MULTI-UNIT CONSUMPTION STRUCTURE AND ITS INFLUENCE ON HEDONIC DECLINE

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ABSTRACT

The unfortunate fact of consumption is that enjoyment decreases with repeated consumption, a phenomenon known as hedonic decline. This work investigates how the *structure* of repeated consumption influences such hedonic decline. Repeated consumption may occur across a series of consumption units, such as individual songs within a playlist or a series of posts on a social media feed. This work examines how two specific consumption structures, increasing and decreasing, can influence hedonic decline for such multi-unit consumption episodes. Increasing (vs. decreasing) structures refer to circumstances where consumption quantity grows (vs. declines) with repetition (e.g., the duration of songs: 3-minutes, 4-minutes, 5-minutes (or the reverse); or the number of images in successive social media posts: 1 photo followed by 3 photos (or the reverse)). Five experiments and one archival study show that, holding the total consumption quantity constant, decreasing structures attenuate hedonic decline relative to increasing structures. This structure effect is driven by changes in beliefs about subjective quantity consumed and is mitigated by providing an external reference about consumption quantity. Further, this structure effect has significant impacts on consumer choices. These findings speak to how consumers and firms can structure consumption episodes to minimize hedonic decline and, thus, maximize utility.

Keywords: hedonic decline, hedonic adaptation, satiation, habituation, consumption structure, consumption utility

A core impetus for consumption is the experience of pleasure from goods and services. Unfortunately, the enjoyment derived from most consumption activities declines with exposure to those very same experiences. This reduction in enjoyment is termed hedonic decline (Galak and Redden, 2018), and has been observed across a variety of stimuli such as art (Berlyne and Crozier, 1971), videos (Nelson, Meyvis, and Galak, 2009), and food (Rolls et al., 1981). In fact, hedonic decline is a principal force hindering consumers in their efforts to sustained happiness (Brickman and Campbell, 1971). To illustrate, consider a patron visiting an art museum with the hope of finding pleasure in the act of viewing masterful works for art. In most instances, a patron of an art museum consumes one piece of art at a time (e.g., 1st painting, then 2nd painting, and so on). Unfortunately, as consumption unfolds over the course of a visit to a museum, enjoyment tends to decrease (Redden, 2008). Indeed, much of the literature on hedonic decline focuses on such repeated consumption episodes with nearly uniform results: inevitable hedonic decline (Galak and Redden, 2018, though see Galak, Kim, and Redden, 2022 and O'Brien, 2021 for exceptions to this). However, this description of consumption in an art museum is, perhaps, a bit overly simplistic. In reality, art museums are structured quite differently: exhibits are typically placed throughout various rooms or even various buildings. This structure creates units of consumption naturally grouped by the physical layout of the museum itself. Though, on the surface, it may seem that such grouping of consumption does little to change the inevitable hedonic decline that comes with viewing multiple pieces of art, there is reason to suspect that this *multi-unit consumption*, as we term it, can play a critical role in determining the degree of this apparently inevitable hedonic decline. More formally, we define multi-unit consumption as a larger consumption experience consisting of multiple consumption *units* such as songs, social media posts, and pieces of arts. And, of course, such multi-unit consumption is not limited to art

museums. For instance, when viewing social media posts on sites such as Instagram, posts are often structured to include multiple images or short videos, with the posts themselves acting as discrete units of consumption. When attending academic conferences, presentations are often grouped into sessions of several talks, with the coffee breaks acting as delineations between sessions. As a final example, in the domain of music, consumers frequently listen to a series of songs in a single playlist, where each song has a different duration. Here, each song is its own unit of consumption (see the Pretest in Study 4 for supporting evidence of this claim) with the duration of each song being analogous to the quantity of, say pieces of art on display in a single room. What then, might such varying consumption quantities under multi-unit consumption do to change the rate at which consumers experience hedonic decline?

The literature on repeated consumption does not provide a clear-cut answer to this question. Previous work examining the influence of repeated consumption on utility are generally concentrated on environments where consumption quantity per unit is relatively homogenous over repetitions (Galak and Redden, 2018). However, as presented earlier, consumers commonly face environments where consumption quantity per unit fluctuates over the course of an entire consumption experience. As such, the current work investigates the impact of such varying consumption quantities on hedonic decline. And, specifically, we focus on how and why different structures of varying consumption quantities change enjoyment over the course of a repeated consumption experience. Structure can mean many different things, but in this work, we define it to mean the way in which individual consumption episodes are allocated across groups or units. For instance, returning to the art museum example, a curator could decide that a 15-piece exhibit should be spread across five rooms with each room containing exactly three works of art. This would constitute what we term a *uniform*

consumption structure. Alternatively, she, may structure the exhibit to start with five pieces in the first gallery, four in the second gallery, three in the third gallery, two in the fourth gallery, and end with a single piece in the fifth gallery. This would constitute what we term a *decreasing* consumption structure. Of note, the order of pieces, in this hypothetical scenario, is ordered identically across these two structures, and yet the structure itself, by virtue of having the consumption quantities decrease as a patron progresses through the exhibit, might influence their overall level of hedonic decline and ultimate enjoyment. Of course, the curator could also structure the gallery in what we term an *increasing* consumption structure, where the first gallery contains one painting, the second contains two paintings, and so on. The underlying art doesn't change, nor does the order of the art consumed. Rather, what changes across these experiences is the way that the consumption is structured. To be sure, there are other structural components that could be considered, but, for the purposes of this work, we focus solely on consumption quantity per unit. And, of course, this need not be limited to art museums. The duration of individual songs in a larger playlist can be structured in an increasing or decreasing consumption structure. Social media users can create posts with a uniform number of images in each post, or curate their posts to have an increasing or decreasing number of photos in each. And conference organizers can schedule sessions with an equal number of presentations in each session, or start the day off slow, ramping up to longer, multi-presentations sessions, or vice versa. Ultimately, the question of interest here is whether this choice in quantity per consumption unit influences hedonic decline, and, critically, if it does, why it does so.

One hint as to whether there might be an influence of varying consumption quantities on hedonic decline comes from the literature on how self-reflection influences hedonic decline (Geier, Wansink, and Rozin, 2012; Van De Veer et al., 2016). This work suggests that aside from

physiological factors such as stomach distention (Geliebter, 1988; Kissileff et al., 2003) or blood glucose levels (Grossman, 1986) and perceptual factors such as stimulus concentration (Ghosal et al., 2014; O'Sullivan et al., 2010) or perceptual attention (Blass et al., 2006), a third factor that influences hedonic decline is the way in which individuals subjectively interpret past consumption. For instance, merely consuming variety is typically insufficient to reduce hedonic decline. Rather, variety needs to be top of mind (Galak, Redden, and Kruger, 2009) or be deemed positive (Etkin and Mogilner, 2016) for hedonic decline to decrease. Though quantity of consumption is also a critical input to hedonic decline, more relevant to the present work is the *perception* of how much quantity one has consumed in determining the degree of hedonic decline (Redden and Galak, 2013). This is particularly true in settings where it is unclear how much consumption is normative. For example, if a consumer is asked whether eating 10 M&M's candies is too little consumption or too much consumption, they are unlikely to have a strong sense in either direction. Rather, they are likely to use external cues to appraise whether this level of consumption is too little or too much. Indeed, merely telling consumers that a single serving of M&M's candies is 32 pieces (the true serving size as defined by the manufacturer), might lead them to believe that eating 10 M&M's candies is not all that much, and thus create the belief that hedonic decline is unlikely to unfold. This belief, as past work has shown (Redden and Galak, 2013), is enough to result in an actual change in hedonic decline (a reduction, in this case).

This subjective perception of consumption quantity might inform how varying consumption quantities influence hedonic decline. When consumers experience a *decreasing* consumption structure, each unit of consumption constitutes a consumption quantity that is smaller than the previous one. As such, lacking other information to inform what a typical volume of consumption is, consumers might use their immediately previous consumption

experience (the preceding unit) as a reference point against which to compare their current consumption quantity. For instance, if the first unit of consumption contains 5 works of art, then when evaluating the subjective quantity of the second unit of 4 works of art, this new unit (4 works for art) is seen as relatively less consumption, which then informs how much hedonic decline one experiences—less in this case. In contrast, in an *increasing* consumption structure, the opposite is true. The first unit of consumption may contain a single work of art, against which subsequent units are compared to. Since each subsequent unit contains more works of art than the previous one, consumers are likely to perceive their subjective quantity as being relatively larger, which then again informs how much hedonic decline they experience—more in this case. It is this change in subjective quantity, resulting from quantity allocation, that is likely to drive a change in hedonic decline. Of note, varying consumption quantities do not mean a change in how much or what a consumer consumes. Rather, they merely refer to the change in the structure of how that consumption unfolds.

In the present paper, we propose two structures of varying consumption quantities that influence hedonic decline under repeated consumption. We test this proposal across one archival study and five experiments and demonstrate how these structures affect subjective assessment of consumption quantity and, ultimately, the degree of hedonic decline.

CONCEPTUAL BACKGROUND

How External Cues Influence Hedonic Decline

Hedonic decline occurs when repeated consumption or extended exposure leads to a significant attenuation of response to a hedonic stimulus. Various mechanisms such as

habituation (Epstein et al., 2009), hedonic adaptation (Frederick and Loewenstein, 1999), and sensory-specific satiety (Inman, 2001; Rolls et al., 1981) are known to cause hedonic decline, but the consequence of hedonic decline is largely homogenous regardless of the underlying mechanisms: decline in pleasure of consuming a stimulus (see Galak et al., 2022 for an exception to this). Though some bottom-up processes such as physiological feedback cues are certainty responsible for aspects of hedonic decline, here we focus on how external cues can influence the top-down processes that lead to hedonic decline. For instance, as aforementioned, whereas variety, in and of itself, can certainly reduce hedonic decline (Ratner, Kahn, and Kahneman, 1999; Sevilla, Lu, and Kahn, 2019), it is the subjective assessment of that variety that is most pivotal in influencing actual changes in hedonic decline (Galak et al., 2009). Like variety of consumption, a key input to hedonic decline is the inter-consumption interval between consumption episodes (Epstein et al., 1995; Epstein et al., 2009). The longer the interval between consumption episodes, the less hedonic decline experienced. However, like with the previous example, rather than actual inter-consumption timing being most relevant to determining hedonic decline, it appears that the perception of the length of that inter-consumption interval is what matters most (Galak et al., 2014).

Most relevant to the present work, whereas actual consumption quantity is certainly an input to hedonic decline, with more consumption resulting in more hedonic decline (Groves and Thompson, 1970), the perception of consumption quantity is often far more impactful in determining the degree of hedonic decline (Raghubir and Krishna, 1999; Redden and Galak, 2013; Sackett et al., 2010). For instance, an external cue of packaging shape can influence the degree of hedonic decline experienced, via a change in subjective quantity. In one study, participants drank more soft drink when it was poured in a tall and narrow cup as compared to a

short and wide cup, even though the volume of the two cups was identical (Raghubir and Krishna, 1999). In the taller cup condition, the greater intake of soft drink was mediated by lower perceived consumption quantity and, in turn, increased actual consumption. In similar work, other facets of food packaging modulated actual food intake (Scott et al., 2008). In yet other work, subjective consumption quantity was more directly manipulated by changing an external reference for defining a normative degree of consumption. Participants who viewed a pleasing photo 20 times, experienced more hedonic decline after being made to feel as though 20 consumption episodes was a considerable amount to consume, as compared to when they were made to feel as though it was a small amount to consume (Redden and Galak, 2013). Critically, this change in subjective consumption quantity resulted in changes in actual hedonic decline, even though in all experimental conditions, actual consumption quantity was identical.

This last form of an external cue is most relevant in understanding how varying consumption quantities, via increasing versus decreasing consumption structures might influence hedonic decline. Unlike this previous work, however, which applied completely external cues to influence perceptions of subjective variety, time passage, or quantity, in the present work, we consider a cue that is endogenous to the experience itself: quantity of consumption in an immediately previous unit of consumption.

Varying Consumption Quantities and Its Relation to Hedonic Decline

As aforementioned, for the purposes of this paper, when we refer to varying consumption quantities, we specifically focus on the variability in how much one consumes in any given unit of consumption, in a multi-unit consumption setting. This multi-unit consumption is characterized by consumption episodes that are either naturally occurring (such as based on a

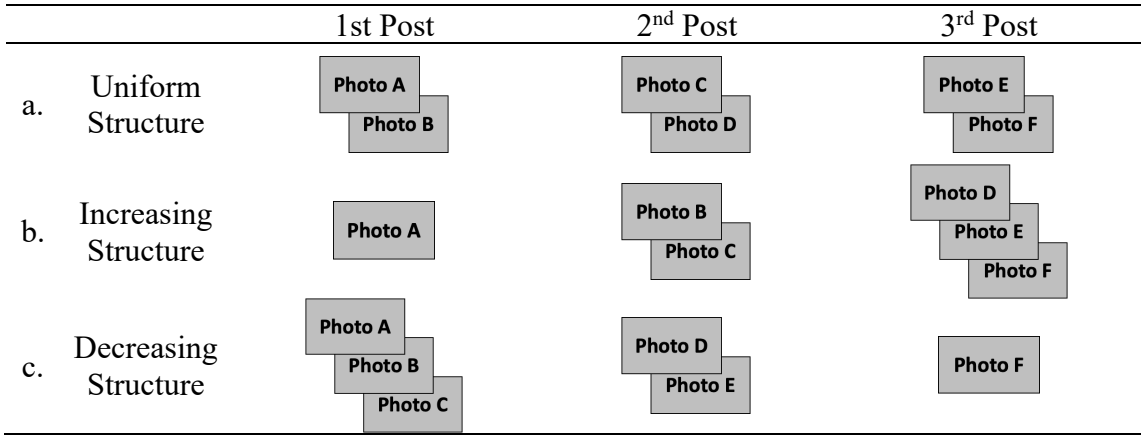
pre-existing structure like a museum's floor plan) or exogenously imposed (such as with a decision about how to structure multiple social media posts consisting of multiple images each). Critically, what a unit is, is in the eye of the consumer. That is, as we will demonstrate below, there are cases where a single unit of consumption includes several unique parts (e.g., a single social media post containing multiple photos) or where a single element is the unit itself (e.g., a single song in a playlist of songs). In all cases, it is what consumers perceive that defines the delineation between units, but this delineation can also be manipulated as with the previously mentioned exogenously imposed divides between consumption instances. To illustrate multi-unit consumption with multiple parts to a single unit, consider a social media platform such as Instagram, which allows its users to display multiple images on a single post. On the other side of this user generated content, viewers typically scroll through many posts during a single viewing session (Alhabash and Ma, 2017) and are thus exposed to many images, all grouped into discrete units (the posts themselves). For situations where a single element of consumption is the unit itself, consider music streaming services such as Spotify that allow users to listen to music in a dynamically created playlist. Here, each song is a unit, in large part because the songs are of relatively long duration (i.e., multiple minutes each) and because that is how users perceive them (again, see the Pretest to Study 4 for evidence of this). What is critical in all of these cases is that multi-unit consumption can vary as a function of the structure that is either naturally present or that is imposed on it. It is this variation that we consider here.

Specifically, in this work, we consider three ways in which those groups can be structured: uniform, increasing, and decreasing. To illustrate, let us return to the Instagram example from above. Consider a user who has six photographs that they wish to post across three separate posts. Under a uniform structure (Figure 1.a), they could create three posts of two

photos each. On the other hand, they could decide to post one photograph in the first post, two in the second, and three in the third. This would constitute an increasing structure (Figure 1.b). More formally, we define an increasing structure as any in which successive units of consumption increase in the number of items they include. Finally, they could decide to post three photographs in the first post, two in the second, and one in the third. This would constitute a decreasing structure (Figure 1.c). More formally, we define a decreasing structure as any in which successive units of consumption decrease in the number of items they include.

FIGURE 1

EXAMPLES OF (a) UNIFORM, (b) INCREASING, AND (c) DECREASING CONSUMPTION STRUCTURES OF PHOTOGRAPHS



On the surface, if we assume that the order of the photographs themselves is invariant across the three structures described, these differences may seem immaterial. After all, viewers of these posts view them in the same sequence, making the consumption sequence of the photographs themselves identical across these variants. Thus, neither improving versus declining sequences (Loewenstein and Prelec, 1991) nor the peak-end effect (Kahneman et al., 1993) will predict different degrees of hedonic decline across increasing and decreasing consumption

structures. Also, the total number of interruptions are identical across increasing and decreasing structures, thus interruptions, a factor that mitigates hedonic decline (Nelson and Meyvis, 2008), cannot account for the difference between the two consumption structures. On the other hand, as will become evident below, it is our prediction that these three structures will significantly alter the way in which hedonic decline unfolds because of changes in perceptions of subjective quantity across them.

Before exploring this prediction more intently, it is worth mentioning that varying consumption quantities across multiple units need not follow just one of the three consumption structures presented above. Consumption quantity of each unit may fluctuate randomly without a specific pattern or could oscillate (i.e., increasing, then decreasing, then increasing, and so on). However, the present paper focuses primarily on increasing and decreasing consumption structures for two reasons. First, to the best of our knowledge, despite the obvious presence of such consumption structures in real world consumption settings, no previous work has examined their role in the context of consumption enjoyment and hedonic decline. Second, and perhaps more importantly, other complex consumption structures such as oscillating structures can typically be decomposed into uniform, increasing, and decreasing consumption structures, suggesting that the understanding of these two fundamental structures is likely to provide a basis for understanding other, more complex, structures in the future. Thus, though the present work may not address all questions related to varying consumption quantities under multi-unit consumption, it serves to provide meaningful insights into understanding the dynamics of multi-unit consumption more generally. Additionally, it is possible that consumers stop consumption in the middle of increasing or decreasing consumption structures. Although such decision-making is an important topic in repeated consumption (O'Brien, 2021), the current work largely focuses

on situations where the consumption of an entire consumption structure is completed (though see Study 4for an exception to this), whether it is an increasing structure or a decreasing structure.

So how, then, do increasing and decreasing consumption structures affect subjective quantity and hedonic decline? To better understand this process, we turn to the literature on reference point formation. A growing body of work has argued that reference points may change depending on attributes that are accessible to a decision maker (Bhatia and Golman, 2019; Bordalo, Gennaioli, and Shleifer, 2013; Kıbrıs, Masatlioglu, and Suleymanov, 2021; Pachur et al., 2018). In prior studies on subjective quantity and hedonic decline, researchers presented external quantity cues (Raghubir and Krishna, 1999; Redden and Galak, 2013; Sackett et al., 2010), and such cues acted as reference points against which individuals would compare their consumption experience. When such interventions are absent, however, what reference point do people draw upon? Relevant to the present work, previous research on reference-dependence has shown that in the absence of an obvious external reference point, consumers tend to use recently encountered stimuli to form their initial reference point (Arkes et al., 2008; Boyle, Bishop, and Welsh, 1985; Huber, Viscusi, and Bell, 2008). A series of studies on biding iterations found that the final bids became higher when the randomly assigned starting bids were high (e.g., $120) than when they were low (e.g., $0; Boyle et al., 1985). Therefore, in an absence of a natural external reference to inform participants of the value of an entity, they anchor on a previous value that they encounter. For this work, we apply the same logic to multi-unit consumption: consumers are likely to refer to a preceding unit of consumption to form a reference quantity and update their reference quantity based on successive units.

Increasing consumption structures begin with a unit with a small quantity, followed by units that become progressively larger. Conversely, decreasing consumption structures begin

with a unit with a large quantity, followed by units that become progressively smaller. Therefore, consumers are likely to form a relatively low reference quantity at the beginning of an increasing consumption structure and adjust it upward as they advance to subsequent units. The opposite pattern is likely to be observed under decreasing consumption structures: reference quantity will be high at the first unit, but it will drop as consumers progress to subsequent units. To articulate, again returning to the Instagram example above, Instagram users under the increasing consumption structure first view posts with 1 picture and then posts with 2 pictures (Figure 1.b). They thus see more pictures in the second post than the first post. On the other hand, under the decreasing consumption structure, they view posts with 3 pictures before posts with 2 pictures (Figure 1.c). Zooming in to the second consumption unit (with 2 pictures) in both situations, under the increasing consumption structure, the quantity consumed (2 pictures) is compared against a small reference quantity (a single picture), whereas under the decreasing consumption structure, the quantity consumed (again, 2 pictures) is compared to a relatively large reference quantity (three pictures). This difference in reference quantities is thus likely to shift subjective quantity, such that subjective quantity of the 2-picture post will become relatively large under the increasing consumption structure but relatively small under the decreasing consumption structure. This dynamic then continues across subsequent units. As a result, even though the total number of pictures is identical across the two consumption structures, those under the decreasing consumption structure will feel as if they viewed fewer photographs than those under the increasing consumption structure.

Although we illustrate the difference between the two consumption structures using a specific example, this dynamic is likely to apply to other circumstances where multi-unit consumption is structured in either increasing or decreasing structures. That is, having multi-unit

consumption in decreasing consumption structures is likely to reduce subjective quantity as compared to having it in increasing consumption structures. Consistent with prior work (Redden and Galak, 2013), this reduced subjective quantity under the decreasing consumption structure will then mitigate hedonic decline. More formally:

H1: Experiencing consumption in a decreasing consumption structure will reduce hedonic decline as compared to experiencing consumption in an increasing consumption structure, holding the total consumption quantity constant.

H2: The lower level of hedonic decline experienced under a decreasing consumption structure versus an increasing consumption structure is mediated by a lower level of subjective quantity consumed.

These hypotheses are predicated on the notion that consumers use preceding consumption units to create a reference point against which to evaluate their current level of consumption quantity. However, much like with the disruption of internal reference cues in other types of judgment formation, cues external to the immediate circumstances are likely to mitigate this effect (Eyring and Narayanan, 2018; Olsen, 2017). In this case, an external cue would be an indication of what a typical consumption amount is in the given setting. Much like with the previous example of consuming 10 M&M's candies, consumers do not typically instinctively have a good sense of whether 10 candies is a lot or a little, but when they are provided with an external reference to which they can compare their consumption, they are then able to form a reasonable judgment. In the same way, if an Instagram user is told that they should expect to

view two photographs per post, on average, in the example provided above, we would predict that the influence of a proceeding unit of consumption on subsequent assessments of consumption quantity will be mitigated. Formally:

H3: Providing an external reference about consumption quantity will attenuate the structure effect on hedonic decline (H1).

To summarize, we predict that organizing multi-unit consumption into decreasing consumption structures will slow down hedonic decline as compared to organizing it into increasing consumption structures. This effect, however, will be less pronounced when there is an external quantity cue. We tested these predictions across five experiments and one large-scale archival study.

STUDY OVERVIEW

Five experiments and one large-scale archival study were conducted to test the key predictions detailed above. Studies 1A and 1B provide initial evidence of the basic effect and test downstream consequences, namely choice of re-consumption and intent to re-consume (Galak et al., 2009; Garbinsky, Morewedge, and Shiv, 2014). According to our prediction, participants should be more willing to view additional stimuli when prior stimuli are organized in decreasing structures than increasing structures, as hedonic decline is attenuated in the former. Studies 2A and 2B not only directly measure the degree of hedonic decline for the varying consumption structures, but also demonstrate that subjective quantity, in part, mediates the relationship

between consumption structure and hedonic decline. Study 3 shows that providing an external reference about consumption quantity per unit narrows the gap in hedonic decline between decreasing structures and increasing structures. This result is in line with the notion that people derive reference quantities based on an external cue if one is available (Eyring and Narayanan, 2018; Olsen, 2017). Consequently, with such an external reference, consumers rely less on their initial and previous consumption when they form a reference quantity and, in turn, the structure effect on hedonic decline is mitigated. Finally, Study 4 tested the proposed structure effect on hedonic decline with a large-scale dataset from a music streaming platform, Spotify. This large-scale archival study demonstrates that decreasing structures attenuates hedonic decline relative to increasing structures with real world consumption behavior.

In each study, we report all measures, manipulations, and exclusions. Sample sizes were determined before data collection based on research budgets, and data collection was terminated when pre-determined sample sizes were met. Since we had no reasonable prior for the size of the proposed structure effect, a power analysis was not feasible for sample size estimations. Therefore, we set sample sizes as large as possible within our research budgets to maximize the statistical power of each study. Critically, no statistical analyses were conducted during data collection, and no participants were excluded from the final analyses.

STUDIES 1A AND 1B

Studies 1A and 1B serve as initial demonstrations of our core prediction: that increasing versus decreasing consumption structures meaningfully influence enjoyment. They accomplish this by observing downstream consequences of the influence that consumption structure has on

hedonic decline, namely re-consumption. We look to re-consumption because consumers are less likely to re-consume the same or similar stimuli that they previously consumed when they experience greater hedonic decline (Galak et al., 2009; Garbinsky, Morewedge, and Shiv, 2014). We thus assign participants to either an increasing structure or a decreasing structure and observe whether the consumption structure changes their intent to re-consume (Study 1A) and choice of re-consumption (Study 1B). Specifically, for both studies, we predict that desire and choice of re-consumption will be lower following an increasing consumption structure relative to a decreasing consumption structure. Therefore, though these studies do not directly measure enjoyment, they test the core prediction of the present paper (H1) by examining downstream consequences that are strongly correlated with hedonic decline. Of note, as with all studies in this paper, the total amount of consumption and the total number of interruptions (or breaks) across conditions remains fixed. Only the *structure* of varying consumption quantities differ in each condition.

Methods

Participants. Participants were recruited from Amazon Mechanical Turk in exchange for monetary compensation ($N_{\text{Study-1A}}$ = 151, 54% Female, M_{age} = 40.08; $N_{\text{Study-1B}}$ = 403, 64% Female, M_{age} = 39.54).

Procedures. Studies 1A and 1B shared the same experimental paradigms, except for the dependent measurements. To increase the realism of the stimuli, Instagram posts were used. On that social media platform, users routinely post photographs that range from pictures of the meal they are eating, the friends they are interacting with, to the pets that they play with. In this case, we chose to present images of cats as they are readily available to us, are often seen on

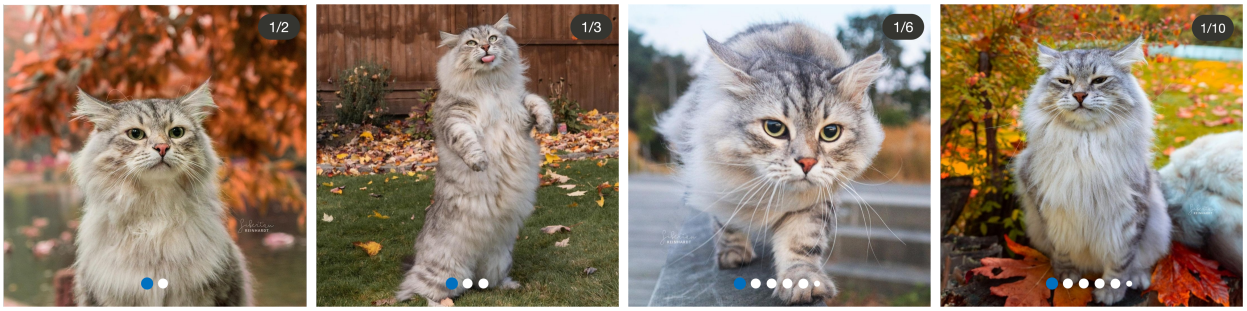
Instagram, and provide enough variability to allow for multiple exposures without seeming overly repetitive. As in the social media platform, the photographs were grouped into separate posts, and, in each post, the number of images per post and the order of the current image were indicated on the top right corner of each image (e.g., 1/6, 2/6, 3/6, etc.). Also, white and blue dots at the center bottom of each image were included to indicate the relative position of the present image. For instance, out of three white dots, one on the right was colored blue for the first image, while one in the center became blue upon displaying the second image (Figure 2). Finally, to control for exposure time per image, each cat image appeared for 4 seconds and automatically advanced (by "sliding out to the left") to the next image, followed by the next photograph that slid in from right. After all pictures of a post were presented, the post advanced to the next post by "sliding" upward, and the next post slid in from the bottom. Those horizontal and vertical movements of photos and posts, respectively, followed the actual user interface of Instagram and highlighted intra-post and inter-post changes, respectively.

To facilitate the key manipulation, participants viewed four posts consisting of a specific number of photographs. In the increasing structure condition, the posts contained, 2, 3, 6, and 10 images each, respectively. In the decreasing structure condition, the posts contained, 10, 6, 3, and 2 images each, respectively. In this way, the total number of photos was identical for all participants, but the sequencing varied by condition. Participants were randomly assigned to view these posts in either of these two structures. Following viewing all four posts, participants indicated their intention to "view other posts" from the same Instagram account on a 7-point scale (1 = Not at all, 7 = Very much; Study 1A) or whether they wanted to view other posts from the same Instagram account as a binary choice (Yes vs. No; Study 1B).

Finally, on a subsequent screen, participants answered some basic demographic questions and were thanked for their participation. Additionally, participants indicated whether they currently owned or had owned a cat. This item was added to rule out the possibility that differences in re-consumption between the two consumption structure conditions arose from difference in general preference for cats. There was no significant difference in cat ownership across the conditions ($p > .10$) and, as such, this variable will not be discussed further.

FIGURE 2

EXAMPLES OF INSTAGRAM POSTS (STUDIES 1A AND 1B)



NOTE.—At the right top of each post, the order of the current photo within a post and the total number of photographs for the post was displayed. Participants in the increasing structure condition viewed the post with 2 photos first, one with 3 photos second, one with 6 photos third, and one with 10 photos fourth. By contrast, participants in the decreasing structure condition viewed the four posts in the opposite order (i.e., 10 photos – 6 photos – 3 photos – 2 photos).

Results and Discussions

The consumption structure manipulation had a significant effect on re-consumption. Specifically, those in the decreasing structure condition reported higher intent to watch other posts from the same Instagram account ($M_{decreasing} = 4.11$, $SD_{decreasing} = 2.10$) than those in the increasing structure condition ($M_{increasing} = 3.09$, $SD_{decreasing} = 1.94$, $t = -3.09$, $p = .002$; Study 1A). Study 1B replicated the finding that the choice of re-consumption was higher in the decreasing

structure condition (32%) than the increasing structure condition (24%), though the effect was only marginally significant ($\chi^2 = 2.87$, $p = .090$).

Although enjoyment was not directly measured in Studies 1A and 1B, confirming H1, inclination to re-consume additional Instagram posts in the decreasing structure conditions suggest that participants experienced less hedonic decline under the decreasing structure than the increasing structure (Galak et al., 2009; Garbinsky et al., 2014).

STUDIES 2A AND 2B

Studies 2A and 2B have three primary goals. First, by measuring enjoyment rather than behavior, Studies 2A and 2B provide more direct evidence of the influence of consumption structures on hedonic decline. Second, Studies 2A and 2B allow us to rule out an alternative account that peak-end effects or improving versus declining sequences could explain the results of Studies 1A and 1B. As described in Studies 1A and 1B, participants in the decreasing structure conditions were exposed to the Instagram posts in reverse order relative to those in the increasing structure conditions. It is thus possible that the difference between the two conditions is driven by this reverse order rather than by changes in the structure of varying consumption quantities. In the present study, this is not the case as the order of stimuli are randomized. Of note, in Study 3, we further rule out this alternative by having participants repeat consumption of the same stimulus and, in turn, fixing the objective quality of stimuli throughout a multi-unit consumption experience. Finally, Studies 2A and 2B investigate the relationship between hedonic decline and subjective quantity by directly measuring subjective quantity and testing its mediating effect on hedonic decline.

Methods

Participants. Seven hundred and ninety-seven participants were recruited from Amazon Mechanical Turk for the two experiments. Studies 2A and 2B aimed to recruit two hundred participants per condition, and the total sample sizes almost met the target of eight hundred participants in total ($N_{\text{Study-3A}}$ = 400, 59% Female, M_{age} = 32.93; $N_{\text{Study-3B}}$ = 397, 54% Female, M_{age} = 33.85).

Procedures. Photo slideshows were used as stimuli in Studies 2A and 2B, and each slideshow consisted of four beach photographs that were randomly drawn from ninety-six beach pictures. These beach pictures were rated positively in a prior study where participants viewed a 4-photo slideshow randomly drawn from the same pool of beach pictures and indicated their enjoyment on a 101-point scale (0 = Very little, 100 = Very much; N = 2,968, M = 76.94, SD = 24.46; stimuli drawn from Galak et al., 2022).

Both experiments were divided into four parts: a pre-trial session, a filler task, a main session, and demographic questions. In the pre-trial session, participants viewed a photo slideshow and indicated how much they currently enjoyed watching the slideshow in a 101-point scale (0 = Very little, 100 = Very much). This pre-trial enjoyment rating served as the baseline enjoyment rating. Additionally, participants were then asked to indicate their subjective assessment of how many photographs they just viewed (a 101-point scale; 0 = a little, 100 = a lot; Redden and Galak, 2013). Participants then completed a filler task in which they watched a one-and-a-half-minute television commercial (Jeep's Superbowl ad) and responded to questions regarding the advertisement. The purpose of this filler task was to temporally separate the pre-trial session from the main session.

After the filler task, participants were informed that they would view photo slideshows split into units of varying quantities. Participants were informed of the total number of units, yet they were not told how many photo slideshows would be displayed per unit or in total. We did not reveal the total number of repetitions as participants might infer their consumption quantity per unit based on that information and, in turn, form a reference quantity in advance. However, at the beginning of every unit, participants were informed how many photo slideshows would be presented in that particular unit. After all slideshows of each unit were displayed, participants indicated their enjoyment and subjective quantity on the same scales used in the pre-trial session.

In the main session, participants were randomly assigned to either an increasing structure or a decreasing structure. In the increasing structure conditions, the units were structured in a way such that subsequent units had more photos than previous unit. In the decreasing structure conditions, the opposite was true. In Study 2A, participants in the increasing structure condition viewed 1, 4, 7, and 11 slideshows, respectively, in each unit, whereas participants in the decreasing structure condition viewed 11, 7, 4, and 1 slideshow, in each unit. In Study 2B, participants in the increasing structure condition viewed 1 and 6 slideshows, respectively, in each unit, whereas participants in the decreasing structure condition viewed 6 and 1 slideshow, in each unit. It is noteworthy that Study 2B only consisted of two units, thus further testing the generalizability of our result to a situation where multi-unit consumption has, by definition, the fewest possible units to still be "multi"-unit.

To compute the degree of hedonic decline, the difference between the final enjoyment rating (i.e., the enjoyment rating of the fourth unit in Study 2A and the second unit in Study 2B) and the baseline enjoyment rating (i.e., the enjoyment rating of the pre-trial session) was used. Enjoyment ratings of the other units were ignored due to the fact that those units are

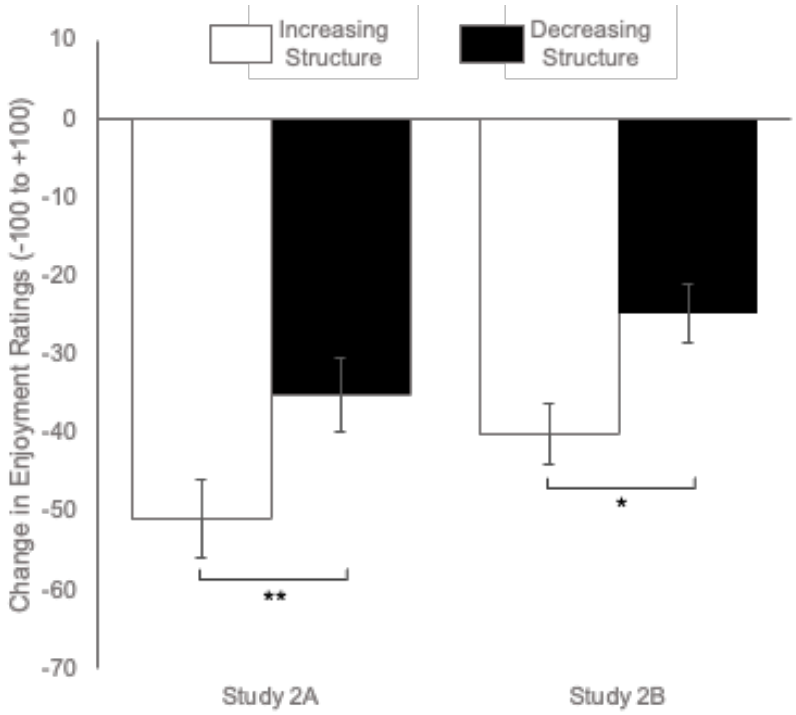
incomparable as the cumulative consumption quantity was different across them. For example, in the second unit of Study 2A, the cumulative consumption quantity was five repetitions (1 + 4) in the increasing structure condition, but it was eighteen repetitions (11 + 7) in the decreasing structure condition. Comparing those blocks directly would obviously result in very different ratings of enjoyment, since hedonic decline is likely to be much greater in the latter case. Therefore, the degree of hedonic decline was only calculated based on the difference between the pre-trial enjoyment rating and the final enjoyment rating since at the final enjoyment rating, both the cumulative consumption quantity and the number of units were identical across increasing and decreasing structure conditions. Finally, participants answered some basic demographic questions and were thanked for their participation.

Results and Discussions

As explained earlier, the degree of hedonic decline was calculated by comparing the enjoyment ratings of the pre-trial session and the final unit of the main trial session. As predicted, the degree of hedonic decline was significantly smaller under the decreasing structures than the increasing structures in Studies 2A ($M_{decreasing}$ = -40.14, $SD_{decreasing}$ = 33.75, $M_{increasing}$ = -50.85, $SD_{increasing}$ = 35.49, t = 3.09, p = .002) and 2B ($M_{decreasing}$ = -26.89, $SD_{decreasing}$ = 27.35, $M_{increasing}$ = -34.07, $SD_{increasing}$ = 28.72, t = 2.55, p = .011; Figure 3; see Appendix A for the means of the baseline and final enjoyment ratings). Put simply, Studies 2A and 2B demonstrate that consumers experience hedonic decline more slowly under decreasing structures relative to increasing structures.

FIGURE 3

CHANGE IN ENJOYMENT RATING BETWEEN THE PRE-TRIAL SESSION AND THE FINAL ENJOYMENT MEASURE (STUDIES 2A AND 2B; -100 TO +100)



NOTE.—Error bars represent 95% confidence intervals (**: $p < .01$; *: $p < .05$; †: $p < .10$).

More importantly, those in the decreasing structure conditions felt that they consumed less than those in the increasing structure conditions, even for blocks with the same numbers of photo slideshows. That is, the subjective assessment of the same consumption quantities became smaller under the decreasing structures than the increasing structures (Table 1). For example, in Study 2B, the average subjective quantity of seeing six slideshows was 76.65 points out of the 101-point scale in the increasing structure condition, but it was 56.75 points in the decreasing sequence condition ($t = 5.95$, $p < .001$). This tendency to overstate subjective quantities under the increasing structures emerged in five of the six units (across both studies), even though there was no significant difference in the subjective quantities in the pre-trial sessions (Table 1), suggesting that the disparity in the subjective quantities arose from the consumption structure manipulations

and not a difference in baseline tendencies to evaluate subjective consumption quantities. Moreover, the aggregate subjective quantity of all units was also smaller in the decreasing structure conditions than the increasing structure conditions in Studies 2A ($M_{decreasing}$ = 226.18, $SD_{decreasing}$ = 93.22, $M_{increasing}$ = 263.79, $SD_{increasing}$ = 74.39, t = 4.46, p = .001) and 2B ($M_{decreasing}$ = 86.98, $SD_{decreasing}$ = 47.46, $M_{increasing}$ = 105.16, $SD_{increasing}$ = 42.15, t = 4.04, p = .001). Taken together, the results displayed in Table 1 provide initial support for H2, that decreasing structures reduce subjective quantity relative to increasing structures.

TABLE 1

SUBJECTIVE QUANTITY OF PHOTO SLIDESHOW (101-POINT SCALE, 0 = A LITTLE, 100 = A LOT)

Number of Stimuli	Study 2A				Study 2B			
	Increasing Structure (N = 199)	Decreasing Structure (N = 201)	t	p	Increasing Structure (N = 199)	Decreasing Structure (N = 198)	t	p
1 (Pre-trial)	37.58 (30.87)	33.70 (29.13)	1.29	.197	28.67 (27.34)	32.67 (29.74)	-1.39	.164
1	37.17 (30.03)	28.91 (30.93)	2.71	.007	30.51 (27.04)	30.23 (28.43)	0.10	.920
4	66.04 (26.87)	56.23 (31.34)	3.36	.001				
6					74.65 (28.06)	56.75 (31.72)	5.95	< .001
7	78.59 (26.46)	70.74 (30.17)	2.77	.006				
10	82.00 (29.06)	70.30 (33.44)	3.74	< .001				

NOTE.—Standard deviations are in parentheses. The order of the units is re-arranged that units containing the same number of stimuli are placed next to each other.

Finally, to assess the role that subjective consumption quantity plays in determining the degree of hedonic decline, we conducted mediation analyses that had the consumption structure manipulation as the independent variable (0 = increasing structure, 1 = decreasing structure), the

aggregate subjective quantity of all blocks as the mediator, and the degree of hedonic decline as the dependent variable. Of note, the aggregate subjective quantity was used as the mediator since this aggregate value reflects cumulative differences in subjective quantities between the increasing versus decreasing structures during the main session, which corresponds to the dependent variable (i.e., the change in enjoyment ratings between before and after the main session). Consistent with the key prediction (H2), decreasing structures reduced the aggregate subjective quantity, and the reduced subjective quantity mitigated hedonic decline. To be specific, the indirect effect of the subjective quantity was significant in Study 2B (b = -0.85, 95% CI [-2.37, -0.45]) and marginally significant in Study 2A (b = -1.39, 95% CI [-3.13, 0.08]). Moreover, both indirect effects were directionally consistent with the prediction that decreasing structures reduced subjective quantity and, in turn, decelerated hedonic decline (H2).

In sum, Studies 2A and 2B directly measured enjoyment and subjective quantity and demonstrated that decreasing structures reduced hedonic decline relative to increasing structures. Further these studies show that subjective quantity mediated the effect of decreasing structures on hedonic decline.

STUDY 3

Although Studies 2A and 2B revealed the link between subjective quantity and hedonic decline, the evidence provided by those studies is correlational in nature. As such, the present study manipulates subjective quantity directly by providing an external cue about consumption quantity. If, as we claim, consumption structure results in changes to hedonic decline via a change in subjective quantity, then manipulating subjective quantity directly should lend strong support to this idea. An external reference, rather than one derived from previous units of

consumption, aims to do just that. As such, in Study 3, half of the participants are informed of the average consumption quantity per unit in advance of any consumption structure manipulation in order to create an external reference point related to quantity. We predict (H3) that this manipulation should attenuate the difference between increasing and decreasing structures because consumers would have similar, fixed, reference quantities to judge their consumption against, thus reducing the influence of consumption structure on hedonic decline.

Study 3 also tests the generalizability of the core effect by using a novel stimulus, music. Finally, Study 3 aims to understand if repetition of identical stimuli yields similar results to those observed in the previous studies, where stimuli were similar, but not identical across units. Additionally, consuming a single stimulus throughout the experiment allows us to further rule out an alternative account that peak-end effects or improving versus declining sequences could explain the results of Studies 1A and 1B. Specifically, because the stimuli themselves are identical in all instances, there neither a particularly positive ending stimulus nor an increase in the objective quality of stimuli could explain the predicted results.

Methods

Participants. Four hundred and eight participants were recruited from Amazon Mechanical Turk in exchange for monetary compensation (60% Female, M_{age} = 36.46). The experiment was a 2 (consumption structure: increasing vs. decreasing) by 2 (presence of an external cue: no-cue vs. external-cue) between-subjects design.

Procedures. Study 3 followed an experimental paradigm similar to that of Studies 2A and 2B, but it differed in two ways: 1) rather than viewing photographs, participants listen to music clips, and 2) in addition to the consumption structure, an external quantity cue was

provided to some participants. The study consisted of four parts as in Studies 2A and 2B: a pre-trial session, a filler task, a main session, and demographic questions. During the pre-trial session, all participants selected a favorite song out of fifteen songs from four different genres: classical music, rock, pop, and country. This allowed participants to select a song that was well liked. They then listened to the 30-second chorus of the chosen song and indicated how much they currently enjoyed the song on a 101-point scale (0 = Very little, 100 = Very much). This pre-trial enjoyment rating served as a baseline enjoyment rating. A filler task involving the viewing of unrelated photographs was inserted between the pre-trial session and the following main session to temporally separate the two.

In the main portion of the study, participants were first informed of the total number of units in the experiment. However, participants were unaware of how many times the chosen song would be played. We did not reveal the total number of repetitions as participants might infer their consumption quantity per unit based on that information and, in turn, form a reference quantity in advance. Next, all participants listened to the chorus of their chosen song fifteen times across five units. In each unit, a cover page that displays the unit number (e.g., Block 1) appeared, and the chosen song was played a specific number of times, depending on condition. Participants then responded to the same enjoyment measure used in the pre-trial session after each unit concluded. Following the enjoyment measure, participants advanced to the next unit and repeated the same processes until all five units were concluded. The number of repetitions per unit varied depending on the consumption structure conditions. In the increasing structure condition, the first unit consisted of one song, with the number of songs increasing by one in each subsequent unit (1 song – 2 songs – 3 songs – 4 songs – 5 songs). In the decreasing structure condition, the first unit consisted of five songs, with the number of songs decreasing by

one in each subsequent unit (5 songs – 4 songs – 3 songs – 2 songs – 1 song). In sum, regardless of the consumption structures, participants listened to the chosen song fifteen times, but the structure of varying consumption quantities differed across the two conditions. Finally, participants answered some basic demographic questions and were thanked for their participation.

More crucially, orthogonal to the structure condition, about half of the participants were randomly assigned to an external-cue condition where an external cue about consumption quantity was provided prior to the start of the main experience. The other half were assigned to a no-cue condition. As in Studies 2A and 2B, those in the no-cue conditions did not receive any information about consumption quantity, and they were only informed of the number of units. By contrast, those in the external-cue conditions were also (truthfully) informed that the average number of repetitions in each unit would be three. Specifically, prior to the first unit in the main session of the study, they were told that "on average you will listen to the song THREE times in each block." As such, participants in the external-cue conditions could use this externally provided reference to contrast their consumption amount against, rather than solely relying on the consumption quantity of a previously consumed unit. We predict that participants should thus experience a smaller difference in hedonic decline across consumption structures when the external cue is present (H3).

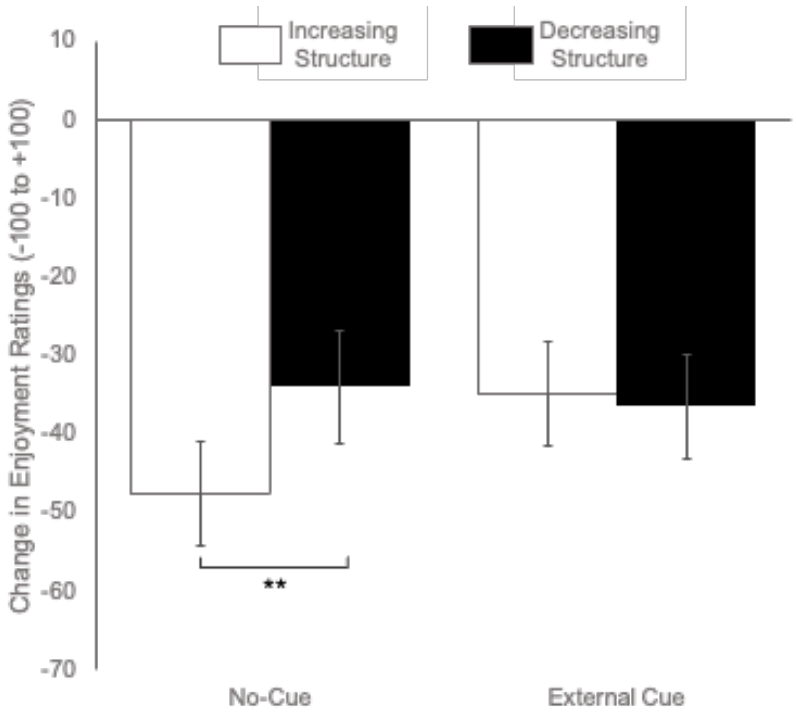
Results and Discussions

As in Studies 2A and 2B, the degree of hedonic decline was calculated by comparing the enjoyment ratings of the pre-trial session and the final block of the main session. We submitted this change in hedonic decline to a 2 (consumption structure: increasing vs. decreasing) by 2

(presence of an external cue: no-cue vs. external-cue) ANOVA and observed the predicted 2-way interaction ($F(1, 404) = 4.86$, $p = .028$). Unpacking this result, and as can be seen in Figure 4, in the no-cue condition, replicating the results of the previous studies, hedonic decline was greater in the increasing structure condition ($M_{increasing} = -47.67$, $SD_{increasing} = 34.69$) as compared to the decreasing structure condition ($M_{decreasing} = -34.92$, $SD_{decreasing} = 36.34$; $F(1, 404) = 6.72$, $p = .010$). However, unlike the previous studies but consistent with H3, when participants were presented with an external cue, there was no difference in the degree of hedonic decline between the increasing ($M_{increasing} = -33.98$, $SD_{increasing} = 34.10$) and decreasing structure conditions ($M_{decreasing} = -36.56$, $SD_{decreasing} = 35.02$; $F(1, 404) = 0.27$, $p = .601$; see Appendix A for the means of the baseline and final enjoyment ratings).

FIGURE 4

CHANGE IN ENJOYMENT RATING BETWEEN THE PRE-TRIAL SESSION AND THE FINAL ENJOYMENT MEASURE (STUDY 3; -100 TO +100)



NOTE.—Error bars represent 95% confidence intervals (**: $p < .01$; *: $p < .05$; †: $p < .10$).

In sum, Study 3 demonstrated that a decreasing structure reduces hedonic decline relative to an increasing structure with a novel stimulus, music, and, more importantly, this effect dissipated when an external reference quantity is provided, consistent with H3. The moderation effect lends stronger support to our theory that decreasing structures mitigate hedonic decline relative to increasing structures by changing reference quantities and, in turn, beliefs in subjective quantity consumed.

STUDY 4

As useful as controlled lab-based experiments are in demonstrating the existence and underlying psychological underpinnings of how consumers hedonic response to multi-unit consumption unfolds, they do have their limitations. Most notably, there is an ever-present

concern that findings from the lab fail to generalize to behavior outside laboratory (Anderson, Lindsay, and Bushman, 1999; Mitchell, 2012). To that end, the primary purpose of the present study is to demonstrate that increasing versus decreasing consumption structures influence hedonic decline in a naturalistic context, unincumbered with the limitations of lab research. Specifically, the present study examines actual behavior of users of the Spotify music streaming platform (Brost, Mehrotra, and Jehan, 2019) to understand if consumption structure influences how they experience hedonic decline in this "real-world" situation. Across nearly 2.3 million listening sessions, this study investigates whether an increasing or a decreasing consumption structure changes the rate of hedonic decline in the real-world music consumption. As with most archival analyses, the results of this study are correlational in nature. However, taken together with the causal results from the previous five experiments, this study provides strong evidence to the generalizability of our observed effect.

One challenge in turning to non-experimental data is that we are unable to directly measure hedonic decline, as we did in previous studies. Instead, we much construct a proxy for hedonic decline, and we do so in the behavioral choices that users of make. Specifically, within the span of a single listening session (detailed below), we observe when a user chooses to switch the playlist that they are listening to. On Spotify, users choose to listen to playlists that they themselves created, or, more typically, that are generated by Spotify based on a "seed" provided by a user (e.g., Techno songs, songs by the Beatles, etc.). Previous work has shown that when users experience significant hedonic decline within a single consumption setting (e.g., a playlist of songs), one option they take to ameliorate such decline is to simply opt out of continuation of that type of consumption (Ratner, Kahn, and Kahneman, 1999; Sevilla, Lu, and Kahn, 2019). It is this behavior that we observe and that we use as a proxy to identify hedonic decline. In other

words, we assume that one driver for users to switch playlists is the degree of hedonic decline that they are experiencing with the current playlist being listened to. And much like with our previous studies, we predict that this switching behavior, a proxy for hedonic decline, will be moderated by the increasing versus decreasing structure of the songs being listened to.

In this context, we classify increasing and decreasing consumption structures based on the temporal duration of successive songs. For instance, we may observe that a user was first exposed to a 3-minute-long song, followed by a 4-minute-long song. This would be analogous to the increasing consumption structure conditions of our previous experiments. In contrast, the same user might instead have been first exposed to a 4-minute-long song, followed by a 3-minute-long song. This would, instead, be analogous to the decreasing consumption structure conditions of our pervious experiments. More importantly, such consumption structures tend to be externally imposed on users, rather than being arranged by user themselves. Indeed, in our data, only 0.21% of listening sessions involve playlists that were manually constructed by users, with the remaining playlists generated by Spotify based on a "seed" provided by a user. That is, as mentioned above, users can select a category of music to listen to, but they typically are unable to select exactly which songs they will hear, and, critically, in what order they hear them (though there is a subtle distinction between "free" and "premium" users that we describe in the methods section below). Beyond this, we observe if users listen to a playlist on shuffle or not, allowing us to consider only cases where the order of songs is truly random. In sum, by identifying increasing and decreasing structures based on the difference in durations between songs and employing playlist switching as the dependent variable, we can make a clear prediction about users' behavior: in the case where users listen to songs in a decreasing consumption structure, *ceteris paribus*, they are less likely to change playlists, compared to when

listening in an increasing consumption structure. Put another way, users will experience less hedonic decline under a decreasing consumption structure compared to an increasing consumption structure, and this will manifest in a decrease in the tendency to change to the playlist being listened to.

Data

The data come from a publicly available dataset provided by Spotify (Brost et al., 2019). The original dataset contained roughly 130 million anonymized listening session from the period of July, 2018 through September, 2018. A listening session is defined, by Spotify, as songs played with no more than a 60-second inactivity gap between each song. To reduce the computational challenge of analyzing such an expansive dataset, we restricted our analyses to a sample of roughly 10% of the entire dataset[1]. In doing so, we restrict ourselves to 12,495,349 listening sessions. Of those listening sessions, 2,273,755 were included in our analyses based on the inclusion criteria detailed in the next section. Each listening session consists of between 10 and 20 songs (a designation made by Spotify). For each session, we observe, at the song level, a number of variables, but central to this analysis, we consider the position of the song within the session, the choice of a user to continue listening to a song or to skip it, whether the user is a free or premium Spotify member, whether the user is listening to the playlist on shuffle or not, whether the user chooses to switch playlists, and the duration of each song. Please see Brost, Mehrotra, and Jehan (2019) for a full list of variables available in this dataset. For our main

[1] The data were provided in 10 separate batches (with all batches including all days within the study window). We analyze the first batch in its entirety and, as a robustness check, randomly sample from the other batches. This random sampling yielded virtually identical results to what we present here, and so we omit any further discussion on this topic. Of note, the full dataset is made available to the public by Spotify.

analysis, we focus on song position within session, song duration, and playlist switching behavior.

Methods

We first operationalize what an increasing versus decreasing structure is in this context. However, unlike prior experiments where we exogenously impose delineation between consumption units, there is no such manipulation here. We thus need to identify how consumers construe a unit of consumption in the Spotify context. As described earlier, Spotify users listen to a playlist, or multiple playlists, consisting of individual songs, and it is uncertain whether they will view a playlist of songs as a unit of consumption, or a single song as a unit of consumption. To understand the perception of a consumption unit, we conducted a pretest exploring whether a unit of consumption is considered to be a playlist of songs or a single song in the Spotify context (N = 101). Critically, we asked participants to indicated what they believed a unit of consumption in this context would be (from -3 = much more like a playlist of songs to +3 = much more like a single song; the order of the two anchors was randomized). We found that participants tend to believe that a song is more likely to be considered a unit of consumption than an entire playlist ($M = 0.84$, $SD = 2.20$, one-sample t-test against $0 = 3.84$, $p < .001$). Unpacking this, 58% of participants considered a single song a consumption unit, but less than half of that (27%) considered a playlist of songs a consumption unit. Therefore, in this study, we operationalize an increasing versus decreasing structure based on duration per song and treat each song as a unit.

To articulate, an increasing structure is defined as a listening sequence in which the duration of all successive songs increases (e.g., Song 1: 3 minutes; Song 2: 4 minutes; Song 3: 5

minutes) and a decreasing structure is defined as a listening sequence in which the duration of all successive songs decreases (e.g., Song 1: 5 minutes; Song 2: 4 minutes; Song 3: 3 minutes). The minimum length for a sequence is two songs, with no maximum. We include sequences where songs 1) were all listened to in their entirety (i.e., no skips) and 2) where, within the sequence, no change of playlist occurred. For our main analysis, for each listening session, we identify the longest possible sequence before a consumption structure terminates. Once a sequence terminates, we consider the next song to be the "focal" song. If a user chooses to switch playlists for this focal song, we classify that as a "switch." If, instead, a user chooses to continue listening to the same playlist, we classify that as a "non-switch." Once a sequence is deemed to have concluded, all listening behavior after the focal song is discarded and not analyzed. No sequence begins mid-listening session to avoid any influence that preceding listening sequences may have on listening (and switching) behavior. We provide a few examples in Figure 5 to illustrate the most typically observed sequence types and how we categorize them. A summary of sequence length frequencies can be found in Table 2.

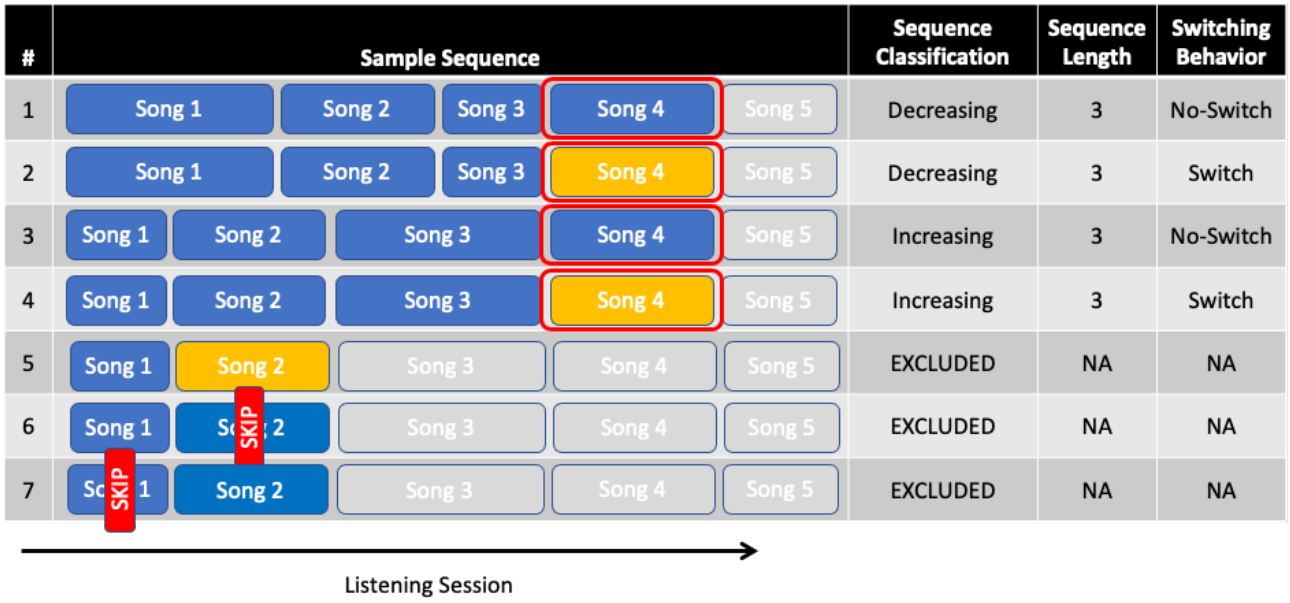
TABLE 2

FREQUENCY OF SEQUENCE LENGTHS PRIOR TO TERMINATION IN STUDY 4

Sequence Length Before a Consumption Structure Terminates	Overall Frequency	Frequency for Those Who Did Not Switch Playlists	Frequency for Those Who Did Switch Playlists
2	69.88%	69.69%	75.30%
3	23.03%	23.16%	19.42%
4	5.73%	5.78%	4.35%
5	1.15%	1.16%	0.79%
6	0.18%	0.18%	0.12%

FIGURE 5

SAMPLE SEQUENCES AND THEIR CORRESPONDING CLASSIFICATIONS IN STUDY 4



NOTE.—This figure presents a series of sample sequences and how they are classified in our analyses. The width of visual representation of a song reflects the song's duration. The color of a song (Blue vs. Orange) reflects songs from the same playlist. Gray songs represent songs that are not considered as they occur after the focal song is played. For instance, the first sequence has three songs that successively decrease in duration. The sequence terminates because the fourth song is longer than the third. As such, the fourth song is the focal song. In this example, we thus classify the sequence as being decreasing, of length three, and because the color has not changed, there is no switch in playlist (i.e., the user has continued to listen to the same playlist).

Given the operationalization outlined above, our final dataset consists of 2,273,755 listening sequences, with the proportion of increasing and decreasing structures within the qualified listening sequences being relatively balanced ($N_{\text{Increasing}}$ = 1,083,767 [47.66%] vs. $N_{\text{Decreasing}}$ = 1,189,988 [52.34%]). In addition to the session length, consumption structure, and choice to switch contexts, we also observe a series of session-level variables that we use to test for model robustness. The first of these is the total duration of all the songs listened to prior to the focal song. Though the length of the sequence is, as intuition would suggest, correlated with the total duration of the songs listened to ($r = .82$, $p < .001$), it may be the case that the total

duration of songs listened to prior to the focal song varies by consumption structure. Indeed, the total duration of songs listened to prior to the focal song is slightly longer for increasing structures (M = 516.84 seconds) than for decreasing structures (M = 490.30 seconds, t(2,256,500) = -115.97, p < .001). As such, we include this measure as a covariate to account for this difference.

The next two control measures define the nature of the experience that users have. Some users choose to listen to a playlist in the exact sequence that it is structured (e.g., song played from a single album in their original sequence) or on they can choose to shuffle the songs into a random sequence. This is important to our conceptualization since playlists that are not shuffled may be structured intentionally by their creators (or by Spotify) to influence the rate of hedonic decline. As such, if users (or Spotify) are aware that a decreasing structure might reduce hedonic decline, a non-shuffled playlist may endogenously be designed to have a decreasing consumption structure. Empirically, that is not the case as virtually exactly the same number of playlists are set to shuffle regardless of the consumption structure (Decreasing = 27.43%; Increasing = 27.54%; $\chi^2(1)$=3.34 , p=0.068). However, we still include this variable as a covariate (and interaction term) to ensure that none of our results are driven by an endogenous choice of how a playlist is structured. Finally, we also observe if a user pays for the Spotify Premium service (74.98%) or not (25.02%). This is relevant as premium users are able to select specific songs to listen to (rather than just playlists of songs) and are able to skip an unlimited number of songs, whereas free users are limited to only listening to playlists (without selecting specific songs) and have a limited number of opportunities to skip a song. For our conceptualization, if users can pick specific songs, then they may endogenously choose to structure their listening session to minimize hedonic decline, making the task of identifying the influence of consumption structure

of switching behavior difficult. Indeed, premium users are slightly more likely to listen to songs under a decreasing (75.4%) versus an increasing (74.5%; $\chi^2(1)$=215.84, $p < .001$) consumption structure. As such, we include this variable (and interaction term) as a covariate in our analyses. Additionally, for robustness, we separately consider only those users who listen to their playlists on shuffle and who are "free" users. These users have no control over the consumption structure of their listening session, and so endogeneity concerns are minimized.

Results

Our primary interest is in the likelihood that a user chooses to switch playlists following a sequence of songs listened to in an increasing or decreasing consumption structure. To provide an intuition for the results, we first conduct a series of separate simple logistic regressions predicting switching behavior as a function of consumption structure (decreasing structures and increasing structures coded as 0 and 1, respectively) for each level of sequence length. We present the results in Table 3, but, to summarize, in all cases except for sequences of length six (which represented a very small sample size), we observe a statistically significant difference in switching rates between increasing and decreasing consumption structures. Specifically, in almost all cases, when users listen to music under an increasing consumption structure, the likelihood that they will switch to a new playlist is greater than if they listen to music under a decreasing consumption structure.

TABLE 3

SWITCHING TENDENCY AS A FUNCTION OF SEQUENCE LENGTHS AND CONSUMPTION STRUCTURE IN STUDY 4

Sequence Length Before a Consumption Structure Terminates	*N*	% Switching in Decreasing Structure	% Switching in Increasing Structure	Logistic Regression Results
2	1,588,912	3.4%	3.9%	0.13 (0.01), OR = 1.15***
3	523,717	2.6%	3.1%	0.17 (0.02), OR = 1.19***
4	130,360	2.3%	2.8%	0.19 (0.04), OR = 1.21***
5	26,070	2.1%	2.6%	0.20 (0.08), OR = 1.22*
6	4,008	2.0%	2.8%	0.32 (0.21), OR = 1.38
All	2,273,755	3.1%	3.6%	0.15 (0.01), OR = 1.16***

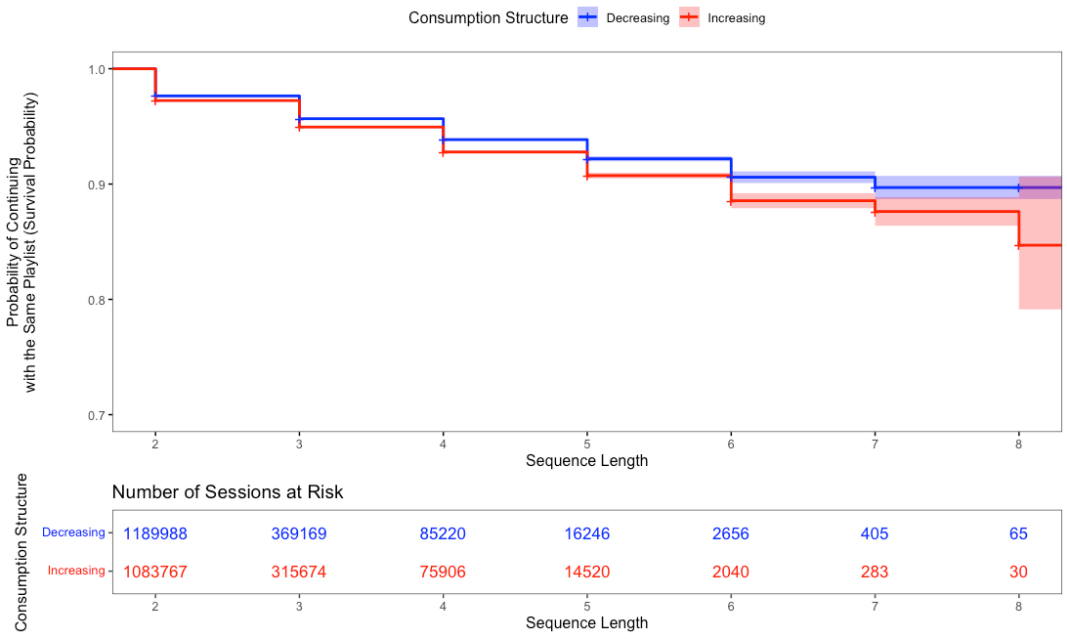
NOTE.— Values in cells for Logistic Regression Results represent results of separate models testing switching tendency as a function of consumption structure (decreasing structures and increasing structures coded as 0 and 1, respectively). Values represent model Bs and their corresponding SE as well as Odds Ratios. ***: $p < .001$; **: $p < .01$; *: $p < .05$

However, as the length of listening sequences varies across session, and since some of our data include censoring, we model this choice more formally using survival analysis (Cox proportional hazard model; Cox, 1972). Specifically, when estimating the rate of switching playlists, our model accounts for censored data in which listening sequences terminate without switching behavior. With censored data, we cannot observe when users would have switched their playlist as the sequences terminates due to deviation from increasing or decreasing structures, not switching behavior. Therefore, our model ensures that biases introduced by censored data are minimized. This allows us to capture the influence of consumption structure on switching behavior while also taking into account the fact that listening sequences vary in length and that some of our data are censored. Put differently, this analysis considers how likely a user is to still be listening to the same playlist given the consumption structure that they were exposed to (to that point) as well as, simultaneously, the total duration of the preceding sequence of songs. As such, we conduct a survival analysis looking at the likelihood of switching contexts as a function of consumption structure. As can be seen in Table 4 (Model 1), using a Decreasing consumption structure as the referent, we see a significant effect of consumption structure on

likelihood to switch playlists (B = 0.16, exp(B) = 1.17, 95% CI:[1.16, 1.19], p < .001). In other words, consistent with our predictions, users in an Increasing consumption structure are 1.17 times more likely to switch to a different playlist compared to users in a Decreasing consumption structure. We plot the Kaplan-Meier survival times in Figure 6. As can be seen, as represented by the blue line, for all sequence lengths, the likelihood that a user continues to listen to the same playlist (their "survival") is higher when the preceding songs are played in a decreasing sequence.

FIGURE 6

KAPLAN -MEIER SURVIVAL CURVES FOR BASELINE MODEL IN STUDY 4



Note.—Shaded regions of graph represent 95% confidence intervals. Curves plotted higher reflect a greater likelihood of still listening to the same playlist following a sequence of a given length (i.e., greater "survival").

TABLE 4

SURIVAL ANALYSIS MODEL RESULTS FOR STUDY 4

	Model 1: Base Model	*Model 2: Base Model + Covariates*	*Model 3: Base Model only with Free + Shuffle Users*	*Model 4: Base Model only with Free + Shuffle Users + Covariates*
Consumption Structure (0 = Decreasing; 1 = Increasing)	1.18 [1.16, 1.19]***	1.32 [1.27, 1.37]***	1.14 [1.06, 1.22] ***	1.24 [1.15, 1.33]***
Log(Sum of the Duration of Previous Songs)		0.25 [0.25, 0.26]***		0.30 [0.26, 0.33]***
Premium (0 = Free, 1 = Premium)		1.85 [1.80, 1.91]***		
Shuffle (0 = No, 1 = Yes)		1.24 [1.17, 1.31]***		
Consumption Structure x Premium		0.98 [0.94, 1.02]		
Consumption Structure x Shuffle		0.95 [0.88, 1.03]		
Premium x Shuffle		0.56 [0.53, 0.60]***		
Consumption Structure x Premium x Shuffle		1.04 [0.95, 1.13]		

NOTE.— Values in cells represents model estimates of exp(B) and their corresponding 95% confidence intervals. ***: $p < .001$; **: $p < .01$; *: $p < .05$).

In addition to this baseline model, we also test to see if this result is robust to the inclusion of several covariates (Model 2). Specifically, we include the log of the total duration of songs listened to prior to the focal song, a dummy indicator for whether the user is a premium or a free Spotify user, a dummy indicator for whether the user listened to the playlist on shuffle or not, and all possible interactions between these last two variables and the primary independent variable (consumption structure). In doing so, the influence of consumption structure on switching tendency remains largely unchanged (B = 0.27, exp(B) = 1.32, 95% CI:[1.27, 1.37], $p < .001$). We next restrict our analyses only to sessions where users are not premium users and who choose to listen to their playlist on shuffle (n = 109,025). Despite the smaller sample size, the baseline model (Model 3) results are consistent with the previous findings (B = 0.13, exp(B) = 1.14, 95% CI:[1.06, 1.22], $p < .001$). This is also true when we control for the total duration of songs listened to prior to the focal song (Model 4; B = 0.21, exp(B) = 1.24, 95% CI:[1.15, 1.33], $p < .001$). In other words, across these four model specifications, when users listen to songs in a

decreasing structure (versus an increasing structure), they are less likely to switch playlists, suggesting a lower level of hedonic decline.

Robustness Checks

In addition to our primary analyses, we also consider a different conceptualization of sequence length in order to test for the robustness of our results. Indeed, the way in which we defined a valid sequence is not the only possible approach. Specifically, in our main analysis, we identify the longest possible sequence as being one where consecutive songs all share the same consumption structure (increasing or decreasing). This necessarily means that longer sequences include shorter sequences within them. For instance, consider a four-song sequence that is characterized as follows; Song 1: 3 minutes, Song 2: 4 minutes, Song 3: 5 minutes, Song 4: 2 minutes. Our original conceptualization categorized this as a three-song sequence and the fourth song would be the target song. This is because Songs 1-3 are all increasing in duration, and Song 4 deviates from that pattern. However, it is also the case that this sequence includes a two-song sequence (Songs 1 and 2) and we could, instead, consider the third song as the target song. In other words, regardless of whether the third song in this sequence continues with the increasing or decreasing pattern of the first two songs, we can consider this a two-song sequence (even though we do not do so in our original conceptualization). What is worth highlighting here is that every valid sequence (ones that don't include skips or changes in playlist) must be at least two songs long. As such, we can consider only these two-song sequences, regardless of what the longest possible sequence *could* have been and see if the consumption structure still influences playlist switching behavior. In short, it does. Even when considering the consumption structure of just the first two songs and treating the third song as focal, our results remain largely

unchanged. Specifically, a logistic regression prediction switching behavior as a function of consumption structure returns a significant effect in the predicted direction ($B = 0.08$, $SE = 0.007$, $OR = 1.08$, $z = 10.78$, $p < .001$). Those who listened to the first two songs in the consumption sequence under an increasing consumption structure were 1.09 times more likely to switch playlists than those who did so under a decreasing consumption structure. Of note, this was also the case when we include the same control variables (and interaction terms) as in our main analysis (see Model 6 in Appendix B for details).

Discussion

The present study provides a test of our core hypothesis using real-world behaviors of users from the Spotify music listening platform. In doing so, we are able to demonstrate that the effect observed in a more tightly controlled laboratory settings, replicates in this much less controlled, but much more ecologically valid setting. Indeed, it is worth noting that the size of the effect we observe here is rather small (less than 1% change in user switching behavior), and yet that is what we should expect in such a "noisy" setting. Indeed, the choice of what to listen to is multifaceted and complex, making the likelihood of observing any influence on choice behavior all that more surprising. In sum, taken together with five experiments, Study 4 provides a strong piece of evidence suggesting that decreasing structures attenuate hedonic decline relative to increasing structures.

GENERAL DISCUSSION

Across five experiments and one large-scale archival study, we examine how the structure of varying consumption quantities affects the degree of hedonic decline. Specifically, we focus on two types of varying consumption quantities: 1) increasing consumption structures where successive units of consumption increase in the number of items they include and 2) decreasing consumption structures where successive units of consumption decrease in the number of items they include. Six studies demonstrate that experiencing multi-unit consumption in a decreasing structure mitigates hedonic decline relative to experiencing multi-unit consumption in an increasing structure, holding the total consumption quantity and the total number of interruptions constant. This structure effect also has significant downstream consequences in the form of decisions to re-consume (Studies 1A and 1B) and switching behavior (Study 4). We further identify subjective quantity as a mediator of the structure effect on hedonic decline (Studies 2A and 2B). More crucially, we directly manipulate subjective quantity by presenting an external reference quantity in Study 3. Here, the external reference quantity mitigates the structure effect such that the difference between increasing and decreasing structures dissipates when an external reference exists. The results of Study 3 suggest that people naturally form different reference quantities based on consumption units they experience, and this endogenous reference formation is less pronounced when an external cue is provided. Finally, in Study 4, we tested our prediction with actual behavior of a large number of Spotify users. In sum, our work demonstrates that decreasing structures reduce subjective quantity and, in turn, slow down hedonic decline relative to increasing structures.

The present work has important theoretical implications across three domains. First, the current findings contribute to our understanding of the influence of bracketing on consumption utility. Psychologists and economists have studied bracketing in the context of decision-making

and risk-taking (Rabin and Weizsäcker, 2009; Read et al., 1999). Consumer behavior researchers, on the other hand, focused on bracketing of products (Janiszewski and Cunha, 2004) and prices (Chakravarti et al., 2002). Although these studies examined bracketing in different contexts, they are similar in that they focus on the influence of mental bracketing on expected utility, rather than experienced utility. However, expected utility does not always match experienced utility (Hsee, Hastie, and Chen, 2008). For example, while narrow bracketing can lead to suboptimal purchases (Haisley, Mostafa, and Loewenstein, 2008), bracketing stimuli narrowly can boost hedonic utility of consumption (Redden, 2008). The present paper demonstrates the importance of bracketing on experienced utility by showing that the degree of hedonic decline varies depending on bracketing of consumption quantities. Furthermore, this research highlights two novel types of bracketing: increasing and decreasing consumption structures that can be observed in the contexts of social media, museums, and streaming services.

Second, the present work extends our understanding of multi-unit consumption. Previous work in this space has focused on the *value* of stimuli (Ariely and Loewenstein, 2000; Fredrickson, 2000; Kahneman et al., 1993). Specifically, holding the total value of stimuli constant, placing a positive stimulus at the end of a consumption episode increases the retrospective evaluation of the episode relative to placing a negative stimulus at the end. This peak-end effect also suggests that individuals tend to overweight a stimulus with the highest value (whether it is positive or negative) when making retrospective assessment of a consumption episode comprised of a series of stimuli. The current work instead investigates the influence of *sequencing* of consumption quantities. Study 3 clearly demonstrates that varying consumption quantities affects hedonic response independent of the peak-end effect as participants of that study repeatedly consumed a single stimulus throughout the experiments, so

the value of the last stimulus was identical, regardless of the structure of varying consumption quantities. As such, this research differs from typical approaches found in the literature, providing future researchers with a novel perspective to analyze consumption of a series of stimuli.

Finally, our work speaks to how people generally form and adjust their judgments. It has been well documented that people have tendencies to anchor on a readily accessible value and adjust from it to make a final judgment (Epley and Gilovich, 2004; Tversky and Kahneman, 1974), even if such anchors are arbitrary. However, after forming their initial evaluation with an arbitrary anchor, people tend to adjust their subsequent judgments in a systematic manner, signifying coherent arbitrariness of human judgments (Ariely, Loewenstein, and Prelec, 2003). The present work strengthens the perspective that human judgments are coherently arbitrary: participants anchor on the first unit to form their initial reference quantity (arbitrariness), yet they update their reference quantity systematically according to subsequent units (coherence). Our work also shows that people rely on accessible attributes such as past consumptions to form reference quantities much like they do when generating reference prices based on past prices (Kalyanaram and Winer, 1995; Thaler, 1985; Winer, 1986), echoing attentional models of reference-dependence (Bhatia and Golman, 2019; Bordalo et al., 2013; Kıbrıs et al., 2021).

The present work has practical implications as well. Firms may organize their products in decreasing structures to maintain customers' enjoyment. A video streaming service can recommend their content in decreasing structures such that the duration of the first video is longer than that of the second video and so on. A curator of art museums may structure rooms in a fashion that patrons view fewer paintings as advance to subsequent rooms. Similarly, consumers can maximize their hedonic utility by consuming stimuli in a decreasing structure.

Alternatively, organizing multi-unit consumption in increasing structures could be a way to prevent overconsumption as consumers will be satiated with the stimuli more easily under increasing structures.

Relevant to these practical implications, future studies on quantity allocation may explore whether people can predict the influence of consumption structures on hedonic decline. Though our work demonstrates that decreasing structures reduce hedonic decline, it is uncertain whether people will accurately predict the effect of such decreasing structures. If consumers have ill-informed beliefs about the influence of consumption structures on enjoyment, then they may make choices that lead to suboptimal consumption utility. Another unanswered question in the present work is whether the structure effect on hedonic decline will emerge when the intervals between units are long (vs. short). We focused on multi-unit consumption that usually lasts around five to ten minutes (Studies 1A, 1B, 2A, 2B, and 3) or up to 30 minutes (Study 4). People may be able to track multiple units of consumption during such relatively short periods, but monitoring consumption quantities is likely to be more difficult when multi-unit consumption persists for longer periods of time spanning, say, days. Identifying temporal limits of the structure effect is an important question that we hope future researchers will tackle.

There is also the possibility of our work informing future research on varying consumption quantities. As aforementioned, quantity allocation may follow more complex structures such as oscillating structures (e.g., increasing, then decreasing, then increasing, and so on) or random structures. Our work does not directly investigate those complex structures. However, the current findings can provide a basis for understanding complex consumption structures as those complex structures usually consist of multiple increasing and decreasing structures. Therefore, future researchers can refer to our findings to construct their hypotheses.

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APPENDICES

APPENDIX A

MEANS OF THE BASELINE AND FINAL ENJOYMENT RATINGS FOR STUDIES 2A, 2B, AND 3

	Consumption Structure	Baseline Enjoyment Rating	Final Enjoyment Rating	Change in Enjoyment Ratings
Study 2A	Increasing	79.96 (21.91)	29.11 (34.16)	-50.85 (35.49)
	Decreasing	76.90 (25.87)	36.76 (33.31)	-40.14 (33.75)
Study 2B	Increasing	77.09 (24.92)	43.02 (33.25)	-34.07 (28.72)
	Decreasing	79.27 (23.07)	52.37 (33.47)	-26.89 (27.35)
Study 3	Increasing	87.99 (16.54)	40.32 (34.92)	-47.67 (34.69)
(No-Cue)	Decreasing	88.01 (19.22)	53.09 (36.23)	-34.92 (36.34)
Study 3	Increasing	88.36 (16.18)	54.38 (36.07)	-33.98 (34.10)
(External Cue)	Decreasing	89.28 (12.92)	52.74 (37.21)	-36.56 (35.02)

NOTE.— Standard deviations in parentheses

APPENDIX B

ADDITIONAL MODEL RESULTS FOR STUDY 4

	Model 5: Two-Song Sequence Conceptualization Base Model	*Model 6: Two-Song Sequence Conceptualization Base Model + Covariates*
Consumption Structure (0 = Decreasing; 1 = Increasing)	0.08 (.007) OR: 1.08***	0.04 (0.02) OR: 1.04*
Log(Sum of the Duration of Previous Songs)		0.40 (0.01) OR: 1.49***
Premium (0 = Free, 1 = Premium)		0.46 (0.01) OR: 1.59***
Shuffle (0 = No, 1 = Yes)		0.15 (0.03) OR: 1.16***
Consumption Structure x Premium		0.03 (0.02) OR: 1.04
Consumption Structure x Shuffle		-0.03 (0.04) OR: 0.97
Premium x Shuffle		-0.51 (0.03) OR: 0.6***
Consumption Structure x Premium x Shuffle		0.02 (0.04) OR: 1.02

NOTE.— Values in cells represents model Bs and their corresponding SE as well as Odds Ratios. ***: $p < .001$; **: $p < .01$; *: $p < .05$).