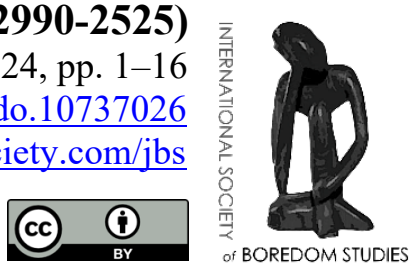
Journal of Boredom Studies (ISSN 2990-2525)
Issue 2, 2024, pp. 1–16
https://doi.org/10.5281/zenodo.10737026
https://www.boredomsociety.com/jbs



Boredom as Information Processing: How Revisiting Ideas from Orin Klapp (1986) Inform the Psychology of Boredom

JAMES DANCKERT
University of Waterloo, Canada
jdancker@uwaterloo.ca
https://orcid.org/0000-0001-8093-066X
ANVITA GOPAL
University of Waterloo, Canada
a3gopal@uwaterloo.ca
https://orcid.org/0000-0003-3738-4215

How to cite this paper: Danckert, J., and Gopal A. (2024). Boredom as Information Processing: How Revisiting Ideas from Orin Klapp (1986) Inform the Psychology of Boredom. *Journal of Boredom Studies*, *2*. https://doi.org/10.5281/zenodo.10737026

Abstract: Almost forty years ago, sociologist Orin Klapp penned a treatise on boredom couched in terms of information processing. His essential claim was that boredom would arise at both low and high rates of information change. At the low end, there was too much redundancy and monotony, with any new piece of information failing to add meaning to what was already known. At the high end, noisy and chaotic barrages of information preclude meaning making and result in boredom. In essence, this can be seen as a drive to find a Goldilocks' zone of information processing. While this theory of boredom is intriguing and clearly fits within other meaning-based accounts of the experience, there has been little direct experimental testing of the idea. This piece first characterizes Klapp's theory before presenting what evidence there is that boredom arises at both high and low ends of various domains related to information processing (e.g., difficulty, challenge). Next, we discuss recent computational accounts that suggest a similar role for boredom in optimally processing information. We end with a call for more research to test Klapp's model of boredom.

Keywords: boredom, information processing, exploration/exploitation, computational modeling.

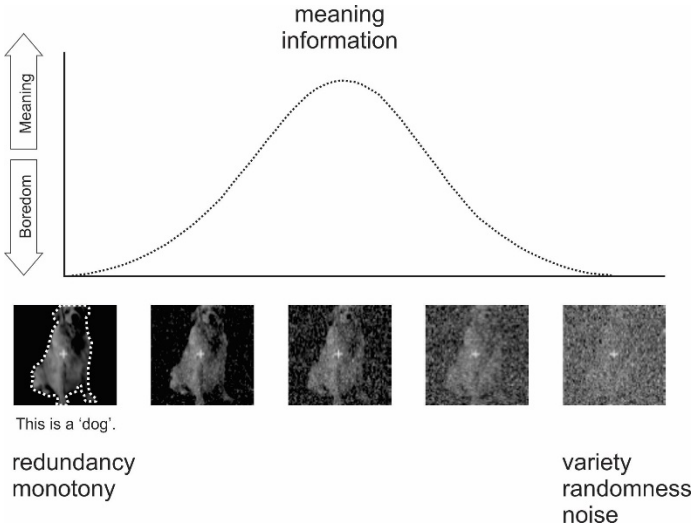
Received 10 November 2023; Accepted 26 February 2024.

1. Introduction

> It is not at all unusual to have the television or radio on while reading a newspaper, eating breakfast, and now and then talking to somebody. We may also carry a watch or pocket pager whose beeping signals remind us to move along to new stimuli. We may also carry a cassette recorder ("ghetto blaster") as we walk down the street—adding noise for everyone else—or wear a "Walkman," giving continual entertainment in our own sonic cocoon (Klapp, 1986, pp. 1–2).

This quote, from early on in Orin Klapp's (1986) treatise on boredom, captures only one end of the spectrum of information processing he was concerned with—the end at which it feels like trying to drink water from a firehose. The full theory suggests that boredom will arise at both low and high levels of rate of information change. As the ghetto blasters and pagers and Walkmans bombard us with information, the task of making sense of that information becomes challenging, if not impossible. At the other end of the scale, if we have only a single, unchanging source of information (or multiple sources that, in essence, convey the same information; Figure 1), there is so much built-in redundancy that we find ourselves bored.

Figure 1. Schematic Representation of the Role Played by Information in Boredom According to Klapp (1986).

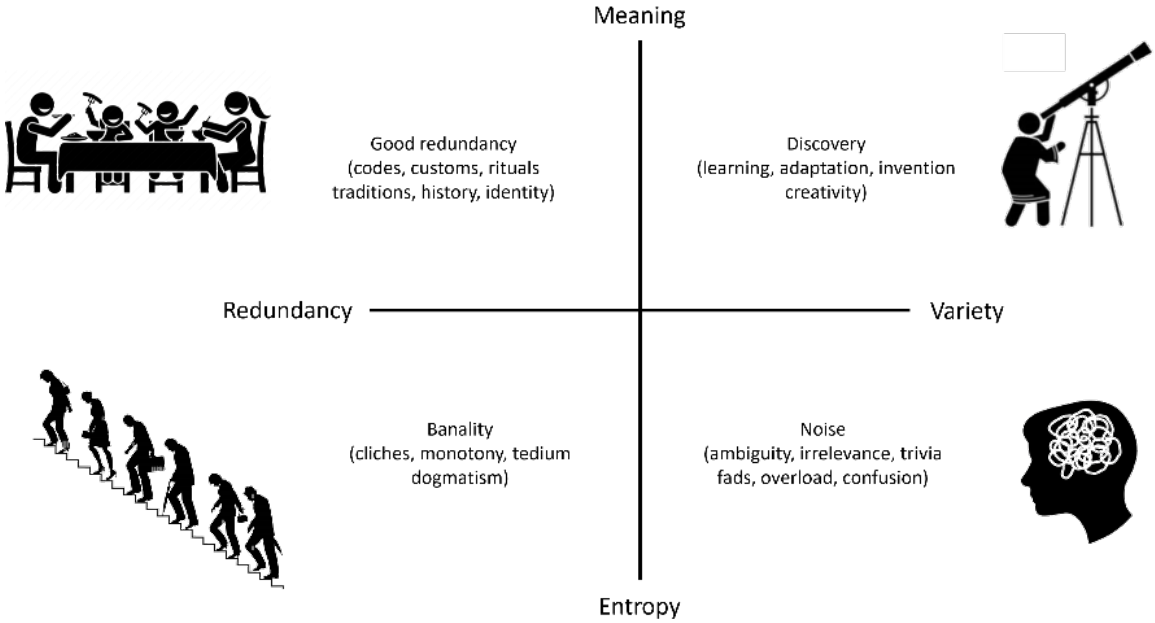


Note: When information is redundant—for example, a picture of a dog, with an outline of the dog added, and the verbal label 'dog'—boredom is more likely, and when there is too much variety, noise, or randomness, boredom will also arise. The challenge is essentially one of extracting meaning from the world around us.

Clearly embedded in a meaning-making framework (see Van Tilburg and Igou, 2012), the account of boredom Klapp gives is one that suggests we ought to be able to find some kind of Goldilocks' zone of information processing. Indeed, this may be something we strive for (Danckert and Elpidorou, 2023; Eastwood et al., 2012; Tam et al., 2021a).

Klapp's model was not two-dimensional. He thought that some amount (or types) of redundancy was good and that our best achievements arise from circumstances in which we may first find information processing challenging (Figure 2).

Figure 2. Broad Outline of the Two Dimensions along which Klapp Saw Information Processing as Critical to Meaning-making.



Note: Information can be scaled along a meaning-entropy (randomness) dimension or a redundancy-variety dimension. Example activities in each quadrant represent the confluence of the scale ends (e.g., banality occurs when both redundancy and entropy are high). Source: Adapted from Klapp (1986, p. 119).

More specifically, redundancy could be considered both good and bad depending on the meaning we extract from it. Rituals and customs, from family meals to religious gatherings, provide structure and meaning to life, ultimately contributing to our identity.[1] But when redundancy descends into the banal, we see only the tedium of routines that lack meaning. Similarly, variety of information is critical for guiding the way in which we explore our environs and enables learning, adaptation, and more to occur. One might even suggest that creativity depends on some variety of incoming information, or at the very least, variety in the ways of perceiving and expressing what that information might mean.[2] Nonetheless, when variety is untethered from meaning it becomes mere noise, representing irrelevant information (Klapp spends considerable time talking of fads and trivia) or becoming at best ambiguous and confusing.

[1] This distinction highlights the fact that Klapp's theory is not purely an information processing account in the terms used in that literature. Pointedly, information gain is not the concern for Klapp. One could mount an argument that redundant information may still represent information gain (e.g., repetitions of the same event/stimulus help build probabilistic models of those events). Nevertheless, what Klapp is concerned about is the intersection between the amount of information (and potentially the rate of change, although he is not explicit about this) and the meaning represented in that information.

[2] There is an interesting aside to be had here. Many want to believe that boredom begets creativity (see Nettinga et al., 2023, for a strong refutation of this myth). However, in Klapp's model, variety of information will only lead to creativity if meaning can be extracted from the noise. For some, boredom is defined by a lack of meaning and so will be unlikely to ever *lead to* creativity.

Klapp's treatise was a sociological one, critiquing the way in which society writ large produces and *consumes* information. With less available to consume we are better placed to make sense of what is in front of us. According to Klapp, this also opens us up to positive experiences, such as the capacity to experience awe and wonder, and to be curious about our surroundings. On the other hand, an explosion of constantly changing information leads to novelty becoming meaningless, diminishing our capacity for such things as awe and wonder.[3]

2. Linking the Sociology of Boredom to the Psychology of Boredom

Our aim here is not to offer a critique of Klapp's sociological framework. Instead, we endeavor to bridge the gap between Klapp's framework and a psychological understanding of boredom within the individual. We seek to explore how Klapp's elucidation of the social construction of information could shed light on the psychological manifestations of boredom and boredom proneness.

In some sense, Klapp's account casts boredom as a defensive reaction to, or retreat from, noise at one end of the spectrum and an appetitive search for information at the other. This clearly pushes us to strive for a Goldilocks' zone somewhere in the middle. There may indeed be a natural oscillation cycle between 'good redundancy' and 'variety' (Figure 2) that captures the dynamics of two drives—the drive to exploit known resources on the one hand, and to explore for better resources on the other (Danckert, 2019). At the end of the spectrum that Klapp labels banality, we may feel the urge to explore our environs for something new to engage with—a move towards variety. At the end of the spectrum he labels noise, we may instead want to retreat into known circumstances that we can exploit for optimal engagement (Agrawal et al., 2022). What Klapp is claiming is that increased noise and redundancy—which he saw as a function of his information age and can only be assumed to have increased in our own time—makes it more challenging to achieve that natural oscillation between good redundancy and variety, the balance between exploratory and exploitative drives (Danckert, 2019).

There is some prescience to Klapp's claim that if our communal crisis of meaning-making is predicated on information overload, the solution will not lie in simply adding more information, something our current age has clearly done (intentionally or otherwise). The analogy he adopts here is with food. Simply consuming more leads to gluttony and discomfort. Boredom is the outcome of the uncomfortable overconsumption of information.[4]

Time also plays an important role here in Klapp's discussion of information and meaning-making. He makes a distinction between subjective time and clock time. This is essentially about

[3] Klapp draws this analogy out with a distinction between rural and urban populations to suggest that the former, by virtue of being less inundated with information, has a greater capacity to make meaning and experience awe and as a result, will be less prone to boredom. This is, in part, based on sociologist Georg Simmel's (1950) claims that there is "an incapacity (in the urban) […] to react to new situations with the appropriate energy" (p. 410). It turns out that this is not born out by data which shows that boredom is in fact elevated in rural populations (e.g., Willging et al., 2014), probably reflecting differences in opportunities for engagement.

[4] Klapp provides data to suggest that the usage frequency of the words 'boredom', 'monotony', and 'routine' almost tripled from 1931 to 1961 and that boredom showed a ten fold increase in common usage by the time of his writing. A search on Google's Ngram Viewer suggests that usage of the word boredom continued to rise into the 2010's. https://acortar.link/zHTPKl.

the 'slow horse' (Klapp's terminology) of meaning-making. That is, when we do the more challenging work of making meaning out of our environs, this evolves on a slower, subjective time scale. When society ramps up the amount and pace of information processing this forces us to process things more rapidly *and* more shallowly, bringing subjective time more in-line with absolute clock time which, by undercutting the meaning-making process, leads to a more pervasive sense of boredom across society.

One manifestation of this, for Klapp, is evident in changing fads, the rapid movement of interest from one shiny object to the next. Such swift transitions from one popular trend or fashion to another suggests only shallow engagement, a failure to do the slower work of meaning-making. Intriguingly, one recent computational model showed that boredom can indeed influence changing preferences at a population level (Seiler and Rumpel, 2023). These authors first examined the changing trends for fashions on the cover of *Cosmopolitan* magazine over a roughly 20-year period and showed that the predominant colors did indeed show evidence of trends (i.e., short periods of time with consistent colors modeled interspersed by longer periods in which colors of the cover fashion models were more varied). The authors then created computational agents that could be programmed to have varying levels of boredom. The agents then 'chose' what color to wear on a given day and when those agents then interacted with one another, similar color choices were coded as more boring than distinct color choices among the whole population of agents. This led to the evolution of trends comparable to those seen on the real-world cover of *Cosmo*. The level of boredom in the population could then be tuned up or down. When boredom levels in the population were very low the color choices of agents rapidly converged onto a single color—a kind of uniformity one might expect in a dystopian, autocratic regime. When boredom levels were set to be extremely high, fashion trends, such as they were, became highly unstable. For Klapp, this might represent boredom at the extremes of information processing with meaningless redundancy at one end and chaotic noise at the other (Figures 1 and 2).

Ultimately, for Klapp, these challenges of meaning making amidst an abundance of ever-increasing information, leads to a widespread meaning gap between the sheer volume of what is available and our capacity (as both individuals and at a societal level) to make sense of that information. This presages our current age, where mis- and disinformation are rife (Pennycook and Rand, 2021). Indeed, Klapp (1986) explicitly warned against not only expanding amounts of information, but fractionating the sources of that information:

> the more information is repeated and duplicated, the larger the scale of diffusion, the greater the speed of processing, the more *opinion leaders* and *gatekeepers* and *networks*, *the more filtering of messages, the more kinds of media through which information is passed*, the more decoding and encoding, and so on—the more degraded information might be (p. 126, emphasis added).

Klapp's 'opinion leaders' and 'gatekeepers' are today's influencers.

Where Klapp was exploring the ways in which the structure of society conspired to overproduce information and the consequences of that proliferation, we are interested in how his account might frame the individual's experience of boredom. In one important sense, Klapp's model casts boredom in information processing terms such that we search for optimal levels of meaning—a kind of Goldilocks' zone.

3. Searching for the Goldilocks' Zone

We have suggested previously, that for the trait boredom prone, there are challenges of information processing that can be cast in terms of both exploitation *and* exploration (Danckert, 2019). For the former, perhaps the most consistent cognitive finding in the literature highlights that those high in trait boredom proneness struggle to focus and sustain attention (Hunter and Eastwood, 2018; Malkovsky et al., 2012; Tam et al., 2021a). That is, the trait boredom prone fail to fully exploit their cognitive resources to meet the demands of the task at hand. For the latter (exploratory failures), it has been suggested that those high in trait boredom proneness fail to adopt goal pursuit modes that would enable them to launch into action (Mugon et al., 2018). While Klapp's theory was largely focused on state boredom[5] within a broad societal context, these theories suggest that a search for an optimal zone of engagement with the world, characterizes both the state and the conundrum experienced by those high in trait boredom—what John Eastwood calls the 'desire bind' of wanting to engage with the world, but not wanting anything that is currently available (Eastwood and Gorelik, 2019).

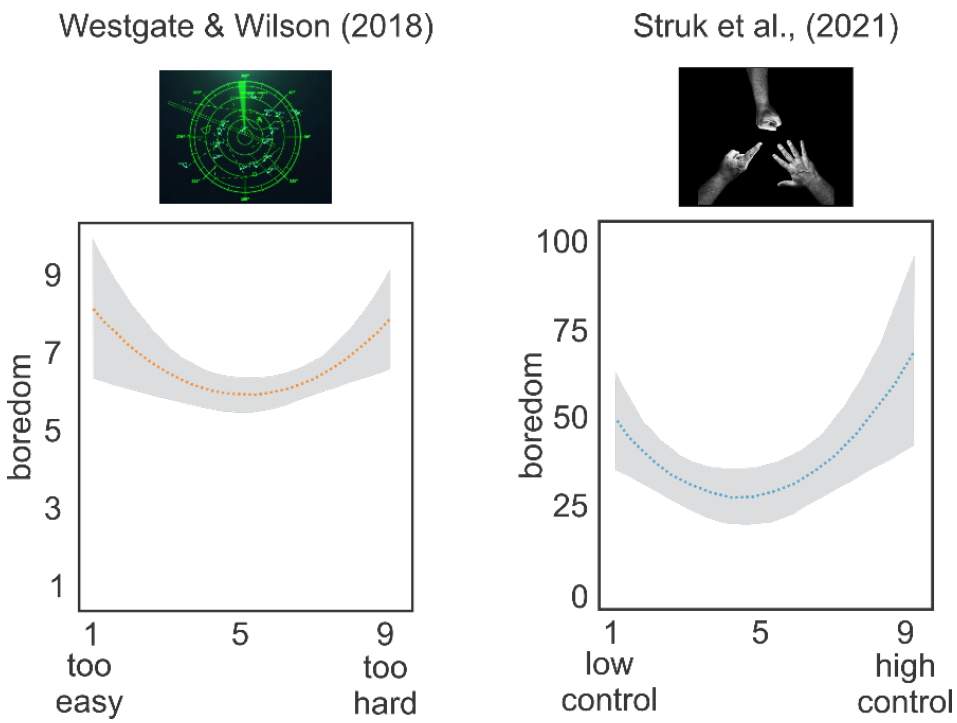
A broad implication of Klapp's theory is that humans strive to maintain some optimal level of cognitive engagement—a kind of cognitive homeostasis (Danckert and Elpidorou, 2023). By analogy with physical homeostatic mechanisms, whereby deviation from a set point of values (in reality, a range of values) signals the need for the organism to adjust behaviour to promote survival, boredom signals the need to alter behaviour to more optimally deploy our skills and talents in-the-moment. But what evidence is there that humans do indeed do this?

Westgate and Wilson (2018) presented a series of experiments to test their model of boredom as a combination of attentional engagement and meaning. In one such experiment, they had participants perform a kind of 'air traffic control' task in which they were to avoid having planes crash on a radar screen. Task difficulty was titrated such that at very low levels of difficulty—when there were few planes to monitor and it was facile to avoid collisions—participants reported high levels of boredom. Interestingly, at very high levels of difficulty—with many planes on screen and a high degree of challenge to avoid collisions—people again reported experiencing high levels of boredom (Figure 3). While not a direct test of information processing, these data suggest that, at least in terms of task difficulty, boredom is felt most strongly at the extremes, as Klapp would predict.

Similarly, we had participants play the children's game of rock, paper, scissors against a computer opponent that was rigged to let the participant either win all the time or lose all the time. Participants rated their perceived level of control and boredom in both conditions with results showing that boredom was highest at the low *and* high levels of perceived control (Struk et al., 2021; Figure 3).

[5] By state boredom we mean the in-the-moment feelings of boredom, sometimes referred to as situational boredom to highlight the circumstantial factors that cause one to be bored. The trait disposition to experience state boredom more frequently and intensely is what is referred to as trait boredom proneness (Tam et al., 2021b).

Figure 3. Data showing boredom at the extremes of tasks difficulty and perceived control.



Note: Data is adapted from Westgate and Wilson (2018; left panel, adapted from their Figure 3, of Study 3, p. 703) and Struk et al. (2021; right panel adapted from their Figure 4, p. 11). In both instances boredom is highest at the extremes of either self-reported difficulty or perceived control over the task.

Both of these studies suggest that boredom is highest when we are outside of some optimal zone of engagement, whether in terms of the perceived difficulty of the task, or our sense of control over how the task progresses. What they do not explicitly address is the hypothesis that humans *strive to find that zone*. There are a number of ways to construe how humans engage in goal pursuit ranging from satisficing (doing only what is necessary) to maximizing (making the best use of a situation as possible; Kapteyn et al., 1979), to the calculation of opportunity costs (i.e., changing tasks/goals when opportunity costs are high; Kurzban et al., 2013; Struk et al., 2020), and more (see Gollwitzer and Oettingen, 2012 for review). What is relevant here is that each of these approaches to goal pursuit helps to keep us within an optimal range of cognitive engagement. That is, different circumstances may demand distinct goal approaches, but in all instances what we are striving for is optimal deployment of cognitive resources. This hypothesis is yet to be directly tested, but there are intriguing hints from other work that suggest it is at least plausible.

Geana et al. (2016) had participants play a number guessing game that had three distinct levels; in one condition numbers were generated from a uniform, random distribution. In this instance, there was no way that people could guess the upcoming number at better than chance levels. In another condition, the number to be guessed was previewed for the participant, making

the task facile (not really a guessing task at all). The third condition drew numbers from a Gaussian distribution. In this instance, participants could use error feedback to learn the Gaussian and improve their guesses, which is precisely what they did. What is relevant for our purposes is that it was this condition that had the lowest ratings of boredom. Thus, when there was at least some information to be learned from the task, participants were more engaged and less bored (Geana et al., 2016).

There is also good evidence to suggest that for many of us, doing nothing is accompanied by deep feelings of dissatisfaction, so much so that we may be willing to engage in self-harm. Wilson et al. (2014) showed this by having people sit in a room with nothing but their thoughts for fifteen minutes. While many found this to be pleasant (or were at least ambivalent about the experience) around one-third of the participants reported it to be unpleasant. When these participants were given the opportunity to self-administer electric shocks, many of them chose to do so even though they had previously indicated they would pay money to actively avoid experiencing the shocks (the participants had previewed the shocks just prior to spending fifteen minutes in the empty room; see also Havermans et al., 2015; Nederkoorn et al., 2016; Struk et al., 2020 for similar results).

It is plausible that one could engage in internal reverie while in an otherwise barren environment.[6] Certainly, work from Van Tilburg et al. (2013) suggests that nostalgic reverie can act as an antidote to boredom. But what the Wilson et al. (2014) data suggests is that for many individuals, this is difficult to do, and that they prefer to engage with the external world. Intriguingly, this experience is not unique to humans, as Yawata et al. (2023) showed that mice placed in an empty room sought aversive stimuli (a nose poke hole that delivered a puff of air, a stimulus mice tend to find aversive). The rate of seeking aversive stimuli was more frequent for mice in an empty room when compared with mice housed in cages with interesting objects for them to engage with. It seems that the desire to be engaged in optimal ways with the world may be universal.

Consistent with the need to engage (to act, as opposed to doing nothing), work conducted during the pandemic showed that those high in boredom proneness were also more likely to break the rules of social distancing (Boylan et al., 2021; Drody et al., 2022; Wolff et al., 2020). This was not merely a question of impulse control. Boredom proneness was found to impact rule-breaking behaviours even when trait level self-control was accounted for (Boylan et al., 2021). Taken together, these data highlight our desire to engage in optimal ways with the world, a desire that is felt acutely when our current circumstances contain little to no information to engage us cognitively (either because we are in a room with nothing but our thoughts, or we are confined to our homes as a function of pandemic restrictions).

Computational models of boredom cast it firmly in terms of a drive to explore. An early model even suggested that boredom may function to solve the so-called ‘dark room’ problem (Friston et al., 2012; Sun and Firestone, 2020). This problem is endemic to predictive coding accounts of brain function. In these models, the brain creates mental representations of the world

[6] It is worth pointing out that more comprehensive sensory deprivation does lead to boredom in initial stages before more complex and often detrimental effects ensue (e.g., hallucinations; Heron, 1957).

that enable predictions of the outcomes of intended actions. When those actions are deployed some form of predictive error is represented and used to adjust future actions (Friston and Kiebel, 2009). More generally then, if the organism is *driven to reduce predictive errors*, one ideal strategy would be to crawl up into a ball in the corner of a dark room—a maximally predictive environment. Clearly, we (and other animals with similar nervous systems) do not do this. One thing preventing us from adopting this strategy may be boredom (Gomez-Ramirez and Costa, 2017). As entropy falls below a certain level, signaling a thoroughly predictable circumstance (Klapp's bad redundancy), boredom may signal our need to explore the environs for something more variable to engage with (see also Agrawal et al., 2022).

Boredom has also been shown to be a great driver of learning. When presented with maze-like learning tasks, a computational agent guided by boredom performed better than one guided by curiosity (Yu et al., 2019). This is not to suggest that curiosity plays no role in learning, but rather that, under some circumstances, boredom will drive exploration more efficiently than will curiosity. Indeed, curiosity in a pure form may function to root one to the spot. In another maze learning task, Burda et al. (2018) presented an ever-changing stimulus on one wall of a virtual maze. Their computational agent, driven by curiosity, stopped to examine this constantly changing, but ultimately meaningless, stimulus. In Klapp's terms, this is the equivalent of the noisy end of the spectrum, where so many sources of information make it impossible to extract meaning from the noise. Taken together, these computational accounts of boredom (and to some extent, curiosity), suggest that we strive to find some optimal zone of engagement with the world around us.

4. Boredom in the Age of Information

If Klapp was concerned in 1986 that the exponential influx of information would hinder the process of meaning-making, one can only speculate on how that concern might be magnified in our current environs. Buckminster Fuller popularized the notion of the knowledge-doubling curve, the time span over which the total amount of information doubles, purportedly taking around a hundred years until we reached the middle of the 20th Century where the timespan reduces to 25 years. Recent suggestions put this doubling timeframe at anywhere between 12 months and 12 hours,[7] although Klapp (and we) might want to make an important distinction here between knowledge and information.

It is not only the amount of information that has exponentially grown, but also the rate at which that information is presented and processed. At the time of Klapp's writing the rate of information processing in computers was around 256,000 bits per second. Clearly, we now exceed that by several orders of magnitude (average computers operating at 3.5 to 4.2 GHz). Such an expansion in information processing rate makes the analogy of trying to drink water from a firehose even more apt. And all this can be done through a device we hold in our hands,

[7] Clearly this is a challenging claim to substantiate. For one thing, one would need to define what counts as knowledge (as we suggest in the text, there is likely a very important distinction to be made between knowledge and mere information). For just one account of the possible rate of information doubling (we prefer to stick with information as opposed to knowledge) see Carroll (2022). See also Chu and Trujillo (2009) for a comprehensve edited volumen on Buckminster Fuller.

carry with us everywhere and that has the capacity to inundate us with notifications beyond the wildest capacities of the pocket pagers, Walkmans, and ghetto blasters that had Klapp concerned in the quote that leads this piece.

Regardless of how quickly the amount of available information doubles, Klapp's concern was that our information age would lead to an epidemic of boredom, precisely because there was too much information and too little capacity for making meaning. In short, as the amount of information increases, we require more 'channels' on which to process that information. There is an inherent bottleneck that we must then face given the limited perceptual, cognitive, and neural resources we have (e.g., Sherman and Usrey, 2021). Ultimately, this forces us to select some channels to focus on and others to ignore. We attempt to make meaning of information, to seek patterns, and to build mental models of the world, all as a means of condensing the information at hand into tractable, meaningful parcels. For Klapp, the modern age (mid-1980's for him) was making this harder and harder to achieve as more and more information presented itself.[8]

But what evidence is there that phenomenal changes in the amount, rate, and access to information have led to an epidemic of boredom in our times? An epidemic may be an overstatement, but it is certainly true that recent data from multiple sources suggests that reports of boredom and rates of the trait disposition to experience boredom are both rising (Gu et al., 2023; Weiss et al., 2022; Weybright et al., 2020).[9] Whether these rises are due to information overload requires more research. But it is certainly plausible that the challenge posed by information overload—a challenge in extracting signal from noise to make sense of the world—is at least partly responsible.

There is a great deal of work highlighting the role of boredom in both problematic smartphone use and internet addiction (Cannito et al., 2023; Dora et al., 2021; Elhai et al., 2018; Lin et al., 2009; Wang et al., 2020; Wolniewicz, et al., 2020; Yang et al., 2020). Typically, boredom and boredom proneness function as mediators between problematic smartphone use and challenges to mental wellbeing (including higher levels of anxiety and depression; e.g., Elhai et al., 2018; Wang et al., 2020). Rather than being the outcome of information overload that Klapp initially cast it as, it seems that boredom may drive us *towards* our devices as a solution, an albeit ineffective one, to resolve the uncomfortable feeling of boredom. What remains true from Klapp's account is that our relation to information represents a challenge of meaning-making. While our phones and the internet are clearly exceptional sources of information, when we turn to them out of boredom, we are passively letting the device occupy our minds, as opposed to actively seeking meaning from what is in front of us. This could be cast as an understandable reaction to the vast expanse of information. Rather than doing the slow work of meaning-making (as Klapp casts it) we can more easily indulge in the fast, surface consumption of meaningless drivel.[10] The same can be said of problem gambling (Kruger et al., 2020; Mercer and Eastwood,

[8] One could make a claim that the rise of dis- and misinformation is at least one outcome of this proliferation of the sheer amount of available information (Pantazi et al., 2021).

[9] It is worth pointing out that these findings are evident in both Western and Asian cultures suggesting that the rise in boredom is a widespread socio-cultural phenomenon.

[10] Klapp saw our obsession with rapidly changing fads and meaningless kitsch as signs that there was too much information for us to be able to meaningfully process and that as a result we typically only scratched the surface.

2010). In both instances, the mind can be occupied with an ever-changing stream of information (modern slot machines allow upwards of 20 lines of play, with bells and whistles pushing continued play; Dixon et al., 2018),[11] while not necessarily extracting much meaningful information. Such passive engagement with information can lead to a vicious cycle: boredom pushes you to the passive intake of information, that information fails to satisfy your need for meaning, and more boredom ensues (Danckert and Eastwood, 2020).

What we have called 'passive engagement' Klapp (1986) called 'busy boredom':

> When there is too much chatter, attention becomes shallow, one does not listen with whole-hearted interest but skims and scans *restlessly*, looking for something significant: high mobility, heavy appointments, many messages, many distractions, shallow engagement – *busy boredom* (p. 92, emphasis added).

Klapp suggests a revealing analogy with pain-killers that remains relevant in our age. The increased prescription and use of pain-killers do not represent a cure, but rather the *increased presence of pain*. More information, more easily at hand, with more constant opportunities for engagement (both good and bad), does not represent the successful elimination of ennui, but rather an *increased incidence of boredom* in our own information age. As Klapp (1986) suggests, boredom "arises when pace gets faster, change lacks meaning, and movement lacks arrival" (p. 49). Indeed, he suggests that one response to the barrage of information is to attempt to have your own voice rise above the noise—what he calls 'ego-screaming'. It is easy to see how this is a prescient take on some of the vitriol present on social media (March and Marrington, 2019). Ultimately, our thirst for information and entertainment, particularly social media, then becomes a 'placebo' institution, a structure that gives the illusion of having cured boredom without ever having addressed the cause of the underlying issue (rather, it compounds it by providing yet more information, more rapidly presented).

Clearly, a great deal more research is needed to fully test Klapp's notions of information and overload as they relate to the experience of boredom and its outcomes. Carefully titrating the amount of information in any given task is a key first start, but it will be important to control for varying levels of meaning, challenge, and perceived control in order to disambiguate the contribution of each to the feeling of boredom. What kinds of circumstances lead one to perceive information to be impenetrable as opposed to worth the challenge, should delineate the upper bounds of information processing in the context of boredom. Similarly, what differentiates tedious routines from meaningful customs would isolate the lower bounds of boring information processing (Figure 2). It is also clearly worth drawing the bow in the opposite direction to what we have done here—from individual experiences of boredom to the societal structures that promote them. Clearly, we have exponentially increased the amount, rate, and availability of information in our current age relative to the 1980's. In revisiting Klapp's theory, it will be worth investigating the way individual experiences and responses to boredom influence and are influenced by, the structures we engage with when consuming information.

[11] Klapp (1986) foresaw this relation; "Gambling is effective in combatting boredom because it can dramatize the trivial" (p. 138).

References

Agrawal, M., Mattar, M. G., Cohen, J. D., and Daw, N. D. (2022). The Temporal Dynamics of Opportunity Costs: A Normative Account of Cognitive Fatigue and Boredom. *Psychological Review*, *129*(3), 564. https://doi.org/10.1037/rev0000309

Boylan, J., Seli, P., Scholer, A. A., and Danckert, J. (2021). Boredom in the COVID-19 Pandemic: Trait Boredom Proneness, the Desire to Act, and Rule-breaking. *Personality and Individual Differences*, *171*, 110387. https://doi.org/10.1016/j.paid.2020.110387

Burda, Y., Edwards, H., Pathak, D., Storkey, A., Darrell, T., and Efros, A. A. (2018). Large-scale Study of Curiosity-driven Learning. *arXiv preprint arXiv:1808.04355*.

Cannito, L., Ceccato, I., Annunzi, E., Bortolotti, A., D'intino, E., Palumbo, R., and Palumbo, R. (2023). Bored with Boredom? Trait Boredom Predicts Internet Addiction Through the Mediating Role of Attentional Bias Toward Social Networks. *Frontiers in Human Neuroscience*, *17*, 1179142. https://doi.org/10.3389/fnhum.2023.1179142

Carroll, J. (2022, December 12). 23 Trends for 2023: #8 – Knowledge Velocity. *Jim Carrol*. https://jimcarroll.com/2022/12/23-trends-for-2023-8-knowledge-velocity/

Chu, H. Y., and Trujillo, R. G. (2009). *New Views on R. Buckminster Fuller*. Stanford University Press.

Danckert, J. (2019). Boredom: Managing the Delicate Balance Between Exploration and Exploitation. In J. Ros Velasco (Ed.), *Boredom Is in Your Mind: A Shared Psychological-Philosophical Approach* (pp. 37–53). Springer.

Danckert, J., and Elpidorou, A. (2023). In Search of Boredom: Beyond a Functional Account. *Trends in Cognitive Sciences*, *27*, 494–507. https://doi.org/10.1016/j.tics.2023.02.002

Danckert, J., and Eastwood, J. D. (2020). *Out of My Skull: The Psychology of Boredom*. Harvard University Press.

Dixon, M. J., Stange, M., Larche, C. J., Graydon, C., Fugelsang, J. A., and Harrigan, K. A. (2018). Dark Flow, Depression and Multiline Slot Machine Play. *Journal of Gambling Studies*, *34*, 73–84. https://doi.org/10.1007/s10899-017-9695-1

Dora, J., Van Hooff, M., Geurts, S., Kompier, M., and Bijleveld, E. (2021). Fatigue, Boredom and Objectively Measured Smartphone Use at Work. *Royal Society Open Science*, *8*(7), 201915. https://doi.org/10.1098/rsos.201915

Drody, A. C., Hicks, L. J., and Danckert, J. (2022). Boredom proneness and rule-breaking: A persistent relation one year into the COVID-19 pandemic. *Behavioral Sciences*, *12*(8), 251. https://doi.org/10.3390/bs12080251

Eastwood, J. D., and Gorelik, D. (2019). Boredom Is a Feeling of Thinking and a Double-edged Sword. In J. Ros Velasco (Ed.), *Boredom Is in Your Mind: A Shared Psychological-Philosophical Approach* (pp. 55–70). Springer.

Eastwood, J. D., Frischen, A., Fenske, M. J., and Smilek, D. (2012). The Unengaged Mind: Defining Boredom in Terms of Attention. *Perspectives on Psychological Science*, *7*(5), 482–495. https://doi.org/10.1177/1745691612456044

Elhai, J. D., Vasquez, J. K., Lustgarten, S. D., Levine, J. C., and Hall, B. J. (2018). Proneness to Boredom Mediates Relationships Between Problematic Smartphone Use with Depression and Anxiety Severity. *Social Science Computer Review*, *36*(6), 707–720. https://doi.org/10.1177/0894439317741087

Friston, K., Thornton, C., and Clark, A. (2012). Free-energy Minimization and the Dark-room Problem. *Frontiers in Psychology*, *130*. https://doi.org/10.3389/fpsyg.2012.00130

Friston, K., and Kiebel, S. (2009). Predictive Coding under the Free-energy Principle. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1521), 1211–1221. https://doi.org/10.1098/rstb.2008.0300

Geana, A., Wilson, R., Daw, N. D., and Cohen, J. (2016). Boredom, Information-seeking and Exploration. *Cognitive Science*, *40*, 1751–1756.

Gollwitzer, P. M., and Oettingen, G. (2012). Goal Pursuit. In R. M. Ryan (Ed.), *The Oxford Handbook of Human Motivation* (pp. 208–231). Oxford University Press.

Gomez-Ramirez, J., and Costa, T. (2017). Boredom Begets Creativity: A Solution to the Exploitation–exploration Trade-off in Predictive Coding. *Biosystems*, *162*, 168–176. https://doi.org/10.1016/j.biosystems.2017.04.006

Gu, Z., Yang, C., Su, Q., and Liang, Y. (2023). The Boredom Proneness Levels of Chinese College Students Increased over Time: A Meta-analysis of Birth Cohort Differences from 2009 to 2020. *Personality and Individual Differences*, *215*, 112370. https://doi.org/10.1016/j.paid.2023.112370

Havermans, R. C., Vancleef, L., Kalamatianos, A., and Nederkoorn, C. (2015). Eating and Inflicting Pain out of Boredom. *Appetite*, *85*, 52–57. https://doi.org/10.1016/j.appet.2014.11.007

Heron, W. (1957). The Pathology of Boredom. *Scientific American*, *196*(1), 52–57.

Hunter, A., and Eastwood, J. D. (2018). Does State Boredom Cause Failures of Attention? Examining the Relations Between Trait Boredom, State Boredom, and Sustained Attention. *Experimental Brain Research*, *236*, 2483–2492. https://doi.org/10.1007/s00221-016-4749-7

Kapteyn, A., Wansbeek, T., and Buyze, J. (1979). Maximizing or Satisficing. *The Review of Economics and Statistics*, 549–563.

Klapp, O. E. (1986). *Overload and Boredom: Essays on the Quality of Life in the Information Society*. Greenwood Publishing Group Inc.

Kruger, T. B., Dixon, M. J., Graydon, C., Stange, M., Larche, C. J., Smith, S. D., and Smilek, D. (2020). Using Deliberate Mind-wandering to Escape Negative Mood States: Implications for Gambling to Escape. *Journal of Behavioral Addictions*, *9*(3), 723–733. https://doi.org/10.1556/2006.2020.00067

Kurzban, R., Duckworth, A., Kable, J. W., and Myers, J. (2013). An Opportunity Cost Model of Subjective Effort and Task Performance. *Behavioral and Brain Sciences*, *36*(6), 661–679. https://doi.org/10.1017/S0140525X12003196

Lin, C., Lin, S., and Wu, C. (2009). The Effects of Parental Monitoring and Leisure Boredom on Adolescents' Internet Addiction. *Adolescence*, *44*(176), 993–1004.

Malkovsky, E., Merrifield, C., Goldberg, Y., and Danckert, J. (2012). Exploring the Relationship Between Boredom and Sustained Attention. *Experimental Brain Research*, *221*, 59–67. https://doi.org/10.1007/s00221-012-3147-z

March, E., and Marrington, J. (2019). A Qualitative Analysis of Internet Trolling. *Cyberpsychology, Behavior, and Social Networking*, *22*(3), 192–197. https://doi.org/10.1089/cyber.2018.0210

Mercer, K. B., and Eastwood, J. D. (2010). Is Boredom Associated with Problem Gambling Behaviour? It Depends on What You Mean by 'Boredom'. *International Gambling Studies*, *10*(1), 91–104. https://doi.org/10.1080/14459791003754414

Mugon, J., Struk, A., and Danckert, J. (2018). A Failure to Launch: Regulatory Modes and Boredom Proneness. *Frontiers in Psychology*, *9*, 1126. https://doi.org/10.3389/fpsyg.2018.01126

Nederkoorn, C., Vancleef, L., Wilkenhöner, A., Claes, L., and Havermans, R. C. (2016). Self-inflicted Pain out of Boredom. *Psychiatry Research*, *237*, 127–132. https://doi.org/10.1016/j.psychres.2016.01.063

Nettinga, J., Gutglick, R., and Danckert, J. (2023). Exploring the Relation Between State and Trait Boredom and Various Measures of Creativity. *Journal of Boredom Studies*, *1*. https://doi.org/10.5281/zenodo.7993881

Pantazi, M., Hale, S., and Klein, O. (2021). Social and Cognitive Aspects of the Vulnerability to Political Misinformation. *Political Psychology*, *42*, 267–304. https://doi.org/10.1111/pops.12797

Pennycook, G., and Rand, D. G. (2021). The Psychology of Fake News. *Trends in Cognitive Sciences*, *25*, 388–402. https://doi.org/10.1016/j.tics.2021.02.007

Seiler, J. P. H., and Rumpel, S. (2023). Modeling Fashion as an Emergent Collective Behavior of Bored Individuals. *Scientific Reports*, *13*, 20480. https://doi.org/10.1038/s41598-023-47749-7

Sherman, S. M., and Usrey, W. M. (2021). Cortical Control of Behavior and Attention from an Evolutionary Perspective. *Neuron*, *109*(19), 3048–3054. https://doi.org/10.1016/j.neuron.2021.06.021

Simmel, G. (1950). *The Sociology of Georg Simmel*. Simon and Schuster.

Struk, A. A., Scholer, A. A., and Danckert, J. (2021). Perceptions of Control Influence Feelings of Boredom. *Frontiers in Psychology*, *12*, 687623. https://doi.org/10.3389/fpsyg.2021.687623

Struk, A. A., Scholer, A. A., Danckert, J., and Seli, P. (2020). Rich Environments, Dull Experiences: How Environment Can Exacerbate the Effect of Constraint on the Experience of Boredom. *Cognition and Emotion*, *34*(7), 1517–1523. https://doi.org/10.1080/02699931.2020.1763919

Sun, Z., and Firestone, C. (2020). The Dark Room Problem. *Trends in Cognitive Sciences*, *24*(5), 346–348. https://doi.org/10.1016/j.tics.2020.02.006

Tam, K. Y., Van Tilburg, W. A., Chan, C. S., Igou, E. R., and Lau, H. (2021a). Attention Drifting in and out: The Boredom Feedback Model. *Personality and Social Psychology Review*, *25*(3), 251–272. https://doi.org/10.1177/10888683211010297

Tam, K. Y., Van Tilburg, W. A., and Chan, C. S. (2021b). What Is Boredom Proneness? A Comparison of Three Characterizations. *Journal of personality*, *89*(4), 831–846. http://doi.org/10.1111/jopy.12618

Van Tilburg, W. A., Igou, E. R., and Sedikides, C. (2013). In Search of Meaningfulness: Nostalgia as an Antidote to Boredom. *Emotion*, *13*(3), 450. https://dx.doi.org/10.1037/a0030442

Van Tilburg, W. A., and Igou, E. R. (2012). On Boredom: Lack of Challenge and Meaning as Distinct Boredom Experiences. *Motivation and Emotion*, *36*(2), 181–194. https://doi.org/10.1007/s11031-011-9234-9

Wang, Y., Yang, H., Montag, C., and Elhai, J. D. (2020). Boredom Proneness and Rumination Mediate Relationships Between Depression and Anxiety with Problematic Smartphone Use Severity. *Current Psychology*, 1–11. https://doi.org/10.1007/s12144-020-01052-0

Weiss, E. R., Todman, M., Maple, E., and Bunn, R. R. (2022). Boredom in a Time of Uncertainty: State and Trait Boredom's Associations with Psychological Health During COVID-19. *Behavioral Sciences*, *12*(8), 298. https://doi.org/10.3390/bs12080298

Westgate, E. C., and Wilson, T. D. (2018). Boring Thoughts and Bored Minds: The MAC Model of Boredom and Cognitive Engagement. *Psychological Review*, *125*(5), 689. https://dx.doi.org/10.1037/rev0000097

Weybright, E. H., Schulenberg, J., and Caldwell, L. L. (2020). More Bored Today than Yesterday? National Trends in Adolescent Boredom from 2008 to 2017. *Journal of Adolescent Health*, *66*(3), 360–365. https://doi.org/10.1016/j.jadohealth.2019.09.021

Willging, C. E., Quintero, G. A., and Lilliott, E. A. (2014). Hitting the Wall: Youth Perspectives on Boredom, Trouble, and Drug Use Dynamics in Rural New Mexico. *Youth & Society*, *46*(1), 3–29. https://doi.org/10.1177/0044118X11423231

Wilson, T. D., Reinhard, D. A., Westgate, E. C., Gilbert, D. T., Ellerbeck, N., Hahn, C., and Shaked, A. (2014). Just Think: The Challenges of the Disengaged Mind. *Science*, *345*(6192), 75–77. https://www.science.org/doi/10.1126/science.1250830

Wolff, W., Martarelli, C. S., Schüler, J., and Bieleke, M. (2020). High Boredom Proneness and Low Trait Self-control Impair Adherence to Social Distancing Guidelines During the COVID-

19 Pandemic. *International Journal of Environmental Research and Public Health*, *17*(15), 5420. https://dx.doi.org/10.3390/ijerph17155420

Wolniewicz, C. A., Rozgonjuk, D., and Elhai, J. D. (2020). Boredom Proneness and Fear of Missing out Mediate Relations Between Depression and Anxiety with Problematic Smartphone Use. *Human Behavior and Emerging Technologies*, *2*(1), 61–70. https://doi.org/10.1002/hbe2.159

Yang, X. J., Liu, Q. Q., Lian, S. L., and Zhou, Z. K. (2020). Are Bored Minds More Likely to Be Addicted? The Relationship Between Boredom Proneness and Problematic Mobile Phone Use. *Addictive Behaviors*, *108*, 106426. https://doi.org/10.1016/j.addbeh.2020.106426

Yawata, Y., Shikano, Y., Ogasawara, J., Makino, K., Kashima, T., Ihara, K., and Ikegaya, Y. (2023). Mesolimbic Dopamine Release Precedes Actively Sought Aversive Stimuli in Mice. *Nature Communications*, *14*(1), 2433. https://doi.org/10.1038/s41467-023-38130-3

Yu, Y., Chang, A. Y., and Kanai, R. (2019). Boredom-driven Curious Learning by Homeo-heterostatic Value Gradients. *Frontiers in Neurorobotics*, *88*. https://doi.org/10.3389/fnbot.2018.00088