Advancing Understanding of the Aesthetics of Temporal Sequences by Combining Some Principles and Practices in Music and Cuisine With Psychology

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Abstract

We consider how to optimize remembered aesthetic pleasure resulting from temporal sequences of events such as music and meals. We examine what psychology and music can learn from each other and how this knowledge might be applied to tasting menus and other temporal sequences. Common practices in longer musical works suggest the importance of (a) beginnings and endings, (b) variations in affective intensity over time, (c) repetitions, (d) variations on a theme, and (e) a return to prior material at the end of a piece. Results from psychology suggest that for affective memory, the final and peak experiences are most critical. For example, because a strong positive ending may be important for affective memory, and because return is a major feature of the ending of musical works, it may be an error to end meals with desserts, which are not the favorite courses for most people and typically bear no relation to prior courses (hence no return).

Keywords
music, food, concerts, meals, pleasure, memory, sequences, aesthetics

Humans are unique in that they engage in a wide range of entertaining activities that have a time envelope, usually a half hour to a few hours in length: meals, concerts, plays, movies, museum visits, and sports events. Our interest is in describing and understanding the temporal sequences of such events that produce maximal experienced and remembered pleasure. We use meals and complex ensemble pieces from classical music as model systems to explore this general aesthetic problem. We have selected these two domains from among a wide range of temporally sequenced activities in humans for a few reasons. First, they both occur universally and account for a substantial amount of the waking time of humans. In traditional cultures, food activities (foraging, preparation, consumption) involve more time investment than any waking activity other than work (Szalai, 1972). Food also accounts for more monetary expenditures than any other activity in traditional cultures (U.S. Department of Agriculture, 2018). In a study using the experience-sampling method

among eight American participants from a University community, it was found that an experience of music in the previous 2 hr was reported 44% of the time, although it was the primary activity in only 2% of cases. This pilot study suggests that for some Westerners, music is frequently in the background (Sloboda, O'Neill, & Ivaldi, 2001). Of course, in traditional cultures that lack recorded music, musical exposure is lower and may more often be the focus of activity.

So music and meals are universal and abundant, both temporally sequenced, but contrast in the degree of scholarly attention they have received. (Universities typically have music departments but rarely have cuisine departments.) Neither music nor food (outside of obesity, eating disorders, and regulation of food intake)

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has received major attention in modern psychology, probably because modern psychology has focused more on basic processes (e.g., memory, perception) than on the major domains of life (P. Rozin, 2006).[1]

Aims of This Article

In human cultural history and in much of the world until very recently, almost all eating was done in a relatively private, family context, whereas most musical experience was in a more public sphere, such as part of religious ritual or at concerts. Now, at least in more affluent countries, eating meals at restaurants has become very common, and therefore eating has become a much more public activity. These activities—meals in restaurants and complex musical works such as a classical symphony—are the examples we use, along with recent work in psychology, in hopes of uncovering some general aesthetic principles related to event sequences.

We propose to do some analysis of the modern meal and complex musical works (especially from the Classical period) and the experiences and the memories they generate. Although the modern tasting menu is only a few decades old and is currently served primarily in a modest number of high-end restaurants, it is spreading in the restaurant world. This is illustrated by the increasing occurrence, over time, of the phrase "tasting menu" in the massive Google Ngram corpus of American English. Incidence, by 10-year periods (with the standard 3-year "smoothing") was 7.7×10^{-8} in 1978, 4.3×10^{-7} in 1988, 3.6×10^{-6} in 1998, and 9.0×10^{-6} for 2008, an increase of about 2 orders of magnitude over this 30-year period.

As Daniel Kahneman, Barbara Frederickson, and their colleagues (Fredrickson, 2000; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993; Kahneman, Wakker, & Sarin, 1997) have elegantly demonstrated, primarily for negative events, there are sharp and understandable disparities between the affect experienced and the affect remembered. Furthermore, although the affect is clearly determined by content (and context, especially social), it is frequently the case that one remembers the affect clearly ("that was a great concert/meal last week") in the absence of explicit memory of what the content (music or food) was.

Our focus is on remembered pleasure, because it is such an important part of life. A major life aesthetic experience may last 2 hr, but it may be reexperienced in memory for much longer than its live duration. Furthermore, a major determinant of the success of any music or meal (or other experience, such as a play, movie, or museum visit) is that it is recommended to others who have not experienced it. This recommendation is based, of course, on the memory of the experience, rather than the experience itself.

We wish to address the following questions:

1. What is the relationship between the moment-to-moment experienced affect of a meal or complex musical work and the remembered affect of that same event?
2. What is the relation between the content (specifically, the memory for the content) and the recalled affect?
3. What can we learn about optimizing memories of meals and other sequenced events (e.g., museum visits) from the long history of musical works and music theory?
4. What can modern psychology contribute to the optimization of music, meal, and other experiences?
5. How might psychological research be steered in productive directions by examining the accumulated experience of composers and music theorists in creating appealing temporal sequences of events?

Similarities and Differences Between Food/Meals and Music/Concerts

It is our view that both the wisdom embodied in music over the centuries and the results of music scholarship can be valuable to psychologists. We expect less from the sequence of dishes in the meal, because of its much shorter history and the lack of organized scholarship to understand it. At the same time that music may inform psychology, music may not have optimized remembered memories, and modern hedonic psychology may serve to improve it from the listener's perspective.

There are, of course, major differences between food and music. First, food is biologically necessary, and we come to it equipped with a built-in periodic desire (hunger) and certain preferences (e.g., for sweetness and fatty textures). There is no obvious equivalent for music, and we do not yet even understand the adaptive value of this universal human activity. Steven Pinker, in his argument that music has no such evolutionary purpose, equated music to "auditory cheesecake, an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties" (Pinker, 1997, p. 530). Alternative accounts focus on social values, including coordinated action and shared ritual (e.g., Dissanayake, 2000; Huron, 2009). We suggest as well that music appropriates a human proclivity to make sense of and understand the structure of the world. The pleasure of music may be partly an extension of the pleasure we get from gaining usually implicit understanding of the temporal structure of events. This is manifested in a

cycle of realized or sometimes modestly violated expectations (Meyer, 1956).

Second, with respect to the temporal sequence of events, there is a background of decreasing interest in food as a function of increasing satiety during a meal. There is no equivalent for music, presumably at least in part because it is not part of a homeostatically regulated system. Third, there is a major difference between food and music in terms of the sensory/perceptual domains that are engaged. Food appeals to many senses. The core experiences of eating are flavor and mouth feel, which include the senses of smell and taste as well as oral-tactile inputs. Some of these (e.g., sweet or bitter taste, fatty texture) innately stimulate affective systems. The integration of these senses into a unified oral experience is not yet understood (P. Rozin, 1982). Compared with the almost uniquely auditory presentation of music, the multisensory dimensions of eating are extremely complex (Prescott, 2013; E. Rozin, 1982; P. Rozin & Hormes, 2010).

Fourth, despite the primary reliance on but one of the senses, music seems to engage more complex cognitions, involving the integration of numerous sonic parameters, creating structural richness, perhaps more than any other art form does (Meyer, 1956, 1973; Narmour, 1977, 1990, 1991, 1992, 1996, 1999, 2015; A. Rozin, 2000). Fifth, whereas food has become a coordinated sequence of experiences (courses) only in the past 2 centuries, music has been a sequence of experiences over millennia. Finally, because music has been more widely recognized, at least in scholarly circles, as an art form, the structure of music has received a great deal of scholarly attention, in the fields of music theory and history

There is evidence that understanding the structure of events is satisfying, which accounts, for example, for the popularity of puzzles. However, almost all of this evidence comes from structures that are not temporal. One of the problems with our proposal, which derives from the work of Leonard Meyer (1956, 1973), is that it does not account readily for why we enjoy listening to a musical work after we know it well and surely have fully realized expectations. People typically do not enjoy doing the same puzzle over and over again. The implication-realization model suggests two answers to this problem. First, a live performance traditionally allows the performer to express the music in a personal way, which changes emphasis in dynamics and rhythm. So expectations from previous experiences are being subtly varied. However, with repeated hearing of the same performer via recorded music, this does not hold.

Second, Narmour (1990, 1991, 1992) noted that certain expectations are innate, such that when violated, they continue to produce a form of pleasant surprise

(if the violation is done with craft). For example, Narmour claimed that if something repeats (e.g., A-A), there is an innate expectation that it will repeat again. This makes biological and/or adaptive sense. So the expectation after A-A is of another A (A-A-A). This deep expectation forces itself into expectations despite specific experience that contradicts it, so that an experienced A-A-B still has an element of surprise (P. Rozin, Rozin, Appel, & Wachtel, 2006). Sufficient innate expectations, artfully violated, produce the surprise that continues to motivate sensemaking. Creators may exaggerate this tendency, in both music and humor, by starting a third repetition but then violating it, in the form of A-A-A/B, or what we might call A-A-A′ (P. Rozin et al., 2006). It is very common in jokes and music to vary the repetition on the third cycle. So an acquired expectation develops, interacting with the innate repetition predisposition, that a change will occur after two repeats (e.g., the punchline in the joke occurs after the priest and the minister, with, say, the rabbi). When this is violated, as in the not uncommon A-A-A-B form, there is a complex double surprise (P. Rozin et al., 2006).

We believe that, despite these differences, the similarities of eating and listening to music—in particular the similarities between the modern-day tasting menu and a complex classical piece, such as a Haydn or Mozart symphony—invite parallel analysis in which each might uniquely illuminate the other and illuminate psychology. Meals and musical works, at least in Western culture, have much in common. Aside from the basic survival function of food and eating, both are engaged in primarily for pleasure and to organize social interactions. Both events involve very structured sequences of events, of the order of a half hour to a few hours, depending on the musical style (e.g., a rock concert is likely to be longer but with much shorter individual works than a concert of classical music). Both food and music have very strong affective components but resist anything but the crudest verbal descriptions. They provide rich experiences and often recurring and evocative memories. Their presentations, in both cases, involve at least some division of labor between the script for an event (musical scores or recipes, created by composers or food designers, respectively) and the performance of the event (accomplished by performers or chefs).

A Brief History of the Meal and Complex Musical Works

To contextualize our analysis, we begin with brief histories of the meal and the concert in Western culture. We believe this has heuristic value, because we discover that meals and concerts have crossed paths. To glimpse

ahead, modern upscale cuisine, with its tasting menus and the absence of à la carte menus, takes on many of the features of works of classical music and some concerts of both classical and popular music. Most critically, the participant does not make choices to determine the sequence of events. On the other hand, with ready availability of all kinds of music, much music listening now is precisely à la carte because of technological advances.

For most of its history, the meal has been a private affair, shared only by family. That said, it has always had a place in the public domain, at least in rituals such as weddings and funerals. In Western history, eating "out" has occurred in inns for many centuries. Royalty and others who were extremely wealthy ate a variety of foods at meals, often in banquets; as far as we know, until the 19th century, many different foods were simultaneously available (i.e., *service à la française*). For the rest of humanity, eating out (as opposed to eating along with lodging) dates from France in the 19th century, with the rise of the restaurant.

Listening to music, on the other hand, has for most of its history been a public, social experience (e.g., in church, as part of a ritual, or in concerts). But music has always had a more private side; musicians play for small, intimate gatherings (e.g., the 19th-century salon or late-night bebop jam sessions in the 1940s) or perhaps even just for themselves. Listening to music as a fully private activity has emerged on a large scale only recently with the rise of recording and playback technology. Recordings (e.g., MP3 files) allow an individual to listen alone, divorced from the usual social context much in the way that fast food has allowed for private consumption of meals.

Along with the changing social context, the structure of the meal has evolved to be more like that of a musical work or concert. The classic Western restaurant meal comes from France and has three courses: appetizer, main course, and dessert (a somewhat modified Italian form offers an extra pasta course). In its typical version, the diner is offered choices at each course. People ordinarily eat out in groups larger than one and usually do not order the same exact thing. Thus, at any given moment in time, one person may be eating a shrimp cocktail while another is having a salad. Furthermore, at the main course, with three elements typically on the plate (e.g., steak, potatoes, and green beans), even two people who have ordered the same platter may not be eating the same thing at the same time. This means that, unlike two listeners at the same concert, two diners at the same restaurant with the same main course will often experience different temporal sequences of food.

In the past 40 years, high-end restaurants have begun to offer exclusive (and usually expensive and creative)

tasting menus, in which the diners exert no choice. The origins of the tasting menu are not clear. It has a historical precedent in Japan. The kaiseki is a traditional multicourse dinner that originated in Kyoto in the 16th century (Rath, 2013). Within the context of restaurants, the French *degustacion* is the most likely predecessor. But in many small family restaurants, a single food sequence has been offered, as has been the case in formal banquets and family celebrations, such as weddings, for millennia. The popularity of the tasting-menu movement is evidenced by its inclusion in many of what are considered the great restaurants of the world, such as Ferran Adria's El Bulli, Thomas Keller's French Laundry, Rene Redzepi's Noma, and Joel Robuchon's various Ateliers. The tasting menu, in many ways, involves an entire meal of appetizers. (At a recent meeting in Denmark of about 500 chefs, restaurant reviewers, and food providers, during a presentation of material related to this article, a show of hands indicated that the great majority of this audience considered the appetizer—as opposed to the main course or dessert—to be the best part of the meal.)

At El Bulli, for example, one experienced around 30 very small courses, in an order precisely determined by the chef (and with no advance information about the courses or their sequence). For some dishes, one even got instructions about how to eat them (e.g., very rapidly, or A then B). A more typical tasting menu may have 10 to 20 courses, in a precise order. There are several connections between the traditional three-course meal and the modern tasting menu: The progression is usually from relatively light (e.g., vegetables and seafood) to relatively rich (e.g., red meat), and both typically terminate with at least one dessert. The purpose of the tasting menu is not primarily nourishment or to satisfy hunger; rather, it is an aesthetic experience. That is, contemporary cuisine has become a creative art. (Of course, this is not the first time cuisine has been a creative art—according to Escoffier, 1907, that was in 19th century France—but modern cuisine is the first widespread effort to break out of the constraints of classic or traditional cuisines.)

The new chefs seek to be creative and to invent new techniques, new presentations, and new experiences. We believe that diners who go to restaurants serving modern cuisine seek to be surprised, challenged, and amused. In such contexts, the meal focuses on and almost completely determines the social interaction. The food is not only the excuse to gather but also the topic of conversation. Because everyone is eating the same thing at the same time (just as everyone is listening to the same thing at a concert), food is the natural topic of conversation. Modern restaurants have become like art galleries in which the artist's work is edible.

And the creations (dishes, or paintings in a museum) can be discussed as they are experienced, unlike the case of. the modern concert.

The modern tasting menu can be very much like a musical work or concert. When you go to hear a symphony orchestra, Mozart (and the conductor) determines what you hear. You do not get to season the music, and everyone shares the same menu: the movements and pieces in their prescribed order. With these parallels in mind, we now consider the psychological principles underlying the structure of concerts and tasting menus. Why do composers and performers, or chefs, organize these events in the ways that they do? Are there ways that they might change common structures of these events to create better experiences or memories for listeners and diners? For some answers to these questions, we turn to groundbreaking work from psychology on the experience of pleasure and pain.

The Three Temporal Domains of Pleasure

Work by Daniel Kahneman, Barbara Fredrickson, and their colleagues has emphasized three temporal domains or perspectives that bear on our understanding of pleasure: experience, memory, and anticipation (Fredrickson, 2000; Kahneman et al., 1997). This description of affective experience is novel to most people and scholars, but once considered, it is obviously apt. The general formulation had been mentioned previously, for example by Jevons (1905), who stated that there are "three distinct ways . . . in which pleasurable or painful feelings are caused: (a) By memory of past events; (2) By the sensation of present events; (3) By anticipation of future events" (p. 3). Kahneman, Fredrickson, and others have emphasized this conceptualization and explored the relationships among the three temporal domains.

Experience, memory, and anticipation represent both a conceptual framework within which to understand pleasure as well as an individual difference variable (the individual or cultural difference variable refers to the degree to which an individual or culture relies on one of the three framings of affect more than the others). Zimbardo and Boyd (1999) described this temporal triad as "time perspective" and developed psychometric measures of the degree to which an individual (or culture) subscribes to each of the three temporal frames, along with a positive or negative affective aspect of each temporal frame. This resolves into past (memory), present (experience), and future (anticipation). They argued for the adaptive value of a balance between the approaches, and they note the shortcomings in the quality of life that may derive from temporal profile biases.

Bryant (2003) developed a somewhat similar taxonomy, measured by a Savoring Beliefs Inventory, that involved past, present, and future orientations. There are thus two scales to measure degree of adherence to three temporal orientations, although neither Zimbardo and Boyd (1999) nor Bryant (2003) actually presented data that gave an idea of the incidence of the prominence of each type of profile in any sample of people.

In research among Americans, we have approached this same issue using an individual difference variable with a much more direct approach (P. Rozin, 2007). Participants, consisting of the jury pool of Philadelphia and American college students at the University of Pennsylvania, were presented with the following description of three temporal orientations:

> Think of a positive experience, like going to a favorite sports event or concert. We can talk about three aspects of this experience. First, is the ANTICIPATION of the experience . . . you have the ticket and enjoy thinking about going. Second, is the actual EXPERIENCE of the event, when you are attending it. Third is the MEMORIES of the event, remembering the different things that happened. This could be immediately after the event, or days or months or years later. Generally, how important do you think ANTICIPATION, EXPERIENCE, and MEMORY are for **you**, in your life. Rank the three.

The results of this survey of a few hundred participants, revealing the percentage of people who ranked each option as being most important, are given in Table 1. The point of presenting these results and the Zimbardo and Bryant scales is simply to indicate that even within culture, people differ in the reported degree of emphasis on different time perspectives. We make no claim about how this general judgment relates to either judgments or behaviors in specific situations.

Given this perspective, one could reasonably ask of a chef: "Do you want the dining experience that you create for your diners to be one of their best meal experiences or one of their best meal memories?" The relative importance of one or the other may be different for a diner and a chef. Surely, if the chef wants referrals, remembered pleasure is most important, because it is usually well after the meal that a person recommends it to other people. In the next section (consequent on research by Kahneman, Fredrickson, and others), we discuss the major disparities between experienced and remembered pleasure; in a recent synthesis of this perspective by Kahneman (2011), the distinction between memory and experience is described as "two selves."

To get a sense of relations among three temporal perspectives on pleasure, consider the following question:

Table 1. Percentage of People Ranking Each Perspective as Most Important for Positive Experiences

Sample	Memory	Experience	Anticipation
Jury in Philadelphia (n = 143)	29%	48%	22%
American college students (n = 149)	41%	41%	18%

Note: Data from P. Rozin (2007).

"When going to your favorite restaurant, would you rather order your favorite food, or something new?" We have asked this same question about a favorite musical group (your favorite pieces or new ones) or a favorite vacation spot (versus a new highly recommended one; P. Rozin, Remick, & Fischler, 2011). Individuals in France and the United States differ in their response to this type of question: In general, the French are more inclined to prefer the new option (P. Rozin et al., 2011).

If you choose your favorite food, you will maximize anticipation (Table 2). You can look forward to a virtually certain positive experience as opposed to the riskier outcome of trying a new food. Furthermore, you will have a concrete image of what you will experience. Likewise, for experienced pleasure, there is assurance that this will be very high for a favorite food; there is more risk and a lower mean outcome (partly because of regression to the mean) for a new food. However, the picture is different for remembered pleasure. If you choose your favorite food, you will not create a new memory: Your nth experience of your favorite food will merge with the virtually identical memories of the previous $n - 1$ experiences. But the new food, which is likely to be excellent or at least very good, because it is at a favorite restaurant, will create a new memory that you can consume many times over subsequent years and even decades. So the memory perspective favors choosing the new food, but the anticipation and experience perspectives favor choosing the favorite food (Table 2). Presumably, the more important memories are to a person, the more effort that person will devote to creating new memories, even when this may be a costly enterprise, at least in the sense that the actual experience involved in creating the memory may be rather unpleasant (Keinan & Kivetz, 2011). One

might, for example, endure unpleasant rain in Agra, India, to establish a memory of the Taj Mahal. Likewise, those more inclined to prioritize memories may be more reluctant to repeat an extraordinary experience, because of a fear that the second experience will not be as good as the first and may "contaminate" the original, superb memory (Zauberman, Ratner, & Kim, 2009).

Experienced Pleasure Versus Remembered Pleasure

In a very important study, Kahneman et al. (1993) exposed people to two aversive experiences. Both included an episode of 60 s with the participants' hands immersed in cold water, producing pain. In one case, their hands were abruptly removed from the cold water, and in the other, the water was gradually warmed up a small amount over 30 s (the order of the two experiences was randomized). This additional period was still painful, but it was less painful than the prior 60 s. Subjects were then asked which of the two experiences they would prefer to repeat. Most subjects chose the gradual reduction in pain choice, even though they experienced more total pain.

This study was followed by another demonstrating the same point in a real-world situation: retrospective judgments of actual colonoscopy procedures (Redelmeier & Kahneman, 1996). The extraordinarily important point made by these and other studies, under the leadership of Fredrickson and Kahneman, is that remembered pleasure differs from experienced pleasure of the same event, and that there are lawful ways in which they differ (Fredrickson, 2000; Kahneman, 2011; Kahneman et al., 1997). This disparity forces a difficult choice on those who compose events such as

Table 2. Synergies and Oppositions Among Experienced, Remembered, and Anticipated Pleasures

Food type	Experienced	Remembered	Anticipated
New food at favorite restaurant	Positive but variable, mean probably below favorite food	**Distinct new positive memories**	High average but less predictable; a less concrete image
Favorite food at favorite restaurant	**High positive**	No new memories: merge into past memories if same event	**Higher average and predictable; a more concrete image**

Note: Boldface text indicates the choice that will be most positive from each of the temporal perspectives.

musical works or meals: Is the aim to optimize experience or memory?

There are three regularities or rules that partly explain the mapping of experiences to memories (for general treatments of this, based primarily on negative experiences, see Fredrickson, 2000; Kahneman, 2011; Kahneman et al., 1997). First is the *peak rule*: The peak of an experience, negative or positive, plays a disproportionate role in the affective memory of that experience. Second is the *end rule*: The end of an experience also plays a disproportionate role in the affective memory of an experience. Surely Shakespeare's famous quote "All's well that ends well" captures the idea that positive endings are critical in both negative and positive domains. Third is *duration neglect*: Affective memory minimizes the importance of the duration of experiences. Fredrickson and Kahneman (1993) identified duration neglect clearly in a number of studies. Their empirical results indicated that "retrospective evaluations appear to be determined by a weighted average of 'snapshots'" (p. 45). Five minutes of pain or 10 min of pain tend to produce very similar memories, a "snapshot" of the pain episode. Fredrickson (2000) cited the author Milan Kundera, who, in his novel *Immortality*, concluded that "memory does not make films, it makes photographs" (Kundera, 1991, p. 314), and, as Frederickson added, it produces "at best only a few photographs" (p. 45). The duration-neglect principle, applied to the food/meal domain, suggests that one will get about the same remembered pleasure from 2 sips or 10 sips of a great wine or from a single or double portion of a favored food (Rode, Rozin, & Durlach, 2007, confirmed this empirically). But the more structured an experience is, the less one observes duration neglect (Ariely & Zauberman, 2000). It is very important to realize that almost all of the research findings that have established the peak, end, and duration-neglect rules have used negative and rather unstructured experiences (but see Fredrickson & Kahneman, 1993; Rode et al., 2007; A. Rozin, Rozin, & Goldberg, 2004, all discussed later, and a summary by Fredrickson, 2000).

There is a fourth important principle about sequence preferences that almost certainly has implications for memory. The general finding in samples consisting almost entirely of Americans is that people reliably prefer hedonically rising as opposed to hedonically falling experience profiles, when it is stipulated that those experiences consist of exactly the same set of events and the same total amount of momentary experienced pleasure (presented and reviewed by Loewenstein & Prelec, 1993). To some extent, this rising preference can be assimilated under the end rule, but it involves much more because it entails a temporal profile. Using sequences of unpleasant and changing pressure stimuli,

Ariely (1998) found that a rising sequence of pain led to more negative retrospective evaluations than a falling sequence of the same overall experienced negativity. More recent research has shown that the preference for gradually improving hedonic profiles may be limited to certain modes of presentation of the choice (Frederick & Loewenstein, 2008). It has not yet been clearly demonstrated that people remember improving profiles more positively when the total experience is positive as opposed to negative.

We do not yet have a specific model for how people create affective memories of experiences, outside of the rules or regularities just described. We can imagine two different models. In one, they may keep a running tab of the net affective experience as it is happening, carrying out some type of weighting function that emphasizes some moments more than others. Alternatively, when it becomes appropriate (e.g., when asked to create a summary evaluation by an experimenter or by a friend interested in attending the relevant event), they may do so by constructing the net evaluation from remembered features of the experience. Of course, if the observers are asked for a summary evaluation at a time not immediately after the on-line experience, then there is a third possibility: They simply remember their affective judgment at the end of the experience (for a full discussion of the nature of remembered pleasure, see Kahneman, 2011).

Fredrickson and Kahneman (1993) demonstrated duration neglect in some positive domains (movies/videos) and reported some evidence for the peak and end rules in positive domains. There is relevant evidence from an exploration of advertisements. Baumgartner, Sujan, and Padgett (1997) found that participants preferred commercials that had high momentary emotional peaks, ended positively, and generally increased in positive affect from moment to moment. Fredrickson (2000) reported three studies that supported the peak and end rules in the positive domain (movie clips, conversations, and advertisements) and no studies that did not. Subsequently, a few studies on ratings of the quality of whole human lives indicated that the ending was particularly important (e.g., Diener, Wirtz, & Oishi, 2001; P. Rozin & Stellar, 2009).

Relevant positive domains that had not been investigated as of Fredrickson's (2000) report include meals/food, concerts/musical works, sports, and other games. Most relevant to the current discussion is evidence for the peak and end rules, especially the end rule, for meals and musical pieces or concerts. There are a few studies of the effect of the order of dishes in a meal on overall hedonic rating of the meal. Rogozenski and Moskowitz (1982) explored the relative importance of different dishes on overall meal evaluation for members

of the U.S. Army. Soldiers provided like/dislike ratings for each of 144 foods, presented by written description (e.g., "macaroni and cheese"). Using these results, the investigators created a set of written descriptions of meals; participants then rated the meals on the same hedonic scale. The entree was the strongest predictor of the overall rating of a given meal. This result argues against the importance of ends.

Anderson and Norman (1964) examined the importance of the order of dishes in overall meal evaluations. Students rated their liking for 140 verbally presented foods. These ratings were used to construct personalized meals for each participant. The meals were composed of a sequence of six dishes, described simply by their names. They were arranged in two formats: three highly rated foods followed by three low-rated foods, or the opposite. The participants were read the menu of a meal (e.g., H-H-H-L-L-L), and they rated how appealing this meal was. The meals that began with three highly rated foods were rated more highly than meals composed of the same foods in reverse order (Anderson & Norman, 1964). In other words, in contrast to the "end" effect that emerged from the pain studies, there was a primacy or "beginning" effect.

Rode et al. (2007) explored these same issues in the context of "meals." Three different instantiations of the meal experience were studied. One was an imagined multicourse meal in which a picture of each course was shown, and the participants imagined consuming the dish, bite by bite. The second was a minimeal of six jellybeans: two of flavor A, followed by two of flavor B, and then two of flavor C. The third, the most realistic, was a five-course Chinese food meal in a Chinese buffet restaurant. For the Chinese meal, participants tasted and rated a large number of foods at the buffet on an occasion before the test meals, which were constructed individually for each participant on the basis of his or her ratings. Participants consumed meals on five occasions, and each meal included five dishes in sequences of both rising or falling liking. Some meals manipulated duration neglect by doubling the amount of the last (favorite) food consumed in the rising sequence. The results clearly supported duration neglect: doubling the amount of the favorite food consumed had no effect at all on the total meal rating. There was weak evidence that patterns rising in liking are remembered more positively then experience-equal falling sequences. It is notable that in both the imagined meal and real Chinese meal studies, the hedonic value of the component dishes was evaluated not during the test meal but on a previous occasion. In all three meal contexts, there was little evidence for peak, primacy, or recency/end effects.

For music, two studies have explicitly compared moment-to-moment and remembered experience. One

of the studies used a scale of "inexpressiveness-expressiveness," with a focus on understanding performance variables (Sloboda & Lehmann, 2001). The authors found that postperformance ratings were somewhat more highly correlated with the climax than with either the antecedent sections or the coda, which supports the peak rules. Also, the mean of the moment-to-moment ratings correlated with the postperformance ratings at .50.

The second study included records of the moment-to-moment affective ratings for a variety of musical selections, each a few minutes long, sampling both the classical and pop repertoire. The same subjects also provided retrospective affective ratings for each selection, right after the end of the selection (A. Rozin et al., 2004). This set of data affords the possibility of deriving a formula that represents how listeners arrive at remembered affective intensity. We assume that each moment of experienced affective intensity contributes to remembered intensity, albeit not equally. Given the nature of the stimuli as successful pieces of music, it is reasonable to interpret rated affective intensity as positive. The formula derives from three basic factors in determining the extent to which each moment of experienced affect fades in memory: (a) recency, or how long ago the moment occurred; (b) intensity, or how emotionally intense the moment was; and (c) slope (or contrast), or how the moment compared with its immediately preceding context Thus we can represent remembered affective intensity (RAI) as a weighted sum of momentary intensities (MI), where each momentary intensity is adjusted by three coefficients—a recency coefficient, r; an intensity coefficient, i; and a slope coefficient, s: RAI = $\Sigma(\text{MI}_n \times r_n \times i_n \times s_n)$, where n corresponds to each moment of experienced affect. The data—both moment-to-moment affect (MI_n) and remembered affect (RAI)—determine the coefficients.

To appreciate how the formula derives remembered affect from experienced affect, consider Figure 1. Here, a participant's moment-to-moment affect (the bold line) was recorded by the intensity of pressure on a button as the participant listened to an excerpt from Mozart's *Requiem*. This contrasts with the dashed line, which represents how each experienced moment is remembered according to the model. That is, the emotional intensity of each experienced moment is dampened by the three factors (r, i, s), but each moment fades at different rates. Thus, the shape defined by the bold line is not the same as the one defined by the dashed line. A listener's remembered intensity is the integral of the shape defined by the dashed line. Note that the moments from early in the excerpt have faded to almost zero in memory because of the recency factor. Likewise, the highpoints of momentary affect, such as when the voices enter in Measure 3, persist in memory
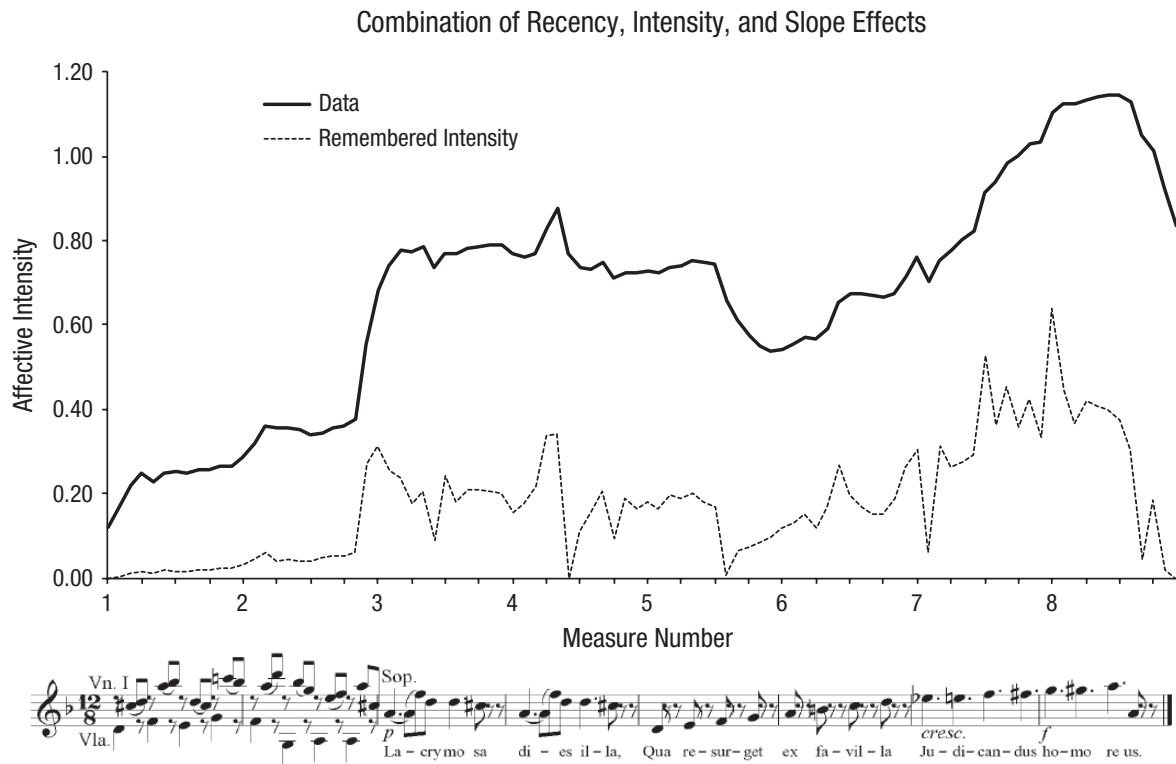
Combination of Recency, Intensity, and Slope Effects

Fig. 1. How memory distorts moment-to-moment experience of music. Affective intensity is graphed as a function of measure number. The heavy line indicates the result for one random participant who listened to Mozart's *Requiem*, "Lacrymosa" (Larghetto), Measures 1 to 8 (musical score and lyrics are shown at the bottom) while pressing a button. The changing intensity of pressure on the button was recorded. The dashed line indicates the model's prediction of remembered intensity for the same passage. From Rozin, A., Rozin, P., & Goldberg, E. The feeling of music past: How listeners remember musical affect. *Music Perception*, 22, 15–39, 2004. Copyright © University of California Press. Reprinted with permission.

disproportionately. And finally, moments that are more intense than the preceding ones, such as in the rise to Measure 8, influence memory more significantly than those that are less intense than preceding moments, such as at the end of the excerpt.

We now work through an example of our model using a common plan for the late 18th century high classical symphony (e.g., Mozart or Haydn): relatively intense outer (i.e., initial and final) movements (faster tempos, louder dynamics, fuller orchestral textures) and relatively less arousing middle movements (slower tempos, quieter dynamics, thinner textures). A movement-by-movement intensity rating (out of 10) might be 9 for the first movement, 3 for the second, 4 for the third, and 8 for the finale. Why did Haydn and many other composers use this arrangement? One possible answer is that memory effects make this arrangement the most intense and positive retrospectively. We calculated the remembered intensity for every possible permutation of four movements with the ratings 3, 4, 8, and 9, using our formula, and we found that of the 24 permutations, the 4 that generate the most positive remembered affect are those that have the most intense movements (i.e., ratings of 8 and 9) as

the outer movements (Table 3). One important component of this arrangement of movements is the finale. Because of the affective recency effect (the "end rule"), the last movement contributes disproportionately to remembered affect. Thus the movement cycles that end with a rating of 8 or 9 produce greater amounts of remembered intensity. The slope is large approaching the beginning of the first movement and the end of the last movement. The first movement follows nothing and hence generates a steep slope just as the last movement does by following one of the less intense movements. The permutations that generate the least remembered affect have the most intense movements as inner movements. These take advantage of neither the recency effect (by "ending with a bang") nor the slope effect (by beginning with a steep slope). Further, these permutations dampen the impact on memory of one of the intense movements. The third movement in the 4-8-9-3 permutation, for example, loses much of its influence on memory because it follows a movement of high intensity and hence does not generate a large slope.

The best experimental evidence for peak-end effects comes from negative events. Our review of positive

Table 3. Theoretically Derived Remembered Affective Intensities for Every Permutation of Rating Combinations (3, 4, 8, and 9) for Individual Movements in a Four-Movement Symphony

Permutation	Predicted remembered intensity
3-4-8-9	12.34
3-4-9-8	12.04
3-8-4-9	13.93
3-8-9-4	*11.19*
3-9-4-8	13.61
3-9-8-4	*11.16*
4-3-8-9	12.88
4-3-9-8	12.65
4-8-3-9	14.58
4-8-9-3	*11.34*
4-9-3-8	14.22
4-9-8-3	*11.19*
8-3-4-9	**15.08**
8-3-9-4	14.09
8-4-3-9	**15.18**
8-4-9-3	13.61
8-9-3-4	12.33
8-9-4-3	11.75
9-3-4-8	**14.85**
9-3-8-4	14.07
9-4-3-8	**14.81**
9-4-8-3	13.52
9-8-3-4	12.30
9-8-4-3	11.78

Note: The permutations in boldface type are predicted to produce the greatest amount of remembered emotional intensity. The permutations in italic type are predicted to produce the least amount of remembered emotional intensity. Adapted from Rozin, A., Rozin, P., & Goldberg, E. The feeling of music past: How listeners remember musical affect. *Music Perception*, 22, 15–39, 2004. Copyright © University of California Press. Used with permission.

events, including some of our own findings, yields positive but mixed results. The older studies, which used movie clips, conversations, or advertisements, reported peak and end effects (summarized in Fredrickson, 2000). It is obvious that in the sequence of sexual events, the typical and presumably most desired sequence has a peak at the end, represented by orgasm. There is data favoring importance of endings for whole lives (Diener et al., 2001; P. Rozin & Stellar, 2009). The few studies involving music do suggest that peak and end effects are important contributors to remembered affect, but the few studies involving food in a positive context have found neither peak nor end effects. The one finding (Rode et al., 2007) consistent with an end effect was that remembered affect was higher for a rising hedonic profile than for a falling hedonic profile, but this could be attributed to a rising trend rather than

an end effect per se. There is very little experimental data on positive sequences for anything (including, of course, both music and food).

For the present, the best reasons to suppose an important end effect for positive sequences are the evidence for the negative effect (with some support from the net effect for positive sequences) and the theoretical assumptions used to explain the negative end results. It is also critical to note that the total number of studies on peak and end effects is rather small, and they encompass a wide range of intervals, from seconds through minutes and hours and all the way to lifetimes. It is quite possible that different principles account for remembered pleasure over vastly different intervals, just as we already know the homogeneity of the events affects the manifestation of peak and end effects (Ariely & Zauberman, 2000). For the remainder of this article, we adopt the assumption, admittedly speculative, that endings are generally of disproportionate importance for remembered affect.

Experienced Versus Remembered Content

It is possible, though unlikely, that remembered content is unrelated to remembered affect. It seems reasonable to believe that the best-remembered components in a sequence of events make a disproportionately large contribution. However, at least one of us (P. Rozin) notes a rather consistent disparity in his affective memory for meals in contrast to his content memory for the same meals. This manifests in two ways. First, his overall affective memory for a meal is often "challenged" when he reviews in some detail the content of the meal (facilitated by the fact that he takes pictures of each of the multiple courses in excellent tasting menus). He often finds that, on such rehearsal, he feels that he has to make a substantial revision downward in his overall affective rating of the meal. Second, he finds that his content memory for dishes on a tasting menu is as much a function of how surprising and extraordinary a dish is as of how aesthetically pleasing a dish is. Thus, for a 27-course meal at Noma in Copenhagen, one of the world's best restaurants, his three most vivid memories are for eating a live shrimp, live ants in a sauce, and an omelet that he prepared himself at the table, under strict supervision by the waiting staff. But he does not consider these three dishes among the very best dishes of this wonderful meal. Finally, as previously mentioned, there is the common phenomenon of a vivid memory of how much one enjoyed a meal or concert without very much content memory of what was actually consumed or performed. This is illustrated

by what we experience as a common exchange in which one person says to another that a recent concert or dinner was outstanding, but when the other person asks about the content of the concert or dinner, the first person cannot readily bring the content to mind.

Our understanding of affective memory, especially for positive sequences, lags far behind the excellent work on content memory dating from Ebbinghaus more than a century ago (for a thorough review of content memory, see Kahana, 2012). Three principles relevant to our sequence orientation stand out: recency, primacy, and peak. The recency effect fades rapidly after the experience, whereas the primacy effect is much more robust, thus contrasting with most results from the negative affective memory literature. The peak effect holds for both types of memory, but factors such as surprisingness and novelty may contribute more to remembered content than to remembered affect. Further work must be done to understand whether there is really a major problem in the relative importance of beginnings or onsets for affective and content memories. Once the content of materials being memorized is meaningful, and the sequence has meaningful links within it, other important features of content memory become manifest (Kahana, 2012). Semantic clustering effects appear, and the organization of particular items in a presented sequence is important itself, given the evidence for semantic and other meaningful processes in recall.

It is widely accepted in content-memory research that memory is a constructive process; that is, there is much active cognition involved in recall. Prior knowledge of language and the world is recruited to weave together coherent recall on the basis of somewhat fragmentary information. Ideas about constructive affective memory are in their infancy. As we noted above, as one consumes a meal or listens to a concert, there may or may not be some representation of the current overall affect of the experience at any moment. Alternatively, remembered affect may be constructed at what is perceived to be the end of a dish/piece or meal/concert or perhaps only when it is requested by a friend (or by some psychologist) who wants to know if the event is worth attending. All we can say at the moment is that the relative importance of beginnings in content memory stands as a challenge for affective memory.

Endings and Narratives

The peak-end rules emerge primarily from studies of continuous negative stimuli, such as cold pressor pain. The end of such experiences is defined by the often unpredictable termination of a continuous stimulus. It can be ended at any moment. Meals and concerts have more internal structure than continuous events, so that endings may be signaled in advance by, for example,

codas in music or a familiar meal structure, such as appetizer, main course, dessert. In the case of narratives, such as plays or novels, the ending may be a surprise, but it is usually presaged in many ways and tends to constitute a meaningful conclusion that makes some sense of what preceded it. The hero emerges safely after dangerous challenges or dies. In either event, a personal drama comes to an end.

Perhaps the clearest example of distinct and powerful endings comes from sports events. The ending involves the determination of the winner. This is a positive or negative event, depending on the predilections of the audience. The power of endings (winning or losing), with an ability to reverse a prior strong hedonic response, is well illustrated by baseball. Imagine that the preferred or home team is losing 3–0 in the ninth inning. It is an important game, and the home team has played badly, allowing three runs to score by fielding errors. Twice, it has had a runner on third base with no one out and was unable to score. The game has been 2 hr of frustration and misery for the fans. In the bottom of the ninth inning, the home team scores four runs and wins. The home-team fan has suffered 2 hr of torture, followed by 10 min of delight. When asked how the game went, the fan is likely to say "great." This speaks to the importance of both duration neglect and of endings. Narrative structures and endings can produce major disparities between experienced pleasure and remembered pleasure. Somehow, the poor play for eight innings can be recast as a dramatic preparation for a turn-around win.

This dominant effect of endings in goal-oriented or narrative sequence was initially described and identified by Carmon and Kahneman (1996). Ariely and Carmon (2003) specifically refer to *retroactive recalibration*, the reinterpretation of the hedonic value of past events in light of current information. The suffering through the first eight innings of the ball game can actually be reinterpreted in such a way that it enhances the overall evaluation. The life of a frustrated, unappreciated artist whose work is discovered and appreciated near the end of her life is judged to be good and happy, even though almost all of her adult life was unhappy (P. Rozin & Stellar, 2009). But consider a scientist who enjoyed success for decades after finding a cure for a major disease; however, toward the end of the scientist's life, the cure is found to have devastating side effects. The life of the artist is judged to be better and happier than the life of the scientist. Indeed, if these reversals in fortune occur posthumously, they still reflect on the judged goodness and the happiness of the life (P. Rozin & Stellar, 2009)! What is an ending is partly a matter of framing.

The line between the more abstract, nonnarrative, and nonverbal experiences of concerts and meals and

verbal or sports narratives is not so clear. In the case of music, narrative is often a part of the experience, as with opera, musicals, lieder, or popular songs. Two related temporal streams of events add a great deal of complexity to the link between experience and memory. There has been no meal equivalent to opera. There are banquets with courses and music/entertainment intertwined, but these are in no sense integrated events. It is within the realm of possibility to arrange a tasting menu that follows a story script. The Passover Seder is a dinner that has an explicit symbolic structure and ties individual foods to explicit events in the history of the Jews in Egypt. It is not clear whether these examples of meal courses and explicit events constitute a true narrative, as in the relation between music and narratives in opera, because the meal narratives do not have a structure that includes identification, elaboration of experiences, expectations of narrative outcomes, and narrative closure. In any event, narrative sequences are better remembered and may be constructed from certain types of sequences of experiences; for humans, narrative is a basic and highly preferred structure (for further discussion, see Kahneman, 2011).

Although most classical music does not have a "narrative" structure, there is often an explicit structure (as with the meal—appetizer, entrée, dessert), such as sonata (exposition, development, recapitulation) or rondo (A-B-A-C-A-B-A) form. More importantly for music, but not for meals as produced so far, there are specific expectations, as in antecedent and consequent phrases. Tonal closure (return to the initial key) is characteristic in the classical tradition. Return to the original key (tonic) is both a signal of an ending and a satisfying resolution of a tension produced by departure from this key. In fact, a critical feature of most Western music, from classical through jazz, musical theatre, and pop, is a return to origins in terms of tonality and sometimes of other parameters (e.g., timbre, rhythm). This return is itself embodied in another form of return, a summary of previous thematic material, in what constitutes the recapitulation or, in folk and pop music, the chorus. All of this suggests that structural-affective features associated with endings in music are embedded in styles but also in what may be innate expectations (such as tonal resolution). These specifics of endings in music are not paralleled in the meal. There is typically no "return" that is represented by dessert.

Content, Affect, Context, and Their Relations

What is an ending? Musical works end most often with an appropriate tonal resolution or with other clear signals, such as a fade out, a ritardando, or a coda. This ending is solidified because it is followed by silence. Concerts often have intermissions; does such a break define an ending? Is the end of a phrase an "ending"? Trips end when one arrives home or maybe when one leaves a distant location to depart for home. Endings are hierarchical in nature. In creating a summary affective memory for an overseas trip, it should be more optimal to disregard the usually unpleasant travel and consider the trip to have begun on arrival at the destination and to end on departure from the destination. The question of "what is an ending?" is of course part of the larger question: What is an experience or an event? When does a discontinuity signal an ending and hence another beginning? Peak, end, and duration neglect all depend on the identity of units or experiences. Gestalt psychology has much to say about the segmentation of experiences but focuses on vision and on segmentation of simultaneously presented components.

Ariely (1998) finds that peak, end, and overall slope all influence retrospective evaluations of pain and that duration neglect tends to hold principally for relatively homogeneous events. Studies by Ariely and his colleagues (Ariely & Carmon, 2003; Ariely & Zauberman, 2000) illustrate the many factors that can influence overall (retrospective) evaluations. The more heterogeneous a situation, and the more temporal partitions there are, the weaker the duration, peak, end, and slope effects and the stronger the relation between average affective intensity and remembered affect. However, the relation between average pleasure and remembered pleasure is stronger than peak-end effects in the studies of three different types of meals (Rode et al., 2007). Furthermore, the segmentation of an "experience" can result from internal structural features or simply from brief interruptions. The authors suggest that each part of a segmented experience may itself follow peak, end, and slope principles. Furthermore, although this has not yet been investigated, the "coherence" of the segments may determine whether they are treated as part of the same experience. Thus, for example, a restaurant dinner followed by a classical music concert with an intermission naturally divides into a meal with multiple segments and a concert with multiple pieces. It is reasonable to ask people how much they enjoyed the meal or the concert, but it is odd to ask how much they enjoyed the last two courses of the meal and the pre-intermission part of the concert. The end of the meal is an ending in a way that the end of the second course is not an ending.

The memory-content literature shows that a list of items to remember that is segregated by some discontinuity (e.g., a change in color of the words presented) can induce a new primacy (enhanced memory) effect for the first word in the "new" sequences. This phenomenon has

been described as release from proactive inhibition. (Craik & Birtwistle, 1971; Gardiner, Craik, & Birtwistle, 1972; Kahana, 2012; Wickens, 1970). For just understanding free recall (content memory) of unrelated words and phenomena such as release from proactive inhibition, primacy, recency, intrusions from prior "lists," and in general the role of temporal and substantive context, highly sophisticated models with many free variables are required (e.g., 16 free parameters in Lohnas, Polyn, & Kahana, 2015). There is not a substantial enough empirical database relating experienced and remembered pleasure to attempt a sophisticated model that might hold across a range of contexts and domains.

The Specifics of Hedonic Interaction of Sequential Events

A fundamental issue in sequences is the relation among neighboring components. Prior events provide contexts—either contrast or continuity—for subsequent events. From our perspective, contrast refers to hedonic changes, although it also exists for sensory (e.g., color, brightness) events. The basic idea of hedonic contrast was described by Gustav Fechner (1898): "That which gives pleasure gives more pleasure the more it enters into contrast with sources of displeasure or of lesser pleasure; and a corresponding proposition holds for that which gives displeasure" (as translated and cited by Beebe-Center, 1932/1965, p. 222; for more information, see Zellner, 2007). Note that Fechner identified both negative and positive contrast. A more negative prior increases the positivity of a subsequent more positive stimulus. A more positive prior increases the negativity of a subsequent more negative stimulus. This relation was clearly shown in a recent study by Parker, Bascom, Rabinovitz, and Zellner (2008), who also reviewed the literature on hedonic contrast. Participants heard three consecutive melodies that were rather unpleasant ("bad"), followed by three melodies that were more pleasant ("good"); "good" and "bad" were determined by prior ratings of other subjects. Another set of participants heard the two sets of three in the opposite order, with the more pleasant triad first. As clearly shown in Figure 2, both negative and positive contrasts occur. Good music that follows bad music gets a notably higher rating than good music that precedes bad music; likewise, bad music that follows good music receives a much lower rating than bad music that precedes good music. Our modeling of remembered affective intensity for musical selections (Rozin et al., 2004), described above, relies on just such contrasts as one of the three independent variables that together account very well for remembered pleasure.
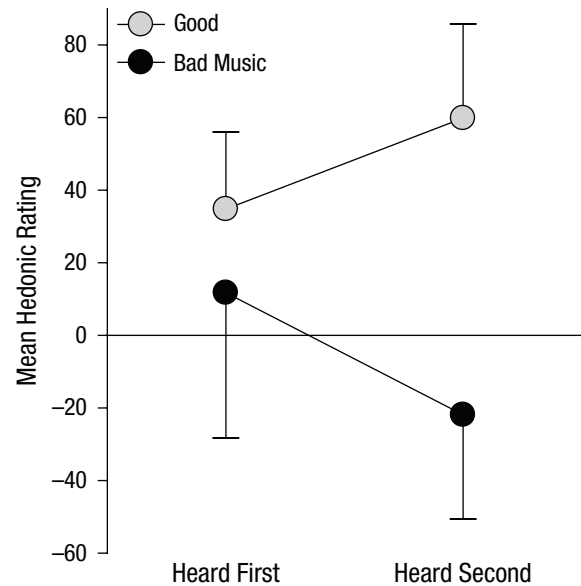

Fig. 2. Mean hedonic ratings of good music (+ 1 *SD*) and bad music (–1 *SD*) when heard first or second. From Parker, S., Bascom, J., Rabinovitz, B., & Zellner, D. Positive and negative hedonic contrast with musical stimuli. *Psychology of Aesthetics, Creativity, and the Arts*, 2, 171–174, 2008. Copyright © American Psychological Association. Reprinted with permission.

Categorization and Contrast

Debra Zellner and her colleagues have clearly established how categorization has a major influence on whether two stimuli will show an hedonic contrast effect (for review, see Zellner, 2007). Her work follows up on a suggestion by Fechner that in order for a contrast effect to occur, "the two factors had to bear a certain resemblance to each other" (Beebe-Center, 1932/1965, p. 223). Zellner and colleagues have demonstrated that if two stimuli are perceived to be in the same "category," then contrast between them will be enhanced. Individuals who spontaneously categorize two sets of stimuli under the same category (compared with those who do not) show more sequential hedonic contrast between the stimuli. For example, some people might categorize canned and gourmet coffees under the same coffee category (showing more contrast) and other people might categorize them into two different categories. The same was shown for domestic and imported beers. In subsequent research (again reviewed in Zellner, 2007), the categorization was imposed on a stimulus set. Some participants were presented with a set of juices (more and less diluted), and others were presented with the same stimuli described as juices (the more concentrated beverages) or commercial drinks (the more diluted beverages): More contrasts between "concentrated" and "diluted"

were shown when the two drinks were both categorized as juices. Under these circumstances, the diluted juices are rated as less pleasant than when the same stimuli are presented as belonging to two categories. Similar results were shown with hedonic ratings of the beauty of birds, with more colorful tropical birds and less colorful North American birds described as such versus being grouped together under the general category of birds.

In the extreme, the quality of the dinner before the concert is probably not going to affect ratings of the concert, but the music in the first half of the concert is likely to affect the rating in the second half.

In the context of concerts, intermissions provide an important opportunity for contrast, as do slower and calmer movements or periods within a movement or piece. The contrast operates on-line, with experienced pleasure, but is also important for remembered pleasure (Rozin et al., 2004). So far as we know, issues of contrast in either experienced or remembered pleasure have not directly entered into menu design or speculations about culinary sequences.

The critical question for overall (remembered) pleasure is whether there is an asymmetry between positive and negative contrast. For example, consider a sequence of events with hedonic ratings (on a scale from 0 to 10) of 4-8-4-8. Is the net hedonic experience more positive than the sequence 6-6-6-6, which has the same average as 4-8-4-8? More data such as those displayed in Figure 2 could speak to this issue. The experience of music appreciation and music composition over centuries is that contrast has a net positive effect.

Beginnings: Overtures and Appetizers

Before beginning on beginnings, we have to introduce a concept that bears directly on the importance of beginnings. It is the idea of a "trapped audience." For many events, once one begins to participate, one is trapped. That is, it is extremely difficult to physically withdraw. This would be true for a typical concert or restaurant meal but less so, for example, for reading a best-selling novel, attending a sports event (where people often get up and leave for refreshments or to depart), or attending a large, somewhat chaotic concert or picnic. The important issue is that one role of beginnings is to engage participants, to convince them that an event is worthwhile and deserves attention. The more one is trapped, the less critical is the very beginning (e.g., the first musical piece or movement or the first meal course) with respect to orienting the participant toward experiencing a quality event. Of course, depending on the medium, an audience may expect a "soft" beginning. For example, in the classical symphony (e.g., by Haydn),

a slow introduction might lead into the expected sonata form of the first movement.

One basis for an importance of the initial event is the primacy effect in content memory. Initial events will be selectively remembered, all else being equal. There is little evidence yet on the relative importance of a beginning for remembered affect, although we have noted an example suggesting enhanced importance for beginnings from "meals" (Anderson & Norman, 1964). We have also noted that, as our model predicts, the most common form of the classical symphony puts the movements with the strongest hedonic profiles at the beginning and end. Because of the importance of contrast, a strong start is likely to be followed by a weaker second component, so that the interactional possibilities near the beginning and further along are numerous. In some forms of music, but not in cuisine, the beginning provides a "peek" at the entire work, as in the overtures to musicals. In general, especially with respect to meals, we think that more attention should be given to the quality of the beginning.

Endings: Codas, Returns, and Desserts

It is clear that endings are important, and they are more important when there is a narrative structure. Endings are not reliably peak experiences in music. For example, pop songs often fade out rather than building to a terminal climax. But endings are often peak experiences, and they reliably include a return, which we believe contributes to some sort of aesthetic satisfaction. Contemporary pop songs most often use verse (V) and chorus (C) form—V_1-V_2-C-V_3-C-V_4-C and so on— and a repeated chorus is most often the terminal segment. Using simply volume and speed as measures of "excitement," in the classical tradition for pieces with a large set of performers (e.g., symphonies), there is often a coda (an addition to the recapitulation) that is of high volume and speed. In classical symphonies without a coda, the recapitulation is often loud and fast. For example, the three greatest symphonies (as rated by conductors; Brown, 2016), Beethoven's Third and Ninth, and Mozart's 41st, all end with a loud and fast section. Of the nine Beethoven symphonies, eight end in such a manner. Emotional peaks in music often occur not at the very end but near it, raising the critical question of what defines an ending.

Western major meals, modeled on the French, typically end with dessert. But dessert is, for most adult consumers, not the "favorite" course. In an Internet survey of representative Americans (n = 200) and French adults (n = 288) that one of us just administered using Qualtrics, respondents were asked which of the three typical courses (or four courses, with the *fromage*

course added for the French) was their favorite. The results for American adults were 17% for the appetizer, 68% for the main course, and 15% for dessert, and the results for French adults were 8% for the appetizer, 62% for the main course, 20% for dessert, and for 7% cheese (*fromage*; P. Rozin, 2012). This contrasts with the preference for appetizers by international chefs and others in the restaurant food business (mentioned above). As one reviewer pointed out, it is possible that if we asked which part of a meal "gives most pleasure," as opposed to the which is the "favorite," desserts might get a higher "score." It may also be that the minority of people who prefer desserts to other courses show particularly strong preferences for this course compared with people who do not prefer desserts. It is notable that sweets are not typical meal endings outside of the Western world and the countries that it has strongly influenced. Dessert is far from a universal course. However, in the Western tradition of eating, largely derived from 18th-century France, a sweet is expected at the end of a meal, and the satisfaction of this expectation may be part of the pleasure and closure in the meal.

Given the suggestion of the importance of endings in the literature on affective memory, chefs (and other organizers of sequences experiences) would do well to consider the possibility of putting their strongest effort at the end of the meal, and it would be useful for psychologists to clarify the conditions under which endings are most important.

From Psychology and Music to Meals and Other Real-World Temporally Sequenced Experiences

In this section, we directly address how knowledge from psychology and the long experience of music as an art form can suggest modifications to optimize affective memory for the many other event sequences that people experience within any particular domain, such as meals, art galleries, experiences within buildings (e.g., starting and ending with lobbies), narrative forms (e.g., movies, plays), and museum exhibits. The arrangement of order in musical presentations is currently more a matter of art than science, but there is a long history of experience and academic analysis behind these efforts. Affective psychology, as reviewed above, has already discovered some basic determinants of affective experience and affective memory. As an example of such advice, we use, in some cases, the arranging of sequences in the tasting menu, given its central role in this article, and the lack of attention to this sequence by both psychologists and chefs:

1. Determine for yourself whether you would choose to optimize the experience of a meal or the memory for that meal.
2. Consider the value of repetition of a course or introduction of variations of a course during a meal.

    Both of these proposals are common in music and rare in meals. They provide some sort of coherence in the event sequence. Such coherence can be accomplished within a course or at different courses during a meal. One of us (A. Rozin) and his colleague Frank Mosca prepared a tasting menu in 2008 that included two dishes, each of which contained five parts. There was a tomato theme to the first dish, with five variants of a tomato, eaten in a specified order. The dish started with a raw heirloom tomato (Fig. 3, center), proceeded to a tomato salad with tomato water vinaigrette (Fig. 3, left), and then moved clockwise around the plate such that the tomato became more and more cooked, elaborated, and embedded, ending with a gazpacho followed by a fried green tomato, and then a bruschetta with slow-roasted yellow tomatoes (Fig. 3, bottom). Later in the meal, a similar presentation was made, again with a theme and variations, but to be eaten in reverse order, beginning with a tart of slow-roasted peaches (Fig. 4, bottom left) and ending with a peach "tartare" (Fig. 4, center). The theme-and-variation component of the meal certainly made this section more memorable because the components were conceptually linked, given that clustering is a major feature in the organization and recall of memories.

3. Consider imposing an overall structure on a tasting menu. In the absence of a narrative, a form common in music is presentation of a theme, elaboration of the theme (e.g., variations, development), and then a return to the original theme, creating a sense of closure. (The theme and variation approach is presented in Figs. 3 and 4 and discussed above.) In addition, the principle of return (e.g., recapitulation in sonata form) is fundamental and omnipresent in at least Western music, classical, jazz, folk, and popular music. This probably functions to produce a summary of the prior experience and a natural ending. Return is also embodied in the same Mosca and Rozin meal we illustrated in Figures 3 and 4, in which the tomato theme and variation was the second course, and the peach theme and

Fig. 3. Theme and variations on the tomato (center). The tomatoes were more cooked and more elaborate with each form and were eaten in the following order: raw heirloom tomato (center), tomato salad (left), gazpacho (top), fried green tomato (right), and roasted tomato bruschetta (bottom).

variation was the penultimate course. In that same meal, the first course was a rose petal sorbet with prosecco, and the last course, a return in style, was a plum-clove soda with crème fraîche ice cream. Another meal, also created by Mosca and Rozin, was modeled on the classical sonata form, with exposition, development, and recapitulation. Structures such as these insist on repetition and return, which the chefs can accomplish through plating design, ingredients, and techniques without literally repeating a course.

Fig. 4. Inverse theme and variations on the peach. Mirroring the tomato sequence in Figure 3, the peaches were less cooked and less elaborate with each form and were eaten in the following order: roasted peach tart (bottom left), peach beignet (bottom right), peach gazpacho (top right), peach salad (top left) and peach carpaccio with sea salt ice cream (center).

4. Pay more attention to course-by-course contrast, setting the stage for peaks with a lower profile, less exciting predecessor. This could include, as is the case in some of the meals at El Bulli, an intermission in which the diner changes environment, from eating on the patio to eating inside. This also allows for two beginnings and two ends. The palate cleanser is an example of a feature of some meals that may serve to both provide contrast and to segment (reframe) the meal.

5. Consider putting the best (most liked) courses at the beginning and end of the menu. The "standard" French menu tends to have the best, largest, and most elaborate dish in the middle, in the main course. Modeled on this (and we think many tasting menus are), there would be a gradual crescendo leading to the middle and then a decline, as shown by the black line in Figure 5. An alternative, such as the classical symphony, and consistent with what we have discussed about affective memory, would be a profile as represented by the red line in Figure 5, with the most liked entities at the beginning and the end. We will even make a radical suggestion for the organization of a 15-course tasting menu: After the first 14 courses, the diner is shown a list (and/or photos) of the courses up to that point and is then asked to select his or her favorite course. The selected course then becomes the 15th course, making it much more likely that the meal will end with a "bang" and including a return at the end. (And the favorite probably will not be a dessert!)

6. Entertain the possibility of creating and realizing expectations and also strategically violating them. This is a major feature of music, considered from the point of view of the listener, in the work of Leonard Meyer (1956, 1973) and Eugene Narmour (1977, 1990, 1991, 1992, 1996, 1999, 2015). It is a very common occurrence in music, and in humor, to take advantage of a human predisposition to assume that if a well-defined event occurs (e.g., a sound) and occurs again, it will then be repeated once more. For a discussion of this in a meal, see Spence and Piqueras-Fiszman (2014). The prevalent A-A-B form in music and humor builds on this with the A-A repetition, but then violates the expectation of a third A with something that may start like a third A but evolve into something that is quite different (B) but remains in the same genre as A. This is discussed in more detail in an earlier section of this article.
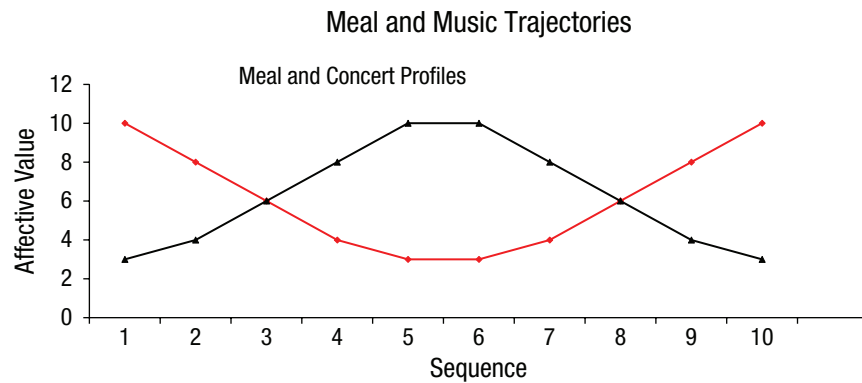
Fig. 5. Affective value in a typical tasting menu (black line) and in a menu designed to maximize positive affective memory (red line).

An Empirical and Theoretical Agenda for Psychology

In contrast to the preceding section, which illustrates how psychology might influence those who create temporally sequenced experiences, in this section, we indicate some ways in which the real-world experience of affective sequences or experimental studies of them might influence psychology, both empirically and theoretically.

1. To what extent does the accuracy or vividness of the content memory for an explicit component event in a sequence predict its relative contribution to the overall hedonic memory? A surprising dish may dominate recall but not overall hedonic memory.
2. Does a notable temporal, spatial, or contextual break in a sequence (such as an intermission or a change in venue from outside to inside in a meal) hedonically segment the experience, so that the last event in the first part assumes greater hedonic importance as an "ending" and the first event in the second part assumes greater hedonic importance as a second beginning?
3. Under what conditions do people segment a sequence into subcategories?
4. Does contrast enhance overall remembered (or experienced) affect, as opposed to sequences that do not generate contrast but have the same mean hedonic value?
5. Does "return," including some of the initial material in the final episode, enhance affective memories?
6. To what degree are the determinants of remembered positive affect the same as the much better understood determinants of remembered negative affect?

7. What is the role of realization of expectations in affective response to a sequence?
8. How might the relations between affective experience and memory be influenced by the length of time occupied by the affective experience? Even if the experience-to-remembered-affect relation is different to some degree across domains (e.g., music, sports, museums, meals), systematic research might define parameters that optimize remembered affect with time and domain specified.

For practical reasons, sequences of art works in a simulated museum setting might be the easiest situation to begin with. Although there is merit to further examining the actual sequences that occur in the real world, assuming there is some wisdom behind them, we believe this area is ripe for experimental study. Sequences (e.g., of previously rated paintings or other visual art works) can be presented in various orders with potential segmenting cues related to the genre of the work or progression in galleries (e.g., passing through a door from one room to another). Such research might best be done in a between-subjects design, using ratings of liking or engagement, or willingness to pay for a repeated sequence, immediately after an event or sometime later. Our study on sequences of real Chinese dishes or moment-to-moment reactions to musical pieces could be a model for this type of research, but using the more easily manipulable series of visual art works.

Conclusion

Many real-world sequences of potentially aesthetic events are presented to participants in an order that is out of their control. This lends itself to research, informed by the established practices of the past, but

capable of isolating the causes of remembered affect. This matter affects daily life but has not been subjected to systematic investigation. Indeed, every time one enters a building, one has the experience of lobby, passage to the destination room, and, later, from the destination room back to the lobby (return) and then outside. We wonder whether architects have thought of this as a temporal sequence with potentially aesthetic qualities. There is much to be done in the humanities and in psychology to understand and instantiate an aesthetics of temporal sequence.

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Both authors were involved in the conceptual development of the ideas presented in this article. Both authors approved the final version of the manuscript for submission.

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Note

1. For interested readers, some general materials on the status of the psychology of music and the psychology of food choice are listed here. The psychology of music is represented in the journal *Music Perception* and in books by Deutsch (2013) and by Hallam, Cross, and Thaut (2011). The psychology of food choice is represented in the journals *Appetite* and *Food Quality and Preference*, in books by Prescott (2013), and, for meals in particular, in books by Meiselman (1999; see in particular the chapter by Pliner and Rozin) and Spence and Piqueras-Fiszman (2014).

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