maybe because, for instance, the properties are perceived to undergo a pattern of change), while on other occasions, the properties that we perceive the person to have are not so indicative.

This view is appealing because of its straightforwardness. One might question what more there could be to perceptually representing a given event than simply representing the objects, along with their properties, that we perceive to participate in that event. One might worry that the view that event representations are *sui generis* seems to suggest that there is mysterious event-specific information that is added to our perceptual experience of events on top of our experience of the relevant objects and their properties, and that it is unclear what that information could possibly be and how it could help explain event perception. Treating token event representations as simply token object representations (which already bind property representations) within particular timeframes takes much of the mystery out of event perception.

But there are problems with this view. Similar to the view that event representations are token-identical to rich property representations, it fails to account for our perceptual attribution of objects and properties *to events*. The only perceptual attribution that occurs in event perception on this view is of properties to objects, and it is by perceptually representing the relevant objects

within a timeframe that we represent the event. But the empirical evidence suggests that we perceptually attribute objects and properties to events themselves, and that is how we perceive a given event to have objects and properties as participants.

The view that event representations are token-identical to object representations within a timeframe is also inconsistent with the fact that we can perceive a single object (or set of objects) to participate in multiple distinct events within the same timeframe. We can perceive a single person to sing for precisely as long as they do jumping jacks, or a speaker to play a shrill, single-pitched beeping sound while playing a smooth glissando sound, or a truck to making a beeping sound while backing up. As a first pass, these pairs of events can be considered distinct to our perceptual system because they involve different sets of perceptible features or different patterns of changes in their features over time. But if a token event representation is identical to a token object representation in a given timeframe, the pairs of events would not be distinguishable to our perceptual system, since they involve the same object in the same timeframe.

Plus, when it comes to events that have multiple perceptible objects as participants, a binding problem similar to the many properties problem occurs. Suppose we perceive a basketball game from $t1$ to $t2$. On this view, our event representation of the basketball game is token-identical to our representations of the set of objects that we perceive to participate in the basketball game (the players, the ball, etc.) from $t1$ to $t2$. For us to perceive all of those objects (and none of the other objects in the scene) as features of a single individual (the event of the basketball game, in this case), we must perceptually attribute all of them to that individual. Otherwise, we would not perceive them as features of the same individual, nor, thus, as participants in the same event. The fact that we are perceiving all of the objects in the event within the same timeframe is not enough to do this binding work, since in any scene, we're likely to be perceiving innumerable objects that we *don't* perceive to participate in the event within the same timeframe. Some single

representation as of an individual must serve to bind together our representations of all of the relevant (and none of the irrelevant) objects in the scene. For events that involve more than one perceptible object, our representation of the event is not, then, token-identical to our set of representations of the objects within a timeframe.

The view that event representations are *sui generis* does not face the problems of this view. As already noted, it makes sense of our perceptually attributing objects and properties to events. It also enables us to perceive multiple distinct events in the same timeframe. Each event that we perceptually represent gets its own event representation. When perceiving a beeping sound and a glissando sound simultaneously, we have one event representation of ‘beeping’ and another event representation of ‘glissando’. We perceive these events to be distinct thanks to our having a separate representation of each.

The *sui generis* view posits that event representations themselves do the work of binding multiple object representations together, when perceiving an event with multiple objects. An event representation is itself a representation as of an individual, so it is capable of binding representations of objects or properties. When perceiving ‘a game of basketball’, we perceptually attribute the various objects like ‘this player’, ‘that player’, ‘the ball’, and so on to the event. Our event representation of the game of basketball binds together all of the relevant object representations, so we can perceive all of those objects to participate in the game of basketball.

The view that event representations are *sui generis* avoids the problems of the views that event representations are token-identical to sets of property representations, rich property representations, and object representations within a timeframe. This is because it rightly construes token event representations to be as of individuals, to which our representations of the objects and properties we perceive to participate in events can be bound.

However, given that the *sui generis* view gets most of its explanatory leverage from treating token event representations as representations as of individuals, there may be room for an alternative view that gets the same explanatory leverage from treating event representations as token-identical to *object* representations, since object representations are themselves individual representations. Perhaps, for instance, event representations are token-identical to event-like object representations, which are special object representations that depict the object as having a short lifespan (relative to most object representations). On this view, our event representation of a person talking is token-identical to our *object* representation ‘a person talking’, which is as of an object that has a much shorter lifespan than most objects we perceptually represent (such as ‘a person’). This view takes the event itself to be represented as an object, but one that does not last long. Importantly, on this view, the event representation is not token-identical to our representation of the object (or objects) that we perceive to *participate* in the event; instead, it is token-identical to an *additional* object representation, to which our representations of the objects that we perceive to participate in the event are bound. So, on this view, our event representation of a person talking is not token-identical to our object representation ‘a person’, but to a *second* object representation of ‘a person talking’, to which the former is bound. The second object representation would represent the object to last for precisely as long as we perceive the event to last.

This view avoids the problems I’ve listed with the other views. Because object representations are representations as of individuals, they can serve to bind the representations of other objects and properties that are attributed to them. When perceiving a basketball game, an event-like object representation of ‘a game of basketball’ could bind our representations of the objects in the event (the players and the ball) and of the properties in the event (the shapes, sizes, locations, and so on of the objects). This allows for the correct direction of attribution. We are perceptually

attributing objects and properties to the event, and on this view, this is done by our representations of those objects and properties being bound to our representation of the event-like object. It also allows for multiple object representations to be bound to the same event-like object representation. There is no trouble binding representations of the several players and the ball to the single ‘game of basketball’ representation, since the latter is simply a representation as of an individual that bears several features. This view also has no trouble accommodating our ability to perceive a single object as participating in multiple distinct events simultaneously. On this view, each distinct event that we perceive has its own event-like object representation, which can bind representations of different sets of objects. So, when hearing a beeping and a glissando, we’d have both a ‘beeping’ and ‘glissando’ event-like object representation, each of which could bind our representation of the speaker that the sounds are playing from.

Furthermore, the view that event representations are token-identical to event-like object representations may be seen as more parsimonious than the view that event representations are *sui generis*, just because we would not have to posit event representations to be over and above object and property representations. We could stick with just object and property representations and go a far way explaining event perception. This view may have additional appeal to those who think that events just are short-lived or fast-paced objects, metaphysically (e.g., Goodman 1951).

The off-putting, though perhaps not devastating, thing about this view is that we are positing a special sort of object representation (namely, an event-like object representation, to which representations of all of the objects and properties we perceive to participate in the event are bound) just to reduce event representations to. As long as we are positing a new sort of individual representation just to explain event perception, it seems more fitting to posit a *sui generis* event representation. Representations as of ‘a person talking’, ‘rain falling’, ‘a song playing’, and the

like seem more event-like than object-like, since they are representations as of events in the world, and since many of the canonical features of events are available to us perceptually when presented with an event (their beginning and ending, their unfolding over time, etc.). It is unclear what an event-like object representation would be, if not merely a *sui generis* event representation. If there is a significant difference between the two, it would have to be shown how one does more explanatory work than the other. But drawing a significant difference between the two threatens to construe the event-like object representation as more object-like than event-like (since the only potentially relevant difference between event representations and event-like object representations is that only the latter is an object representation), and this does not seem to be the right direction to go in when explaining event perception. If, on the other hand, there isn't a significant difference – and it seems to me there isn't –, then positing one or the other will not matter much for the project of explaining event perception, since they will do the same explanatory work.

I conclude, then, that event representations are *sui generis* representations. They are not identical to token object nor property representations, but are over and above object and property representations. When perceiving a game of basketball, we token a *sui generis* event representation as of 'a game of basketball'. This event representation binds our representations of the players, the ball, and all of their properties. It is thanks to the object and property representations being bound to the event representation that we perceive all of those objects and properties (and none of the other objects and properties in the scene) as participating in the game of basketball. For each event we perceive, we represent it with its own event representation, which will bind representations of a particular set of objects and properties in the scene, enabling us to perceive discrete sets of features as participating in discrete events in the scene, simultaneously or serially.

There are two interesting upshots of the sui generis view of event representations. One is that it allows for the possibility that we perceptually attribute certain properties to events that we never attribute to objects, such as ‘being leisurely’. Because the event representation is an individual representation, it can bind property representations itself; the property representations need not first be bound to object representations, which are then bound to the event representation (although this happens as well). So, when perceiving someone taking a leisurely walk, it could be that not only do we perceptually attribute the properties of the person (their shape, size, etc.) to the person, and attribute the person to the event of the leisurely walk. We might also perceptually attribute the property of ‘being leisurely’ to the event of the leisurely walk itself, without attributing it to any object. If there are any properties that we perceptually attribute directly to events themselves, the sui generis view has no trouble accommodating this.

The second upshot is that the sui generis view allows for the possibility that there are some events that we do not perceive as having any objects as participants. Potential examples may include perceiving a light mist falling or a cool breeze blowing. It is not obvious whether we perceptually represent a light mist or a cool breeze as objects. In many cases, the spatial boundaries of a mist and a breeze are unclear perceptually; we often do not discriminate visually or tactually where exactly the mist or breeze lie from where they do not lie in the world. Just as well, the spatial boundaries of the droplets involved in a mist are unclear, and we often don’t discriminate the droplets from each other, neither visually nor tactually.

But it is clear that when perceiving such events as the light mist falling or the cool breeze blowing, we are perceiving *properties*. We perceive the former as involving the properties of being light, cool, and wet, and the latter as involving the properties of being cool, dry, and of a certain strength. To perceive the light mist falling or the cool breeze blowing as having several properties in the scene as participants, all of those properties must be attributed to a single individual.

Otherwise, we would not be able to discriminate the mist or the breeze from other items in the scene (like nearby cars, trees, buildings, and their properties). And if there are no object representations that can bind the many properties together, it must be that event representations are doing the binding work.

If there are indeed any perceptible events that we do not perceive to have objects as participants, the view that event representations are *sui generis* easily accommodates them. We can have an event representation as of ‘a light mist falling’, to which our representations of the properties of being light, cool, and wet are bound. The fact that the event representation binds the property representations together (in the absence of object representations) is what enables our perception of the light mist falling as a discrete unit in the scene.

I have argued that token event representations are *sui generis*, so they are not identical to token object or property representations. I will now explore the possibility of our perceptually attributing event-specific properties to events.

3.2 Temporal Boundness

It seems that events in the world can have certain properties that objects in the world cannot have, such as being slow-paced, hard to follow, tragic, anticlimactic, etc. This being so, perhaps some of the properties that are unique to events are perceptible, and perhaps we typically perceptually attribute them to events, but not to objects. As already noted, perhaps we can perceptually attribute the property of ‘being leisurely’ directly to the event of a person taking a leisurely walk, without attributing it to the person, and, furthermore, without attributing it to *any* object in typical cases. While these sorts of examples are familiar from the metaphysics of events (e.g., Kim 1976), the possibility that there exists a set of properties that are perceptually attributable uniquely to events is significant.

Admitting the existence of such perceptible properties could be admitting a whole new *type* of perceptible property. Many philosophers have individuated types of perceptible properties along the ‘high level vs. low level’ dimension (e.g., Siegel 2006; Bayne 2009; Fish 2013; Montague 2017). This dimension has to do with the relative complexity or richness of a property. Generally, simple properties like shape, color, pitch, and size are considered low level, while kind properties like ‘is a tomato’, ‘is a tree’, and ‘is a face’ are considered high level. Yet it is commonplace to construe all properties as items that can be attributed to one individual or another.

Once we grant, however, that event representations are a *sui generis* representation, this opens the door for new dimensions along which perceptible properties may vary. One such dimension may be whether or not a perceptible property is typically attributed to events and atypically attributed to objects. If there are any properties that are typically attributed to events, it may be faulty to treat all properties as items that are perceptually attributed to one individual or another, as though all properties are generic. Instead, some properties may be better thought of as attributable only to a certain type of individual (in typical cases).

I will argue that there is at least one property that we typically perceptually attribute to events and not to objects. It is the property of ‘having a beginning and end in time’, or ‘being temporally bound’, as I’ll call it. In most cases, we perceptually treat events as things that have a (fairly local) beginning and end in time, and in most cases, we do not perceptually treat objects as things that have a (fairly local) beginning and end in time.

As argued in Chapter 2, empirical evidence shows that we are perceptually sensitive to the beginnings and ends of events. When presented with the beginning or end of an event, we display a host of behavioral, neural, and psychological effects. For instance, when asked to push a button whenever one event in a movie ends and another begins, we do so reliably (Zacks et al. 2007; Speer et al. 2003). The points that we mark as boundaries between successive events correspond

with the sorts of changes that are typical of the ending of one event in the world and/or the beginning of another, such as changes in which objects are present, in activities that people are doing, in spatiotemporal location, etc. (Zacks et al. 2009; Zacks et al. 2006). A set of neural regions is activated transiently at these points as well, both when we are watching movies passively and when we are completing the segmentation task (Zacks et al. 2001; Zacks et al. 2010; Speer et al. 2003). Furthermore, our memory of the boundaries between successive events is better than our memory of what occurs within any single event (Newtson and Engquist 1976; Swallow et al. 2009; Boltz 1992).

It is unlikely that we would display this set of effects when presented with mere objects, rather than events. There is no reason to think that subjects would mark points at which they thought ‘one meaningful unit of activity has ended and another has begun’ (e.g., Eisenberg and Zacks 2016; Kurby and Zacks 2018) reliably when viewing objects that are not doing anything (i.e., not participating in any perceptible events). And given that the neural and psychological effects associated with perceiving the beginnings and ends of events either occur at the points that subjects mark as the beginnings and ends of events, or at least depend on where subjects have marked those boundaries, there is just as well no reason to think that we’d see the typical set of neural and psychological effects if subjects were presented with mere objects for a short time. We are, then, perceptually sensitive to the beginnings and ends of events, and this seems to point to an interesting difference between event perception and object perception.

One might deny, however, that our perceptual sensitivity to the beginnings and ends of events reveals anything unique about event perception. Events in the world typically have a beginning and an end. We are often perceptually presented with the beginnings and ends of events in the world, in part because many of the events that we are presented with have relatively short lifespans. It is not unusual for us to perceive the beginning or end (or, indeed, the entirety)

of an episode of a TV show, a song, a person cooking a meal, etc. We can just as well think of objects as having beginnings and ends, wherein their ‘beginning’ would be their coming-into-being and their ‘end’ would be their ceasing-to-be. We are much less frequently presented with the ‘beginnings’ and ‘ends’ of objects in the world, in part because most of the objects that we perceive have relatively long lifespans. We typically do not perceive the coming-into-being or ceasing-to-be (much less the entire lifespan) of a cup, a dog, a tree, a table, a building, etc.

One might maintain, then, that we in fact display the behavioral, neural, and psychological effects associated with our perceptual sensitivity to the beginnings and ends of events whenever we *are* presented with the coming-into-being and ceasing-to-be of objects. It’s just that we typically are not presented with them, so we infrequently exercise our perceptual sensitivity to them. On this view, then, our perceptual sensitivity to the beginnings and ends of events does not signify an interesting difference between event perception and object perception, for we are perceptually sensitive to the ‘beginnings’ and ‘ends’ of objects just as well.

I grant that it might be the case that we show the effects associated with our perceptual sensitivity to the beginnings and ends of events when presented with the ‘beginnings’ and ‘ends’ of objects. This has yet to be determined empirically. Yet I maintain that, apart perhaps from cases in which we are presented with the ‘beginning’ and/or ‘end’ of an object, there is no reason to think that we would show these effects when presented with a mere object, that is, an object that is not participating in any perceptible event. The ‘beginning’ and ‘end’ of an object might be sufficiently similar to the beginning and end of an event for us to show the effects, but when otherwise presented with a mere object not doing anything, we are not presented with anything sufficiently similar to the beginning and end of an event to show the effects.

Notice that being perceptually sensitive to the ‘beginning’ and ‘end’ of an object is different from being perceptually sensitive to the beginning and end of the *presentation* of an object to us.

We may be able to tell perceptually that a cup is presented to us at $t1$ and ceases to be presented to us at $t2$, but this does not mean that we have exercised our perceptual sensitivity to the ‘beginning’ and ‘end’ of *the cup*. The cup, after all, presumably had existed well before $t1$ and will exist well after $t2$, and, furthermore, just because we have stopped perceiving it does not mean that we represent it as ceasing to exist. Any empirical work that is meant to gauge whether we are in fact perceptually sensitive to the ‘beginnings’ and ‘ends’ of objects, just like we’re sensitive to the beginnings and ends of events, would have to take care to not conflate the ‘beginning’ and ‘end’ of an object with the beginning and end of its presentation to subjects.

While I grant that it may be the case that we are perceptually sensitive to the ‘beginnings’ and ‘ends’ of objects in the same way we are sensitive to the beginnings and ends of events, I maintain nevertheless that our perceptual sensitivity to the beginnings and ends of events points to something unique about event perception. Specifically, it gives us *prima facie* reason to think that we typically attribute temporal boundness to events, and at most atypically attribute temporal boundness to objects. The fact that we frequently exercise our perceptual sensitivity to the beginnings and ends of events makes it plausible to think that our perceptual system positively treats events as the type of thing that has a beginning and end, by binding a representation of temporal boundness to event representations. And given that we relatively infrequently exercise our perceptual sensitivity to the ‘beginnings’ and ‘ends’ of objects, it’s plausible that our perceptual system does not treat objects as the sort of thing that is temporally bound, but instead as the sort of thing that persists indefinitely.

Perceptually attributing temporal boundness to an individual is, though, more than simply being perceptually sensitive to its temporal boundaries. A particularly telling case would be one in which we are not presented with the beginning or end of an event – and thus do not exercise our sensitivity to its temporal boundaries –, yet we nevertheless perceptually treat the event as

having a beginning and end. For example, suppose we are presented with most of a song, but not its beginning nor end; suppose loud conversations in the environment mask the first and last ten seconds of the song. Even though we are not perceptually presented with the beginning nor end of the song (at least, in a way that enables us to actually hear the beginning and end), it may be that our perceptual system nevertheless treats the song as having a beginning and end that are fairly close temporally to the parts of the song that we heard. In other words, our perceptual system may treat the song *not* as persisting indefinitely, but as being temporally bound (where the temporal boundaries are fairly local). If cases such as this exist, it would establish that we are not merely perceptually sensitive to the temporal boundaries of events, but we positively perceptually attribute temporal boundness to events.

Studies on occlusion in event perception are a nudge in favor our attributing temporal boundness to events even when we are not perceptually presented with their boundaries. We can hear a glissando as a single ongoing sound even when it is masked by white noise multiple times (Dannenbring 1976). We can (mistakenly) take ourselves to have heard portions of speech that were actually masked by unrelated sounds and understand the meanings of the spoken sentences accurately (Warren 1970). We can hear an ongoing background noise, such as the running of an air conditioner or the flowing of a river, as continuous when it is masked by white noise, whether or not it is in fact present during the masking (McWalter and McDermott 2019). Occlusion of a given event, then, is not sufficient for our perceptual system treating the event as having come to an end.

The fact that we can perceive an event as persisting despite occlusion, and can furthermore attribute to it features that we had missed during occlusion, lends support to the claim that we can perceptually attribute temporal boundness to events even when we are not presented with their beginning or end. It establishes that we can fill in gaps in our perception of events. Thus,

there is some empirical reason to think that if we miss the beginning or end of a given event, we can nevertheless perceptually treat the event as having a beginning and end.

Yet treating an event as persisting during occlusion is not quite the same as treating an event as having a beginning and end, even when we haven't been presented with them. For example, it could be that we perceptually treat an event as persisting in many cases of occlusion, but we do not do so in cases where the beginning or end of an event are occluded. That is, if we miss five seconds of the *middle* of a song because of a masking noise, we perceptually treat the song as having persisted during the noise; but if we miss the *first* or *final* five seconds of a song due to a masking noise, we do *not* treat the song as having persisted during the noise.

There is no good reason to believe that it is so. It would require our perceptual system to distinguish occluded beginnings and ends from occluded middles of events. If our perceptual system did not distinguish them, then it would complete occluded beginnings and ends, just as it completes occluded middles of events. But, if our perceptual system has distinguished occluded beginnings and ends from occluded middles of events, then it has already recognized that the event indeed persisted during the occluded beginning and end. Telling whether an occluded part was a beginning or end, rather than another part, of an event requires recognizing, first of all, that the event persisted during the occlusion. So, claiming that we do not treat events as persisting during occluded beginnings and ends, but we do treat events as persisting during occluded middles, itself requires our treating events as persisting during occluded beginnings and ends. This is not a tenable view.

A more plausible alternative is that we indeed treat an event as persisting even when we miss its beginning or end, but in these cases, we do not perceptually treat the occluded parts *as* the event's beginning or end per se. So, in the case where we miss the first and last five seconds of a song but hear the rest of it, we perceptually treat the song as having persisted before we started

hearing it and after we stopped hearing it, yet we do not tag the missing parts as being (or at least including) the actual beginning and end of the song. In other words, occlusion of the event's beginning or end is not treated as a *special* case of occlusion by our perceptual system. It is simply another case in which we treat an event as persisting. This is, I suggest, the strongest conclusion we can accept on the basis of the occlusion studies on event perception with good reason.

Treating an event as persisting through the time slots occupied by its beginning or end that we missed does not appear to pose any more of a challenge to our perceptual system than treating an event as persisting during any other part of it that we have missed. The evidence for event completion despite occlusion, then, supports our completing events even when we miss their beginning or end.

The claim that we perceptually attribute temporal boundness to events even when we miss their beginning or end is even stronger, though. To treat an event as *persisting* during the time slots occupied by its beginning or end that we missed is not yet to treat the event as *having a beginning or end that falls in those time slots*. The former is consistent with perceptually treating the event to persist indefinitely, rather than as being temporally bound.

I will take it for granted that we typically perceptually treat *objects* as persisting indefinitely. Ample empirical evidence has demonstrated that our perceptual system achieves object permanence (e.g., Piaget 1954; Baillargeon et al. 1985; Spelke 1990; Bremner et al. 2014). We do not perceptually treat objects as having a fairly local beginning and end in time, or a fairly short lifespan. Instead, we typically expect the objects in our environment to stick around and remain intact. We would be surprised if an object suddenly disappeared or disintegrated.

This is not so for events, I suggest. Even though we can perceptually treat events as persisting despite occlusion, we typically do not treat them as persisting indefinitely. We typically have expectations that the events that we perceive have fairly short lifespans, and we behave in a way

that accords with these expectations. For instance, say we are watching TV and a commercial comes on. Our perceptual system will register that a new event has begun. It will also treat the commercial as being temporally bound, even before we are presented with its end. This, I suggest, is shown by our behavior and expectations. We expect the commercial to come to an end soon (in this case, in less than a minute). We would be surprised if the commercial continued for several minutes. Our expectation also guides our behavior. We may choose to sit through the whole commercial precisely because we know it will not last long, and that the next event on the TV network will begin soon. Or, we may leave the room briefly, knowing it won't be long before the commercial comes to an end and the next event on the network begins. When the commercial comes to an end, our perceptual system registers this, which typically accords with our expectations as to when the event will end.

So, perceptually attributing temporal boundness to events helps explain our expectations and behavior as we are perceiving events. We expect the event that we are perceiving to come to an end fairly soon (though what counts as 'fairly soon' may vary by event type). Just as well, in cases where we miss the beginning of an event, we typically still treat the event as having begun fairly recently. For instance, if we walk into a room in which the chorus of a pop song is playing, in most cases, we would expect that the pop song had not been playing for long before we started hearing it. It would be surprising to learn that it had already been playing for quite some time (say, over ten minutes). It would just as well be surprising to learn that the playing of the song had begun right when we began hearing it (at its chorus, rather than at the song's beginning). Even though our perceptual system would have registered a new event when we started hearing the song, this does not preclude us from perceptually attributing a beginning to the playing of the song that occurred prior to the part of the song that we first heard.

While it is clear that we typically *cognitively* represent events as being temporally bound – we *know* that most of the events we are presented with have a fairly local beginning and end –, it is less clear that we do so *perceptually*. But, I suggest, as long as we are willing to grant that we perceptually represent objects as being *spatially* bound, we should also grant that we perceptually represent events as being temporally bound, since the latter is not any more demanding for the perceptual system. In fact, our perceptually attributing temporal boundness to events can be seen as analogous to our attributing spatial boundness to objects (see, e.g., O’Callaghan 2008, 2007; Zacks and Tversky 2001).

When presented with three-dimensional objects, we perceptually treat them as having spatial boundaries that package them into discrete units that are not too big or small for us to perceive. This is so even though, when presented with any three-dimensional object, we are not presented with *all* of its spatial boundaries (or surfaces) at any one time. At any time, there are parts (edges, surfaces, etc.) of the object that are hidden from us. But we nevertheless perceptually treat the object as being spatially bound – we treat it as having spatial boundaries that fully demarcate it from the rest of the environment, and that are fairly close (spatially) to the parts of the object that we are presented with, even though we do not perceive all of its spatial boundaries. This has been well established by research on object completion (e.g., Spelke 1990; Kellman and Spelke 1983; Kestenbaum, Termine, and Spelke 1987; Soska and Johnson 2008).

Since it is widely accepted that object completion counts as a perceptual activity – and, thus, that we perceptually attribute spatial boundness to objects, even when not presented with all of their boundaries –, we ought just as well to accept that we *perceptually* attribute temporal boundness to events, even when not presented with their beginning or end. Attributing temporal boundness to events is no more demanding than attributing spatial boundness to objects. In both cases, we perceptually treat the individual as having boundaries that are fairly close to the parts

of the individual that we are currently presented with, which demarcate the individual from the rest of the world.

I have argued that we typically perceptually attribute temporal boundness to events, even when not presented with their beginning or end, and that we atypically perceptually attribute temporal boundness to objects (instead, we typically perceptually treat objects as persisting indefinitely). But there are interesting atypical cases of event perception and object perception.

First, it is worth noting that our perceptual system cannot discriminate all events that we are presented with. Some events are too long, too abstract, or the like – such as the season of winter, the presidential election, an imprudent act of vengeance – for us to perceive (at least, as such, or as events). There are limits to our perceptual capacities. The same goes, of course, for object perception. We cannot perceive ‘North America’, ‘the government’, or ‘the most intimidating person in the room’ as such, or as objects.

But among the events that we *can* perceive, there are a few types of cases in which we may not perceptually attribute boundness to them. The first type is one in which we perceive just a snippet of an ongoing event. For instance, we perceive just a few seconds of a helicopter’s flight as it passes above us in the sky, or we hear just a snippet of a song playing in a car as the car drives past us, or we perceive just a glimpse of a baseball game as we drive past the field. An analogous case of object perception would be one in which we perceive only a very small part of the object. Assuming that we perceive ‘the helicopter’s flight’, ‘the playing of the song’, and ‘the baseball game’ as events that extend beyond the small slice of them that we are presented with (and granting that these events are not too long or abstract to be perceptible), it may be that we do not perceptually attribute temporal boundness to them. Our perceptual system may not have received enough information about the event to recognize that it is the kind of thing that has a beginning and end (that we have not been presented with). Our perceptual system may instead

treat the event as persisting indefinitely, which is less committal than tagging the missing segments as being or including the beginning or end of the event.

Yet, I assume that in general, when we are perceiving some event, our perceptual system is just as well treating the sub-events that we are presented with (which the larger event at least partly consists in) as events themselves (see, e.g., Gibson 2015, p. 94). In support of this, empirical work has shown that the points at which subjects mark the beginnings and ends of successive events at a *coarse* grain tend to align with the points they mark at a *fine* grain (e.g., Zacks, Tversky, and Iyer 2001). This is one reason to think that we're perceiving the sub-events that a given event consists in as the event is unfolding. So, even if we do not perceptually treat 'the helicopter's flight', 'the playing of the song', and 'the baseball game' as being temporally bound, we nevertheless treat the parts of the event that we are presented with as being temporally bound.

The second type of case in which we may not perceptually attribute temporal boundness to an event is one in which we perceive a relatively small part of a long event (one that's not too long to be imperceptible). For instance, we perceive a few minutes of a concert, a movie, or a baseball game. An analogous case of object perception would be one in which we perceive a part of a large (but perceptible) object, like the bottom portion of a tall building. In this type of case, the beginning and end of the event may extend too far beyond the parts of the event that we are presented with for our perceptual system to treat the event as being temporally bound. It might, more neutrally, treat the event as persisting indefinitely. Here too, even if it does not treat the event as being temporally bound, it nevertheless treats the sub-events that we are presented with as temporally bound.

So, it may be that some perceptible events are too long, at least relative to the slices of them that we are presented with, for our perceptual system to treat the events as being temporally bound. The temporal boundaries may be too far removed from the parts we are presented with

for us to perceptually treat the event as having temporal boundaries. Where exactly the line falls between the perceptible events that we are partially presented with yet can nevertheless perceptually attribute temporal boundness to, and those that we cannot nevertheless perceptually attribute temporal boundness to, is an empirical question. An analogous question exists with respect to object perception. It may be that our perceptual system does not treat every object as being spatially bound (that is, as having fairly local spatial boundaries), since the spatial boundaries of some objects may lie too far from the parts of the object that we are presented with (either because we are perceiving a very small part of it or because the object is quite large). This may be the case when, e.g., we look at a mountain when standing at its foothills, we look at the sky, or we perceive only a sliver of photograph hidden beneath a pile of papers.

There may be atypical cases of object perception in which we perceptually attribute temporal boundness to objects. Some objects that we perceive have short lifespans which we are often presented with in their entirety. We often perceive the full lifespan of a flame produced by a lighter, a bubble produced by a bubble wand, and a homemade sandwich. These objects persist for such a short period of time that it is not unusual for us to perceive their coming-into-being, their persisting across time, and their ceasing-to-be. In this type of case, it may be that we perceptually attribute temporal boundness to the object itself, wherein we perceptually treat the object itself as having a beginning and end in time. Alternatively, it may be that we perceptually attribute temporal boundness only to some event that the object participates in, such as ‘the lighting of the lighter’, ‘the blowing of the bubble’, or ‘having lunch’. Even if we do perceptually attribute temporal boundness to short-lived objects, most of the objects that we are presented with are not short-lived, and object perception in these cases is notably more similar to event perception than is typical.

I have argued that we typically perceptually attribute temporal boundness to events (though, in certain cases, we might not), and we atypically perceptually attribute temporal boundness to objects (though, in certain cases, we might). This is interesting because it suggests that our perceptual system does not treat all properties as generic items to be attributed to one individual or another. Instead, our perceptual system appears to respect some of the differences between objects and events enough to maintain a distinction between which properties typically belong to which type of individual. In addition to temporal boundness, there may be many other properties that are typically perceptually attributable to events but not to objects.

3.3 Future Directions

We perceive events. Our perceptual representations of events are not token-identical to object or property representations. They are *sui generis*. This is what enables us to perceive events as discrete individuals, with discrete sets of objects and properties in the scene as participants. If event representations were token-identical to sets of property representations, to single, rich property representations, or to object representations within a given timeframe, they would not do this work. Given that event representations are *sui generis*, it is possible for them to bind representations of properties for events that we do not perceive as having any objects as participants, as well as representations of event-specific properties.

One event-specific property that we typically attribute to events is temporal boundness. We typically perceptually treat events as having a beginning and end in time, even if we are not presented with their beginning or end. We typically do not perceptually treat objects as being temporally bound, but instead as persisting indefinitely. Only in atypical cases of event perception – like perceiving just a snippet of an event, or just a part of a long event – might we not attribute temporal boundness to the events, and only in atypical cases of object perception –

like perceiving an object with a very short lifespan – might we attribute temporal boundness to the objects. There may be other properties that we typically perceptually attribute only to events, or only to objects.

It would be fruitful to explore several other issues as they relate to event perception. One issue is the relationship between event perception and other perceptual phenomena that are natural candidates for event perception, such as perception of causation, perception of action, and perception of change. Insofar as all instances of causation, action, and change either are events themselves or are at least parts of larger events, it is *prima facie* plausible that perception of causation, action, and change would thus count as forms of event perception. Yet just because something is an event in the world and is somehow perceptible does not mean that we perceptually treat it as an event. For instance, it is not obvious that all perceptible changes count as ordinary events – or, more relevantly, that they are similar enough to ordinary events for us to perceptually treat them as an event, as opposed to a mere change in objects or properties. If an object undergoes a very slight but perceptible change in location, e.g., it is not clear that we would treat this change as an individual *in itself*, nor that we would attribute temporal boundness to it. In any case, it would be valuable to explore to what extent perception of change, as well as perception of causation and action, will qualify as event perception.

Relatedly, it would be fruitful to investigate the *limits* of event perception. What are the *smallest* events – temporally and/or spatially – that we perceptually treat as events, rather than as mere objects and properties? If a *single* perceptible change in properties is not sufficient, then maybe a *sequence* of a few, related perceptible changes in an object is. And what are the spatiotemporally largest events that we perceptually treat as events? There is, surely, a cap on what our perceptual system can classify as an event, but it's not clear where it lies. Perhaps events longer than a day, or a few hours, or even one hour are too large for us to *perceptually* treat as

events. At most, we would be able to perceptually treat their *sub-events* as events. Similarly, just how much of a given event (that we indeed perceptually treat as an event) must we be presented with in order to perceptually attribute temporal boundness to it? It is unclear what the necessary amount and type of information is for us to treat an event not only as an individual (that is distinct from any of the objects we perceive to participate in the event), but also as having the property of beginning and ending in time. What the limits of event perception are is primarily an empirical matter, so pursuing empirical research directed at discovering these limits would be beneficial.

Another issue is just how rich our *perceptual* representations of events are. This issue may be particularly relevant when thinking about how action perception relates to event perception. When presented with the event of two people having a conversation, how much information do we perceptually represent as features of the event? Can we perceptually represent the two people *as people*, or can we merely perceptually represent them as *two objects* (with a given shape, size, location, etc.)? Can we perceptually represent their emotions, intentions, personalities, and the like, or can we merely perceptually represent more basic properties, like their sizes and shapes? If we can only perceptually represent fairly basic objects and properties, then our event representation of the conversation will be quite basic as well, in which case we'd seem not to represent the conversation *as such*. Discovering which *types* of events we can perceptually represent *as such* – e.g., rich events like conversations and weddings, or basic events like movements and lightings – may give us a better sense of the richness of our perceptual experience generally.

Many other issues would be fruitful to explore as well, such as what the relation is between our perceptual representations of a given event and its sub-events, how event perception might differ in each modality that we perceive events by means of, and to what extent our knowledge of

a given type of event influences our perception of that type of event. Event perception, thus, is a rich topic for further philosophical exploration.

References

- Baillargeon, R., Spelke, E. S. & Wasserman, S. (1985). Object Permanence in Five-Month-Old Infants. *Cognition*, 20, 191-208.
- Batty, C. (2010). A Representational Account of Olfactory Experience. *Canadian Journal of Philosophy*, 40(4), 511–538.
- Bayne, T. (2009). Perception and the Reach of Phenomenal Content. *The Philosophical Quarterly*, 59(236), 385–404.
- Block, N. (2014). Seeing-As in the Light of Vision Science. *Philosophy and Phenomenological Research*, 89(3), 560–572.
- Boltz, M. (1992). Temporal Accent Structure and the Remembering of Filmed Narratives. *Journal of Experimental Psychology: Human Perception and Performance*, 18(1), 90–105.
- Bremner, J. G., Slater, A. M., & Johnson, S. P. (2014). Perception of Object Persistence: The Origins of Object Permanence in Infancy. *Child Development Perspectives*, 9, 7–13.
- Brockhoff, A., Huff, M., Maurer, A., & Papenmeier, F. (2016). Seeing the Unseen? Illusory Causal Filling in FIFA Referees, Players, and Novices. *Cognitive Research: Principles and Implications*, 1(7), 1–12.
- Clark, A. (2004). Feature-Placing and Proto-Objects. *Philosophical Psychology*, 17(4), 443–469.
- Clark, A. (2000). *A Theory of Sentience*. Oxford: Oxford University Press.
- Cohen, J. (2004). Objects, Places, and Perception. *Philosophical Psychology*, 17(4), 471–495.
- Dainton, B. (2008). Sensing Change. *Philosophical Issues*, 18, 362–384.
- Dannenbring, G. L. (1976). Perceived Auditory Continuity with Alternately Rising and Falling Frequency Transitions. *Canadian Journal of Psychology*, 30(2), 99–114.
- Eisenberg, M. L., & Zacks, J. M. (2016). Ambient and Focal Visual Processing of Naturalistic Activity. *Journal of Vision*, 16(2), 1–12.
- Fish, W. (2013). High-Level Properties and Visual Experience. *Philosophical Studies*, 162(1), 43–55.
- Gibson, J. J. (2015). *The Ecological Approach to Visual Perception: Classic Edition*. New York: Psychology Press.
- Goodman, N. (1951). *The Structure of Appearance*. Boston: D. Reidel.
- Jackson, F. (1975). On the Adverbial Analysis of Visual Experience. *Metaphilosophy*, 6(2), 127–135.

- James, W. (1886). The Perception of Time. *The Journal of Speculative Philosophy*, 20(4), 374–407.
- Kellman, P. J., & Spelke, E. S. (1983). Perception of Partly Occluded Objects in Infancy. *Cognitive Psychology*, 15(4), 483–524.
- Kestenbaum, R., Termine, N., & Spelke, E. S. (1987). Perception of Objects and Object Boundaries by 3-Month-Old Infants. *British Journal of Developmental Psychology*, 5, 367–383.
- Kim, J. (1976). Events as Property Exemplifications. In M. Brand & D. Walton (Eds.), *Action Theory* (pp. 310-326). Dordrecht: D. Reidel.
- Kurby, C. A., & Zacks, J. M. (2018). Preserved Neural Event Segmentation in Healthy Older Adults. *Psychology and Aging*, 33(2), 232–245.
- LePoidevin, R. (2004). A Puzzle concerning Time Perception. *Synthese*, 142(1), 109–142.
- McWalter, R., & McDermott, J. H. (2019). Illusory Sound Texture Reveals Multi-Second Statistical Completion in Auditory Scene Analysis. *Nature Communications*, 10(5096), 1–18.
- Montague, M. (2017). Perception and Cognitive Phenomenology. *Philosophical Studies*, 174(8), 2045–2062.
- Newton, D., & Engquist, G. (1976). The Perceptual Organization of Ongoing Behavior. *Journal of Experimental Social Psychology*, 12, 436–450.
- O’Callaghan, C. (2008). Object Perception: Vision and Audition. *Philosophy Compass*, 3(4), 803–829.
- O’Callaghan, C. (2007). *Sounds*. Oxford: Oxford University Press.
- Papenmeier, F., Brockhoff, A., & Huff, M. (2019). Filling the Gap despite Full Attention: The Role of Fast Backward Inferences for Event Completion. *Cognitive Research: Principles and Implications*, 4(3), 1–17.
- Piaget, J. (1954). *The Construction of Reality in the Child*. New York: Basic Books.
- Reid, T. (1855). *Essays on the Intellectual Powers of Man*. Boston: Phillips, Sampson, and Company.
- Siegel, S. (2006). Which Properties Are Represented in Perception? In T. S. Gendler & J. Hawthorne (Eds.), *Perceptual Experience* (pp. 481–503). Oxford: Oxford University Press.
- Soska, K. C., & Johnson, S. P. (2008). Development of Three-Dimensional Object Completion in Infancy. *Developmental Psychology*, 46(1), 129–138.
- Speer, N. K., Swallow, K. M., & Zacks, J. M. (2003). Activation of Human Motion Processing Areas during Event Perception. *Cognitive, Affective and Behavioral Neuroscience*, 3(4), 335–345.

- Spelke, E. S. (1990). Principles of Object Perception. *Cognitive Science*, 14(1), 29–56.
- Strickland, B., & Keil, F. (2011). Event Completion: Event Based Inferences Distort Memory in a Matter of Seconds. *Cognition*, 121(3), 409–415.
- Swallow, M. K., Jeffrey, Z. M., & Richard, A. A. (2009). Event Boundaries in Perception Affect Memory Encoding and Updating. *Journal of Experimental Psychology: General*, 138(2), 236–257.
- Tye, M. (1984). The Adverbial Approach to Visual Experience. *The Philosophical Review*, 93(2), 195–225.
- Warren, R. M. (1970). Perceptual Restoration of Missing Speech Sounds. *Science*, 167(3917), 392–393.
- Zacks, J. M., Braver, T. S., Sheridan, M. A., Donaldson, D. I., Snyder, A. Z., Ollinger, J. M., Buckner, R. L., & Raichle, M. E. (2001). Human Brain Activity Time-Locked to Perceptual Event Boundaries. *Nature: Neuroscience*, 4(6), 651–655.
- Zacks, J. M., Speer, N. K., & Reynolds, J. R. (2009). Segmentation in Reading and Film Comprehension. *Journal of Experimental Psychology: General*, 138(2), 307–327.
- Zacks, J. M., Speer, N. K., Swallow, K. M., Braver, T. S., & Reynolds, J. R. (2007). Event Perception: A Mind/Brain Perspective. *Psychological Bulletin*, 133(2), 273–293.
- Zacks, J. M., Speer, N. K., Swallow, K. M., & Maley, C. J. (2010). The Brain's Cutting-Room Floor: Segmentation of Narrative Cinema. *Frontiers in Human Neuroscience*, 4(168), 1–15.
- Zacks, J. M., Swallow, K. M., Vettel, J. M., & McAvoy, M. P. (2006). Visual Motion and the Neural Correlates of Event Perception. *Brain Research*, 1076, 150–162.
- Zacks, J. M., & Tversky, B. (2001). Event Structure in Perception and Conception. *Psychological Bulletin*, 127(1), 3–21.
- Zacks, J. M., Tversky, B., & Iyer, G. K. (2001). Perceiving, Remembering, and Communicating Structure in Events. *Journal of Experimental Psychology: General*, 130(1), 29–58.