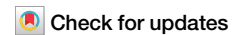


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Effortful leisure is a source of meaning in everyday life



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People derive much purpose from their work, yet time spent on work is decreasing. Here, we ask if effortful leisure is a powerful source of meaning and purpose that could supplement the reduction in labor time. In five studies ($N = 2569$), we investigated the relationship between effort and meaning in leisure activities. In Study 1 ($N = 1145$), we found that participants rated effortful activities as more meaningful, although less enjoyable, suggesting a trade-off between eudaimonic and hedonic wellbeing. Studies 2a ($N = 375$), 2b ($N = 389$), and 3 ($N = 400$) provided causal evidence by comparing effortful (Sudoku puzzling) and non-effortful leisure (watching videos in Studies 2a and 2b; Click-to-Reveal game in Study 3). Effortful activities consistently felt more meaningful, though the effects plateaued at higher levels of effort. Finally, Study 4 ($N = 260$) used experience sampling to assess activities as they occurred in real life. Effortful leisure fostered meaning while maintaining enjoyment, whereas other activities tended to feel less enjoyable with increased effort. Across all studies, we found that effort promotes meaningful experiences, particularly in leisure contexts, where effort does not diminish enjoyment. Effortful leisure may offer a powerful opportunity to supplement or replace the once plentiful purpose we derived from our now diminishing time at work.

Far and away the best prize that life has to offer is the chance to work hard at work worth doing—even in our leisure.

—Theodore Roosevelt (1916)¹

Currently, work accounts for about 50% of waking time expended by the average employed American^{2–4}. However, total labor time has been trending down for over 100 years with leisure time steadily increasing^{5–7}. Looming on the horizon is the so-called automation bomb—the possibility that around 45% of jobs across many industrialized countries will be forfeited to robots or other automated processes^{8–11}. Workers thus face a future where labor hours will significantly decrease and leisure hours drastically increase¹². Here, we explore whether a future life with less work and more play will be a meaningful one.

Leisure has long been identified as a desirable pursuit and labor a necessary evil to achieve it¹³. People will even sacrifice pay for more leisure time¹⁴. However, despite its bad reputation, labor is a significant source of meaning and purpose for many people^{15–21}. If people work less and engage in leisure more will their lives feel less meaningful? Here, we suggest that this depends on how people spend their leisure time.

For many people, relaxation is a default motivation for leisure²². This is why low-effort activities, such as TV watching dominate people's free time²³. But consider activities like volunteering, recreational sports, video games,

and puzzling. These activities are often high in effort demands. Leisure, then, is more identifiable by autonomous choice—activities we engage with without any obligation, compulsion, or need^{13,24–27} and which we do because we enjoy them²⁸. Because of this, leisure is credited as a major source of physical and psychological wellbeing in life^{29–34}, enhancing positive affect and reducing negative affect^{33–35}. Though this makes sense for relaxing forms of leisure such as watching TV or reading a book³⁶, a myriad of mechanisms are believed to explain the effects of leisure more generally, including affiliation, mastery, and meaning²⁶.

If the need for human labor drops significantly, people will need to source meaning from other domains. One might assume that a life of leisure is desirable because it is an abundant source of happiness—specifically enjoyment^{37–41}. Yet, the relationship between leisure and wellbeing is not linear; too much or too little tends to be a bad thing⁴². This makes sense given that work and productive activities more generally are a source of meaning and purpose whereas many leisurely activities are just simply fun^{20,24,25,43}. There is, however, a specific category of leisure that fulfills many of the roles that labor does in our lives: serious leisure.

Leisure is often characterized by relatively low mental or physical activity—a break from the tiring labor of work⁴⁴. This is why many have suggested leisure contributes to wellbeing through replenishing spent cognitive resources^{22,26,45–48}. However, resource models of energy consumption

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and recovery have been critiqued for being both theoretically incoherent^{49,50} and empirically not replicable^{51–53}. Further, many people are invigorated by challenging and effortful leisure activities, and leisure that is high in effort generates better mental health outcomes such as resilience⁵⁴. Serious leisure is one such exemplar.

Serious leisure can be defined as “the systematic pursuit of an amateur, hobbyist, or volunteer activity sufficiently substantial, interesting, and fulfilling for the participant to find a (leisure) career there acquiring and expressing a combination of its special skills, knowledge, and experience”⁵⁵ (p. 498). Like other forms of leisure, serious leisure can be pleasurable, but distinct in its contributions to eudaimonic wellbeing^{26,36,55–62}. Eudaimonic wellbeing is one of two commonly discussed parts of wellbeing. It focuses on meaning, growth, and fulfillments while hedonic wellbeing refers to pleasure or an absence of negative affect¹⁵. Serious leisure is challenging in the ways that work can be^{56,59,63,64}.

We suspect that serious leisure might be particularly good for generating meaning in life for a simple reason: serious leisure is effortful. Effort reflects the exertion of mental or physical force to overcome resistance in pursuit of a goal^{65,66}. We focus on the phenomenological experience of effort, a construct that is aversive but valuable⁶⁷. Effort appears to generate feelings of meaning even on tasks that are highly artificial, lacking clear meaning or purpose^{68,69} and some people seem to find effort particularly meaningful⁷⁰. Our goal is to investigate effort as a specific dimension of serious leisure.

Effortful leisure may be a potent source for eudaimonic wellbeing because it satisfies basic psychological needs, particularly competency and autonomy—two antecedents of eudaimonic wellbeing^{17,71}. During the COVID-19 pandemic, a time period marked by a significant increase in leisure time for many, the pursuit of leisure with the goal of using one’s mind or honing one’s skills and abilities was the most predictive of well-being outcomes⁷². Subjectively effortful challenges enhance feelings of competency⁷³ and activities perceived as autonomous foster both eudaimonic and hedonic wellbeing^{74,75}. Interestingly, effort and autonomy have been observed to interact in differing ways. Tasks that feel autonomous encourage greater effort on that task, and this can make us happier^{76–79}. On the other hand, effortful tasks can bring about deeper work engagement and higher positive affect through feelings of autonomy⁸⁰.

To our knowledge, experimental evidence that effortful or serious leisure feels meaningful has been limited to domains assessing purely hypothetical pro-social activities⁸¹. We seek to extend this work by demonstrating serious leisure broadly feels more meaningful, both hypothetically and in practice, after having exerted actual effort. Further, most studies examine the relationship between serious leisure and eudaimonic wellbeing. These studies have been correlational, and those that have looked specifically at meaning have looked only at broad ascriptions of meaning in life. Here, we are interested in whether effortful activities feel meaningful in the moment and not just whether people who typically engage in serious leisure also tend to have meaningful lives. We present a series of studies providing converging evidence that effortful uses of one’s labor and leisure time are particularly meaningful, and that effortful leisure activities generate more meaning than their less effortful counterparts.

In Study 1 we correlate effort, meaning, pleasure, and perceptions of autonomy across an extensive list of activities people encounter in their daily lives. In Studies 2a, 2b and 3 we experimentally test the effects of effortful leisure (Sudoku puzzling) on experiences of meaning and enjoyment when compared with non-effortful leisure (YouTube videos in Studies 2a and 2b; a “Click-to-Reveal” game in Study 3). Finally, in Study 4 we ran an experience sampling study to examine how in the context of everyday life exerting more effort predicted how meaningful and pleasant different activities felt.

Methods

All studies were approved by the University of Toronto Research Ethics Board. All participants provided informed consent prior to beginning each study. We did not collect any data regarding participant race or ethnicity. In all studies except for Study 1, participants self-reported their sex across four options: male, female, none of the above, and prefer not to disclose. The self-

report item was either contained in our survey, or part of the online participant recruitment platform demographic information.

Preregistration

All methods, analyses, and predictions for Studies 2b, 3, and 4 were pre-registered on As Predicted (Study 2a, preregistered on November 28, 2022: <https://osf.io/qjasz>; Study 3, preregistered on April 24, 2025: <https://osf.io/85res>; Study 4, preregistered on March 27, 2024: <https://osf.io/pgqkn>).

Study 1

In Study 1, we looked for a general relationship between effort and meaning in the activities people participate in throughout daily life. To do this, we provided participants with a list modified from those seen in previous research (e.g., socializing, exercising, volunteering, watching television)⁸². For all activities, we asked participants to rate generally how effortful they feel, how meaningful they feel, how enjoyable they feel, and how in control participants feel during the activities. We also asked participants to respond to the Meaningfulness of Effort Scale⁷⁰. People higher in meaningfulness of effort report greater purpose and significance when they push themselves or are really trying. We wondered whether people high in this trait might find effortful activities especially meaningful.

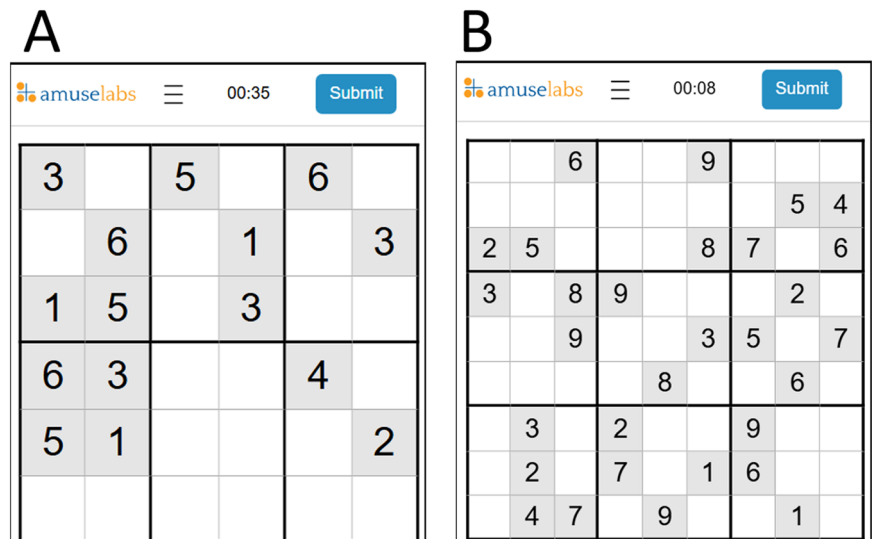
We recruited 1145 undergraduate participants enrolled in an introductory psychology course. Participants received course credit for their participation in our study. Our sample comes from an ethnically diverse, research-intensive major Canadian university. As Study 1 is exploratory, we did not pre-register predictions. Demographic data was not collected for throughout Study 1.

Participants that consented were provided with a list of possible activities they may participate in during daily life. They were presented with this list up to four times, each time asking them to rate each activity on a different dimension. During the first presentation, participants rated activity effort levels by responding to the prompt “Please indicate how effortful it is to complete each of the following tasks. By effortful we mean the task is physically or mentally demanding, requiring hard work”. For the second presentation, participants rated meaningfulness felt during activities by responding to the prompt “Please indicate how meaningful it is to complete each of the following tasks. By meaningful we mean the task is significant and principled, and brings about a clear sense of purpose”. In the third presentation participants rated levels of enjoyment for each activity by responding to the prompt “Please indicate how happy you feel completing each of the following tasks. By happy we mean the task produces a feeling of joy, reward and/or contentment”. Finally, in the fourth presentation, participants rated feelings of freedom or autonomy by responding to the prompt “Please indicate how much freedom you have to complete each of the following tasks. By freedom we mean the ability to freely choose when and how to do each task; freedom refers to the level of flexibility you have to complete each task”. All ratings were made on a 7-point Likert scale. Participants also completed the Meaningfulness of Effort scale (e.g., “When I push myself, what I’m doing feels important.”)⁷⁰.

To categorize activities into leisure versus non-leisure, we had five research assistants blindly rate all activities as either leisurely or not. This gave us a rating from 0 to 5 (0—All rated as not leisure to 5—All rated as leisure). For analyses, we wanted to ensure that we looked at all activities together and exclusively leisure activities. We only considered activities that had 4 or 5 ratings in favor of leisure for leisure-only analyses. For a list of all activities, their leisure scores, and their ratings across effort, meaning, and enjoyment, see Supplementary Table 1 in Supplemental Materials.

Analytic procedures. We had two primary goals for our analyses: (1) to test the extent that effort predicts meaning across leisure activities, and (2) to provide a broad descriptive account of whether more effortful activities also tend to be more meaningful. For the first objective, we decided to run a hierarchical model with a random intercept for participants to account for clustering using the *lme4*⁸³ and *lmerTest*⁸⁴ packages in R. We centered effort within-subjects and used it as a predictor of

Fig. 1 | Medium (Panel A) and Hard (Panel B) Sudoku Tasks in Studies 2a and 2b. *Note.* Panel A contains a 6x6 grid Sudoku puzzle. Panel B contains a 9x9 Sudoku puzzle. Both puzzles provided participants with a timer at the top of the user interface. After completion, participants were prompted to select the submit button so that puzzle completion data could be collected.



ratings of meaning in the model. For the second objective, we plotted activities based on their centered effort and meaning ratings. This graph allows us to see what activities might coincide with a positive effort-meaning relationship and which activities are exceptions to this relationship.

Study 2a and 2b

In Studies 2a and 2b, we wanted to extend the hypothetical and correlational findings from Study 1 by comparing effortful leisure against less effortful leisure in an experimental context. We partnered with Amuse Labs (amuselabs.com), a puzzle making company, to test the experiences of participants while they were puzzling versus watching an entertaining video. Prior evidence suggests that effort's relationship with meaning is curvilinear⁶⁸, such that effortful tasks feel more meaningful up to a point, after which, increases in meaning begin to plateau. Based on this, we compared a low effort condition against a medium effort and high effort condition on feelings of meaningfulness, enjoyment, and boredom. In Study 2b, we replicated Study 2a in a general adult population. We also wanted to include two possible mechanisms, mastery orientation and competency satisfaction.

In Study 2a, we recruited 375 undergraduate participants ($M_{\text{age}} = 18.8$, $SD_{\text{age}} = 1.7$; female = 67.7%, male = 30.9%, prefer not to answer = 1.4%) enrolled in an introductory psychology and they received course credits for their participation. In Study 2b, we recruited 389 participants ($M_{\text{age}} = 40.3$, $SD_{\text{age}} = 13.6$; female = 59.3%, male = 35.2%, prefer not to answer = 5.5%) from the online participant recruitment platform, Prolific Academic. All participants were required to have some Sudoku puzzling experience and received and received £1.75 as compensation for their participation.

Participants were randomly assigned to one of two puzzle conditions, a medium-difficulty 6 × 6 Sudoku puzzle and a hard-difficulty 9 × 9 Sudoku puzzle, or a video condition. Difficulty was pre-determined by Amuse Labs' standardized definition relying on types of logical strategies required to complete the puzzles. The two puzzles are pictured in Fig. 1 as presented to participants. The video conditions consisted of a compilation of “cute and funny animal moments” from YouTube.

Based on our pre-registered exclusion criteria for Study 2a, we removed participants who 215 failed to get 20% of boxes correct within the sudoku puzzles or those that failed to answer 1 out of 216 of 3 attention check questions during the video condition. This led to a final sample of 276,217 participants (27 removed from the medium puzzle, 54 removed from the hard puzzle, and 18,218 from the video condition). Because we did not pre-register Study 2b, we analyzed results both 219 mirroring the exclusion criteria from Study 2a and looking at the data without any exclusions. 220 Overall, the findings did not vary notably with or without exclusions

Measures. After completing their puzzle or video task, participants rated its effortfulness using a modified NASA Task Load Index⁸⁵, which consists of six items on 7-point scales. Because physical effort was not involved in this manipulation, we removed an item pertaining to it (i.e., “How physically demanding was this task?”). Items included in our measure were “how mentally demanding was the task?”, “how hurried or rushed was the pace of the task?”, “how successful were you in accomplishing what you were asked to do?”, “how hard did you have to work to accomplish your level of performance?”, and “how insecure, discouraged, irritated, stressed, and annoyed were you?”. In addition to these items, each participant answered the following items on 7-point scales (1 “Very Low” to 7 “Very High”): “how meaningful did you find this task?”, “how useful and important did you find this task?”, “how bored were you while completing this task?”, “how enjoyable did you find this task?”, and “how satisfied/content did you feel after completing this task?”. Meaningfulness was measured by combining the meaning and importance items ($r = 0.81$).

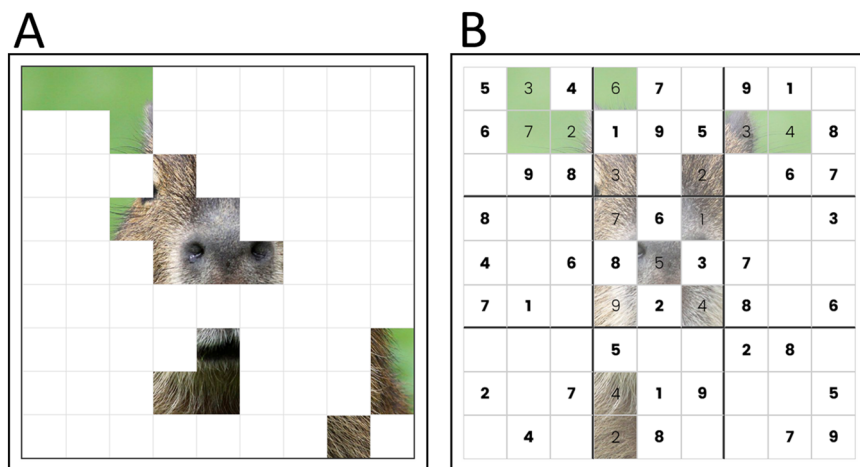
In Study 2b, we added measures of competency, mastery, and autonomy. Autonomy was assessed using a modified autonomy satisfaction scale (e.g., “I had considerable opportunity for independence and freedom in how I completed the task”)⁸⁶. Competency was measured by combining one item from the Player Experience of Need Satisfaction scale (“I felt competent at this task”)⁸⁷ with three items from the Basic Psychological Need Satisfaction at Work scale (e.g., “I felt able to meet the challenge of performing well in this task”)⁸⁸. Mastery orientation was assessed using the mastery-approach scale (e.g., “It was important for me to master all aspects of my performance for this task”)⁸⁹.

Study 3

We recruited 400 participants from Prolific Academic ($M_{\text{age}} = 39.08$, $SD_{\text{age}} = 13.39$; female = 49.1%, male = 50.6%, prefer not to answer = 0.4%). Unlike Studies 2a and 2b, we did not require participants to have puzzling experience. At the beginning of the study, participants were informed that they would complete a task that would gradually reveal a hidden image. We asked participants to fully uncover the image as they would be asked for details about it later on. Participants were paid an average hourly rate of £9.00 per hour (£0.4 for the click-to-reveal task, £2.00 for the Sudoku puzzle).

The goal of Study 3 was to extend Studies 2a and 2b comparing two active tasks. We randomly assigned participants to one of two conditions, a 9 × 9 Sudoku puzzle similar to the one provided in the hard puzzles from Study 2a and 2b or a click-to-reveal condition. As with Studies 2a and 2b, it was possible to solve the 9 × 9 Sudoku through elimination. When a box is

Fig. 2 | Click-to-Reveal (Panel A) and Sudoku (Panel B) Tasks in Study 3. *Note.* Panel A contains a partially completed 9x9 matrix of tiles, the click-to-reveal task. Panel B contains a partially completed 9x9 matrix of numbered tiles, the Sudoku task. In Panel A, as tiles were clicked, they faded to reveal the hidden image, a capybara, behind. In Panel B, as correct values were entered, the white background faded to reveal the hidden image, a capybara, behind.



entered correctly, the background of the tile fades out but the entered number remains visible to ensure that participants can continue solving the remainder of the puzzle. The click-to-reveal task involved a 9×9 matrix of tiles identical in size to the Sudoku. To complete this task, participants had to click each tile, leading to the tiles disappearing. For both tasks, when the tile faded out, a part of a hidden image of a capybara was revealed. When the Sudoku puzzle was fully completed, the pre-filled stiles also faded out to reveal the full image. After either task was completed, we provided the same measures of self-reported effort, meaningfulness, and enjoyment as with Studies 2a and 2b. Figure 2 presents both the click-to-reveal task and the Sudoku task with some tiles correctly filled out.

Based on our pre-registered exclusion criteria for Study 3 we removed participants who self-admitted to not fully engaging with the task. Because we used a performance-based exclusion criteria in Study 2a, we looked at results excluding those who failed to reveal 20% of tiles. We also ran analyses with no exclusion criteria. Overall, the findings did not vary notably with or without exclusions.

Study 4

In Study 4, we explored the experiences of varying activities in peoples' daily lives. Specifically, we preregistered a number of hypotheses based on findings from Studies 1 and 2 as Study 3 was conducted after Study 4. We predicted that when individuals exert more effort than their own average on an activity, they will also find that activity more meaningful. Similarly, individuals who exert more effort on average than their peers will report activities to be more meaningful. We also predicted that more effortful activities and more effort-exerting individuals will report activities as less enjoyable. An experience sampling approach lets us directly test these relationships during an actual activity from daily life. We do not expect the effects of effort to be unique to leisure. Instead, we argue that effort is a core aspect of many activities that feel meaningful.

Participants and procedures. Participants with active social media accounts were recruited via Cloud Connect for an 8-day study ($N = 260$, $M_{\text{age}} = 35$, 145 males 109 females 7 other/prefer not to say/non-response). Upon recruitment, they were directed to read and sign an Informed Consent form. Following consent, participants downloaded the Avicenna app and completed a Welcome Survey to gather baseline individual difference measures. For a list of these items, see Supplemental Materials. Participants received up to \$20 for completing over 75% of their check-in prompts along with the initial and midpoint surveys.

Following this, participants were prompted over 6 days to complete five Check-In Surveys distributed at random intervals within designated time windows between 10 am and 9:45 pm. During the Check-In, participants reported other primary activity in the past 30 min on a provided checklist (e.g., working, eating, exercising, social media) and how much time was

spent on that activity. The list of activities provided to participants was derived from the list used in Study 1 along with additions from Choi and colleagues (2017)^{82,90}. Participants rated the activity on several dimensions including effortfulness ("Please indicate how effortful this activity was. By effortful we mean the activity is physically or mentally demanding, requiring hard work."), meaningfulness ("Please indicate how meaningful this activity was. By meaningful we mean the activity is significant and important, and brings about a clear sense of purpose."), enjoyment ("Please indicate how happy this activity made you feel. By happy we mean the activity produces a feeling of joy, reward and/or contentment."), autonomy, and competency on a scale from 0 (not at all) to 7 (extremely). We used the leisure ratings from Study 1 for activities that overlapped between lists. For any new activity, we had five research assistants rate them using the same procedures as Study 1.

Results

Study 1

We considered whether people perceive effortful activities differently depending on whether they are leisure or not. We found a relatively unified perception of effortful activities. Below, we report effects only looking at leisure activities and looking at all activities, for analyses of non-leisure activities, see Supplemental Materials. Leisure activities rated as more effortful were also rated as more meaningful ($b = 0.1$, $SE = 0.005$, $p < 0.001$, 95% CI [0.086, 0.106]). These effects grew stronger when we controlled for ratings of enjoyment ($b = 0.15$, $SE = 0.007$, $p < 0.001$, 95% CI [0.133, 0.159] for effort; $b = 0.5$, $SE = 0.007$, $p < 0.001$, 95% CI [0.487, 0.513] for enjoyment). This suggests that enjoyment plays a suppressing role in the effort-meaning relationship. Indeed, we found that effort negatively predicts feelings of enjoyment ($b = -0.04$, $SE = 0.006$, $p < 0.001$, 95% CI [-0.052, -0.028]). While effortful activities feel more meaningful, they also seem to feel less pleasurable. Meanwhile, enjoyable activities tend to also feel more meaningful. Thus, when we held hedonic wellbeing constant, a stronger relationship between effort and eudaimonic wellbeing emerged. These findings highlight the effort paradox⁶⁷. While effort may feel aversive, it seems to also hold some value. These analyses held for all activities: effort ratings predicted reported meaningfulness both on its own ($b = 0.04$, $SE = 0.003$, $p < 0.0001$, 95% CI [0.03, 0.043]) and when controlling for enjoyment ($b = 0.14$, $SE = 0.004$, $p < .001$, 95% CI [0.135, 0.151] for effort; $b = 0.49$, $SE = 0.004$, $p < 0.001$, 95% CI [0.484, 0.499] for enjoyment). For a plot of activities along effort and meaning dimensions, see Fig. 3. For an analysis of non-leisure activities, see the Supplementary Materials.

Individual differences. In a set of exploratory analyses, we were interested in whether or not meaningfulness of effort, a personality trait which describes peoples' tendencies towards finding effortful endeavors meaningful, interacts with effort when predicting meaning.

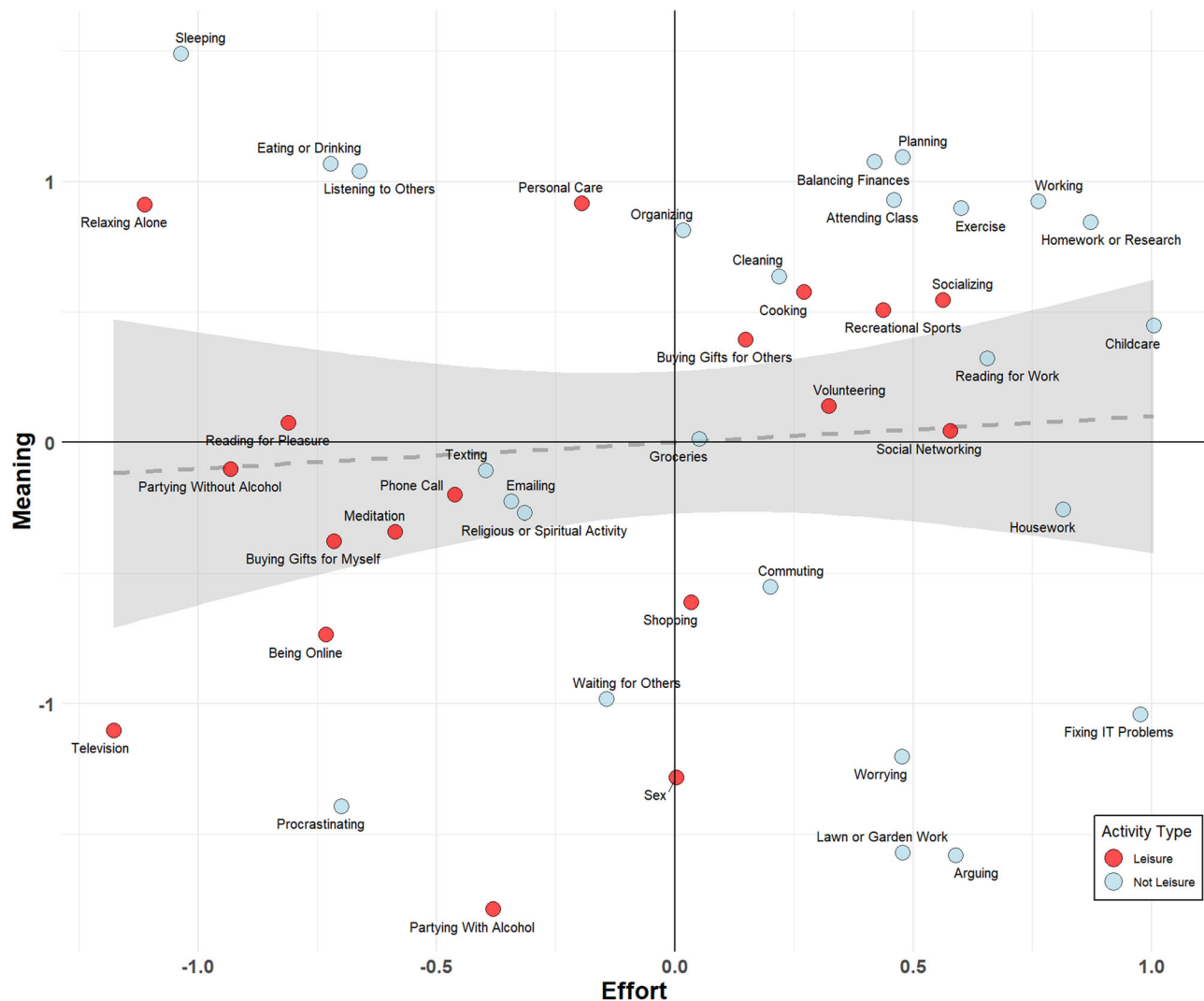


Fig. 3 | Plot of Activities Across Grand-Mean Centered Effort and Meaning for Study 1. Note. Color corresponds with whether an activity was rated as leisure a majority of the time (i.e., 3 or more ratings out of 5). Red denotes a leisure activity; blue denotes a non-leisure activity. Line of best fit for Grand-mean centered activity

ratings with shaded area representing standard error around the mean presented in the background ($n = 43$ activities). For a plot with lines of best fit split by activity type, see Supplemental Materials.

We ran a model similar to the prior hierarchical model, looking only at leisure, but with an interaction term between within-person centered effort and grand mean-centered meaningfulness of effort. First, we found main effects for meaningfulness of effort ($b = 0.19$, $SE = 0.033$, $p < .001$, 95% CI [0.127, 0.258]) and effort ($b = 0.09$, $SE = 0.005$, $p < 0.001$, 95% CI [0.084, 0.104]), suggesting that people higher in meaningfulness of effort tend to find activities more meaningful; but most people tend to report effortful activities as also being meaningful. Critically, we found that effort and trait meaningfulness of effort interacted when predicting meaning ($b = 0.077$, $SE = 0.008$, $p < 0.001$, 95% CI [0.06, 0.094]), with people high in meaningfulness of effort having a tighter relationship between meaning and effort ($b = 0.14$, $SE = 0.007$, 95% CI [0.122, 0.149]) than those low in meaningfulness of effort ($b = 0.05$, $SE = 0.007$, 95% CI [0.038, 0.066]; see Fig. 4 for a visualization of these simple slope effects).

Study 2a and 2b

Study 2a. As an initial manipulation check, we found a significant main effect of condition on self-reported effort $F(2, 273) = 37.82$, $p < 0.001$, partial $\eta^2 = 0.22$, 95% CI [0.14, 0.3]. The Tukey's HSD post-

hoc test revealed that the hard Sudoku puzzle was rated as significantly more effortful than the medium Sudoku puzzle ($M = 4.09$ and $M = 2.95$, respectively; $SE = 0.2$, $p < 0.001$); and the medium Sudoku and hard Sudoku were both rated as more effortful than the video condition ($M = 2.47$; $SE = 0.18$, $p = 0.02$ and $SE = 0.19$, $p < 0.001$, respectively).

For our main analysis, we found a significant effect of condition on perceived task meaningfulness $F(2, 273) = 13.52$, $p < 0.001$, partial $\eta^2 = 0.09$, 95% CI [0.03, 0.16]. With a Tukey's HSD post-hoc test we found no statistically significant difference between the hard and medium Sudoku puzzles ($M = 3.62$ and $M = 3.36$, respectively; $SE = 0.23$, $p = 0.48$); and the medium and hard Sudoku were both rated as more meaningful than the video condition ($M = 2.61$; $SE = 0.20$, $p < 0.001$ and $SE = 0.21$, $p < .001$, respectively; see Fig. 5). Here we can see that the more effortful puzzles are both experienced as more meaningful relative to the video condition.

We also found a condition effect on task enjoyment $F(2, 250) = 8.96$, $p < 0.001$, partial $\eta^2 = 0.07$, 95% CI [0.02, 0.13]. The medium and hard Sudoku puzzles were rated similarly in terms of enjoyment ($M = 5$, $M = 4.71$, respectively; $SE = 0.27$, $p = 0.54$). Surprisingly, the medium and hard Sudoku puzzles were both rated as more enjoyable than the video condition ($M = 3.99$; $SE = 0.25$, $p < 0.001$ and $SE = 0.26$, $p = 0.017$,

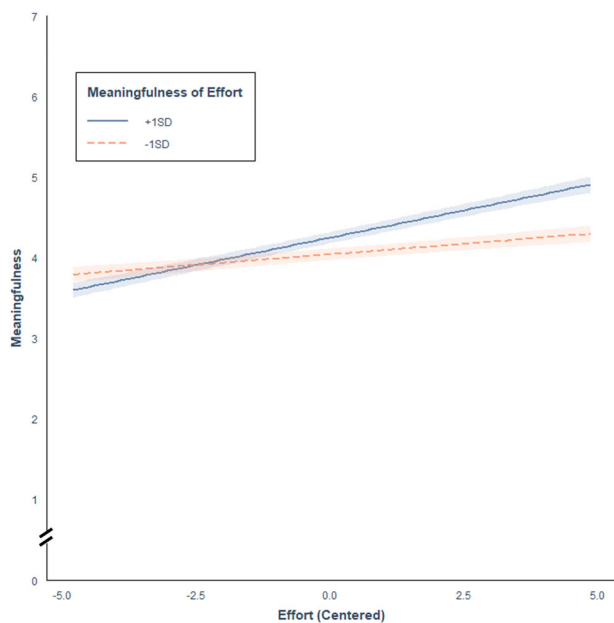


Fig. 4 | Plot of Effort-Meaningfulness of Effort Interaction Predicting Leisure Meaningfulness. Note. Shaded region represents the Standard Error (SE) around the mean ($n = 91,760$ observations across 1145 participants).

respectively). Effort feels unpleasant, so it is interesting to see a context in which an effortful task feels more enjoyable. Together, these findings indicate that the puzzles are generally more enjoyable and meaningful, despite their effortful nature.

Study 2b. As with Study 2a, the manipulation effect on effort was strong, $F(2, 386) = 129.74$, $p < 0.001$, partial $\eta^2 = 0.4$, 95% CI [0.33, 0.47]. The Tukey's HSD post-hoc test demonstrated that the hard Sudoku puzzle was rated as more effortful than the medium Sudoku puzzle ($M = 4.52$ and $M = 3.76$, respectively; $SE = 0.17$, $p < 0.001$); and the medium Sudoku and hard Sudoku were both rated as more effortful than the video condition ($M = 1.96$; $SE = 0.16$, $p < 0.001$ for the medium Sudoku and $SE = 0.16$, $p < 0.001$ for the hard Sudoku).

For our main analysis, we found a significant effort effect on rated meaningfulness, $F(2, 386) = 32.71$, $p < 0.001$, partial $\eta^2 = 0.15$, 95% CI [0.08, 0.21]. Our post-hoc analyses revealed no statistically significant difference between the medium and hard difficulty Sudoku puzzles ($M = 3.63$ for the medium Sudoku and $M = 3.63$ for the hard Sudoku, $SE = 0.18$, $p > 0.999$), however both puzzles were rated as more meaningful than the video condition ($M = 2.38$; $SE = 0.18$, $p < 0.001$ for the medium Sudoku and $SE = 0.18$, $p < 0.001$ for the hard Sudoku; see Fig. 5).

We combined the samples of Studies 2a and 2b to explore whether or not there was a significant curvilinear relationship between self-reported effort and meaningfulness. We included both a linear and squared term for self-reported effort in a linear model predicting meaning. We found a significant effect of linear effort on meaning ($b = 0.64$, $SE = 0.16$, $p < 0.001$, 95% CI [0.34, 0.95]) and a significant curvilinear effect of effort on meaning ($b = -0.06$, $SE = 0.02$, $p = 0.004$, 95% CI [-0.105, -0.02]). The more effortful the task, the more meaningful, but after a certain point, the relationship began to plateau—even showing signs of decreasing. See Fig. 6 for a plot of the relationship observed.

We found no statistically significant difference in ratings of enjoyment across all conditions ($M = 4.78$ for the medium puzzle, $M = 4.6$ for the hard puzzle, and $M = 4.78$ for the video; $F(2, 386) = 0.49$, $p = 0.616$, partial $\eta^2 = 0.003$, 95% CI [0, 0.02]). Overall, we observed a split between eudaimonic and hedonic experiences. While the effortful puzzling conditions were a source of meaning when compared with watching a YouTube video, we failed to find evidence of a difference in ratings of enjoyment between

conditions, though all conditions were rated as moderately enjoyable (i.e., 4.5 out of 7).

We ran analyses looking at effort's relationship with feelings of competency and mastery. In addition, we looked at exploratory path models from effort to meaning through ratings of mastery and competency, but found little to no evidence that either construct explains the effort-meaning relationship. For detailed results, see the Supplemental Materials.

Study 3

We ran an initial manipulation check across conditions on self-reported effort. The Sudoku puzzle was rated as significantly more effortful ($M = 3.97$, $SD = 1.24$) than the click-to-reveal task ($M = 2.37$, $SD = 1.21$; $t(391) = 12.99$, $p < 0.001$, $d = 1.31$, 95% CI [1.09, 1.53]). Further demonstrating our successful manipulation, those in the less-effortful click-to-reveal condition uncovered significantly more tiles ($M = 91.9\%$, $SD = 16.9\%$) compared with those in the Sudoku condition ($M = 76.3\%$, $SD = 37.2\%$; $t(270) = 5.34$, $p < 0.001$, $d = 0.54$, 95% CI [0.34, 0.74]).

For our main analyses, participants rated the high-effort Sudoku task to be a more meaningful experience ($M = 4.85$, $SD = 1.62$) compared with less-effortful click-to-reveal task ($M = 3.4$, $SD = 1.9$; $t(385) = 8.13$, $p < 0.001$, $d = 0.82$, 95% CI [0.61, 1.03]), as predicted in our pre-registered hypothesis. Here, we see further converging evidence that tasks similar in terms of active engagement are rated as more meaningful when they require more effort. Both tasks provided very similar experiences, though the Sudoku required a higher level of cognitive effort to gradually reveal the hidden image. Participants, in turn, experienced this cognitively effortful task as a more meaningful experience. For a plot of task meaningfulness by leisure activity, see Fig. 7.

Because of the inconsistent effects on pleasure that effort seems to have in leisure contexts, we did not pre-register any predictions for differences in ratings of enjoyment. In Study 3, we found consistent effects with Study 2a, our student sample, but this was notably a departure from Study 2b, which was also a Prolific sample. The effortful Sudoku puzzle was rated as more enjoyable ($M = 5.55$, $SD = 1.34$) compared to the less-effortful click-to-reveal task ($M = 4.96$, $SD = 1.56$; $t(386) = 4.1$, $p < 0.001$, $d = 0.41$, 95% CI [0.21, 0.61]). Thus, participants reported more pleasure or enjoyment while pushing themselves harder.

We ran another set of correlational analyses to test for curvilinear effects between self-reported effort and task meaningfulness. We saw a similar set of effects as with Studies 2a and 2b. We found a significant effect of linear effort on meaning ($b = 1.54$, $SE = 0.24$, $p < 0.001$, 95% CI [1.068, 2.013]) and a significant curvilinear effect of effort on meaning ($b = -0.13$, $SE = 0.03$, $p < 0.001$, 95% CI [-0.193, -0.058]). Again, we saw that effort and meaning show a strong positive linear relationship, but at the extreme ends of effort, we see it begin to plateau.

Study 4

Meaning across all activities. In support of our main hypotheses that effortful activities feel meaningful, we found that within-person effort predicted meaning ($b = 0.25$, $SE = 0.01$, $t(4343) = 20.95$, $p < 0.001$, $r = 0.30$, 95% CI [0.28, 0.33]). In addition, between-person effort predicted activity meaningfulness ($b = 0.38$, $SE = 0.06$, $t(191) = 6.32$, $p < 0.001$, $r = 0.42$, 95% CI [0.29, 0.53]). Together, these results imply that when we exert more effort compared to others, we tend to report all activities in our daily lives as more meaningful and when the activity involves greater effort compared to our own average levels of exertion, it also feels more meaningful. For a plot of effort by meaningfulness for each activity see Fig. 8.

Meaning across leisure activities. As with Study 1, we also looked at leisure activities specifically and found that the effects mirrored those found across all activities. We re-ran these analyses looking at different categorizations of leisure and all effects remained identical, for a summary, see Supplemental Materials. Within-person effort predicted meaning ($b = 0.26$, $SE = 0.02$, $t(2178) = 13.51$, $p < 0.001$, $r = 0.28$, 95%

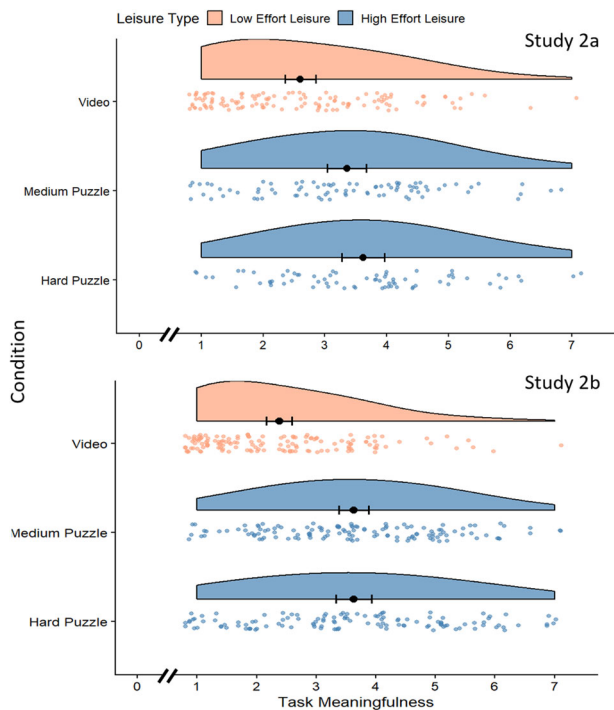


Fig. 5 | Plot of Means for Activity Meaningfulness across Conditions in Studies 2a and 2b. Note. Error bars represent Standard Error (SE) around the mean ($n_{\text{video}} = 123$, $n_{\text{medium}} = 83$, $n_{\text{hard}} = 70$ for Study 2a; $n_{\text{video}} = 139$, $n_{\text{medium}} = 129$, $n_{\text{hard}} = 121$ for Study 2b).

CI[0.24, 0.32]). In addition, between-person effort predicted leisure meaningfulness ($b = 0.40$, $SE = 0.07$, $t(185) = 5.84$, $p < .001$, $r = 0.39$, 95% CI [0.27, 0.51]). Thus, even in our leisure, more effortful activities tend to feel more meaningful in the moment.

Some of the most meaningful leisure activities were also fairly effortful such as taking a trip ($M_{\text{effort}} = 4.47$; $M_{\text{meaning}} = 6.47$), going for a walk ($M_{\text{effort}} = 4.46$; $M_{\text{meaning}} = 6.09$), socializing ($M_{\text{effort}} = 4.58$; $M_{\text{meaning}} = 5.85$), and cooking ($M_{\text{effort}} = 4.88$; $M_{\text{meaning}} = 5.72$). Though, there were some meaningful leisure activities that felt less effortful such as reading ($M_{\text{effort}} = 3.05$; $M_{\text{meaning}} = 5.92$) and listening to music ($M_{\text{effort}} = 2.28$; $M_{\text{meaning}} = 5.81$). Interestingly, we also saw that tasks similar to our low-effort condition such as watching TV ($M_{\text{effort}} = 1.87$; $M_{\text{meaning}} = 3.74$) or online videos ($M_{\text{effort}} = 1.81$; $M_{\text{meaning}} = 3.79$) were both in the low-effort, low-meaning quadrant. By contrast, board games ($M_{\text{effort}} = 3.43$; $M_{\text{meaning}} = 5.71$) and play ($M_{\text{effort}} = 4.54$; $M_{\text{meaning}} = 5.46$), activities somewhat similar to our high-effort puzzling condition, were higher in effort and meaning. Though it is worth noting that board games ($n = 7$) and general play ($n = 26$) were relatively rare observations. See the Supplementary Materials, Supplementary Table 2 for a list of all activities, their mean ratings across measures, and subsequent leisure ratings.

One activity which might be surprising is Instagram usage ($M_{\text{effort}} = 4.46$; $M_{\text{meaning}} = 5.73$). Study 4 involved collecting data from Instagram users, thus, this sample might take Instagram more seriously, or derive more value from the experience of using Instagram. We re-ran analyses while excluding Instagram and found no meaningful changes to our observed effects. For a summary of these findings, see the Supplementary Materials.

Happiness across all activities. We also anticipated that effort is aversive—it does not feel pleasurable despite feeling meaningful. In our second model, we found an interesting set of effects. On the one hand, we found support that the effort feels unpleasant. Within-person effort negatively predicted reported enjoyment of an activity ($b = -0.10$, $SE = 0.01$, $t(4358) = -9.02$, $p < .0001$, $r = 0.14$, 95% CI [0.11, 0.16]). Thus,

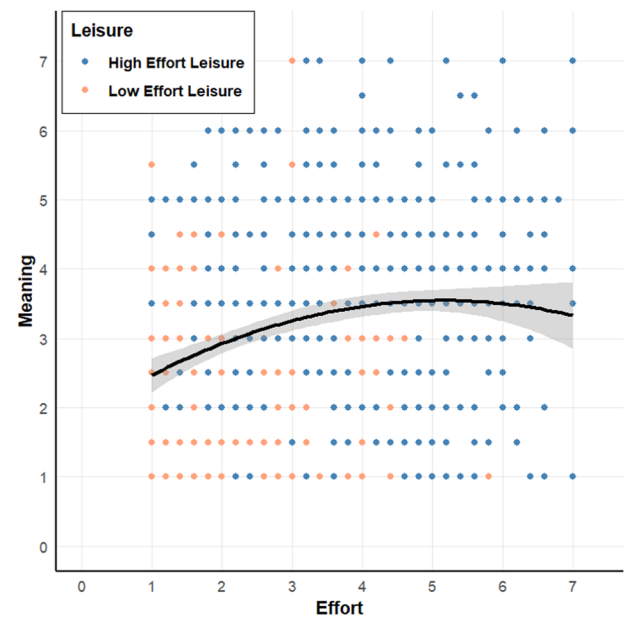


Fig. 6 | Plot of Curvilinear Relationship between Self-Reported Effort and Meaning. Note. Shaded region represents the Standard Error (SE) around the mean ($n = 389$ participants).

when people push themselves to exert more effort, the activity feels unpleasant. However, we found that between-person effort positively predicted enjoyment of an activity ($b = 0.26$, $SE = 0.06$, $t(191) = 4.23$, $p < 0.001$, $r = 0.29$, 95% CI [0.16, 0.42]). People who tend to exert more effort generally derive more pleasure from activities. These results indicate that, in the moment, effort feels unpleasant. People do not enjoy exerting more effort than their usual levels. However, overall, people who tend to exert more effort are happier. For a summary, see Fig. 9.

For non-leisure activities, work and housework were an overwhelming majority of the observations, about 75% of reported non-leisure activities. This makes sense given the significant proportion of waking hours taken up by both work and housework⁴. We re-ran these analyses excluding work and housework and found that the relationship between within-person effort and happiness became insignificant ($b = -0.005$, $SE = 0.013$, $t(3312) = -0.421$, $p = 0.674$, $r = 0.007$, 95% CI [-0.03, 0.04]) while the between person effects remained similar ($b = 0.23$, $SE = 0.06$, $t(190) = 3.87$, $p < 0.001$, $r = 0.27$, 95% CI [0.13, 0.40]).

Happiness across leisure activities. As with our meaningfulness analyses, we looked only at leisure activities. We found a divergence between leisure and all activities. Within-person effort did not predict leisure enjoyment ($b = 0.01$, $SE = 0.02$, $t(2172) = 0.76$, $p = 0.449$, $r = 0.02$, 95% CI [-0.03, 0.06]), though as observed previously, between-person effort predicted leisure enjoyment ($b = 0.26$, $SE = 0.06$, $t(198) = 4.35$, $p < 0.001$, $r = 0.3$, 95% CI [0.17, 0.43]). When only looking at leisure, we no longer see that within-person effort negatively predicts enjoyment. For a summary of both between and within-person effects observed for happiness and meaning, see Fig. 9.

Discussion

If labor is a significant source of purpose for our population^{20,91,92}, and we face a possible shortage of labor hours with a corresponding uptick in leisure time¹², it is important to identify what characteristics make an activity meaningful. Serious leisure is outlined as a unique type of leisure which benefits eudaimonic wellbeing or meaning⁵⁵. Here we identified effort as an overlapping dimension connecting serious leisure and labor, and provide robust evidence that effort plays an important role in promoting meaningful experiences across activities.

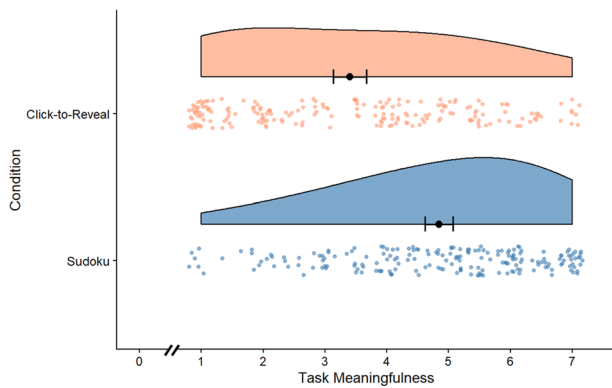


Fig. 7 | Plot of Means for Activity Meaningfulness across Conditions in Study 3.

Note. Error bars represent standard errors of the mean ($n_{\text{click-to-reveal}} = 199$, $n_{\text{sudoku}} = 195$).

In Study 1, we found a general belief people hold that suggests effortful leisure feels meaningful, but unpleasant supporting the paradoxical nature of effort⁶⁷. Effortful leisure was rated as less enjoyable but more meaningful, highlighting a divergence between eudaimonic and hedonic wellbeing⁴³. This may reflect a natural link between effort and meaningful outcomes⁹³ or a justification of effort costs^{94–96}. While it is possible that people spend more effort on meaningful activities, this does not explain why similar investments are not made in more enjoyable activities. Finally, we saw that the link between effort and meaning seems to be stronger among those who naturally find effortful pursuits meaningful⁷⁰.

In Studies 2a and 2b we causally demonstrated that effortful leisure (e.g., puzzling) feels more meaningful than passive leisure (e.g., watching videos), even when we did not see differences in ratings of enjoyment. In Study 2a, puzzles were rated as more enjoyable than the video. In Study 2b, all conditions—the hard puzzle, medium puzzle, and video—showed no significant difference in terms of enjoyment. Interestingly, the effect of effort on meaning showed diminishing returns; while the most effortful task in Study 2a was rated as more meaningful, its score was not significantly higher than the medium-difficulty puzzle. This is underscored by our exploratory correlational analysis and aligns with prior work, which demonstrates a curvilinear relationship between perceived effort and meaningfulness⁶⁸.

We replicated many of these effects in Study 3, where we saw two active tasks differing in effort similarly differed in meaning. An effortful Sudoku was still experienced as more meaningful than a less-effortful click-to-reveal task, even when the end goals were matched. Interestingly, the effortful Sudoku was more enjoyable than the less-effortful click-to-reveal activity. While it is possible that people enjoy effortfully engaging with leisure more, we did not find fully consistent results across our three experimental studies. Thus, it may depend on a mix of population characteristics and context. Our findings in Study 3 again emphasized that while effort may feel more meaningful, whether or not people enjoy that effort varies significantly.

Finally, Study 4 extended findings to real experiences in peoples' every day lives. In general, when activities in life feel more effortful, they also feel more meaningful. This is true both when our levels of exertion are high relative to those around us and relative to our own usual levels of exertion. In addition, when people are exerting more than they usually do, it feels unpleasant and unenjoyable, yet, those who generally push themselves find more enjoyment in their own activities. But, when looking only at leisure activities, there is a caveat. Effortful leisure tends to feel more meaningful, but just as enjoyable as less effortful leisure. The source of our cross-activity findings on effort's aversiveness was driven by non-leisure activities. We saw that non-leisure activities tend to feel less enjoyable when they are more effortful, but even this was nuanced. When we looked at non-leisure activities excluding work and housework, removing approximately 75% of our non-leisure observations, we no longer saw a relationship between effort and enjoyment. While this suggests effort may not be universally aversive

even in obligatory tasks, we caution against overinterpreting this given the substantially reduced sample. Overall, the findings of Study 4, and to an extent Studies 2a, 2b, and 3, somewhat contradict the expectations of participants in Study 1. Though effortful leisure was more meaningful, it was still enjoyable.

Studies 1 and 4 also provide a rich opportunity to compare the hypothetical and real experience of activities in terms of their judged effort and meaning. For one, the relationship between effort and meaning across activities becomes much stronger in practice when compared with in theory. Though we note that the divergence could be a result of the sample we used for Study 1, a younger student sample, making hypothetical judgments for the listed activities. University students may not have a significant reference point for some of the activities. This might explain why, in Study 1, childcare was notably lower in rated meaningfulness compared with Study 4's general adult sample. Additionally, sleeping in Study 1 was one of the most meaningful activities whereas in Study 4 it was below average. By contrast meditation, a traditionally meaningful experience, was expected to be less meaningful to younger adults who are less likely to participate in meditation^{97,98}. Finally, some activities can still be meaningful even when they are not challenging. Socializing with others or activities that are highly engaging, even if low in effort, such as reading and listening to music can be sources of meaning⁹⁹.

Leisure studies

Our findings bridge two growing empirical bodies, the psychological benefits of serious leisure and the value of effort. Leisure provides needed boosts to happiness and general mood^{26,33,34}, and serious leisure has emerged as a particularly potent source of eudaimonic wellbeing⁵⁵. Despite criticisms towards its theoretical definition, research has begun identifying possible mechanisms explaining why serious leisure does lead to fulfillment and meaningfulness^{58,100,101}. Here, we suggest that serious leisure shares a characteristic—effortfulness—with many other meaningful experiences throughout our lives and that this shared characteristic in-part drives the eudaimonic benefits observed.

We provide both causal and correlational evidence that effort itself is one important dimension contributing to the differences between serious and non-serious leisure. We also help address a longstanding question in the meaning literature: where do sources of everyday meaning come from^{102–104}? Effortful activities broadly feel more meaningful, both for leisure and non-leisure. Past research suggests that the effortful pursuit of skills and personal growth partly explains the link between leisure and a life worth living in Japanese students¹⁰¹.

We do not seek to discount the pursuit of personal growth or feelings of competency and investment into activities as likely mechanisms for the relationship between serious leisure and eudaimonic wellbeing. Effort is a significant driver of competency satisfaction when challenge levels match skill⁷³. It is also an inherent part of pushing oneself in pursuit of personal growth such as in the case of deliberate practice, where sustained effort, even if potentially aversive, builds mastery over time^{105–107}. These processes represent longitudinal applications of effort in pursuit of personal growth. In these contexts, effort operates as a necessary path towards meaningful outcomes. Our experiments focus on discrete tasks, where these processes are less salient. The effort-meaning link we observe may reflect the onset of rewarding feelings which help sustain people through effortful pursuits. Thus, our findings isolate effort's immediate effects, which may seed the longer-term pathways that frameworks such as the RAGE to Master or deliberate practice models describe. While finding effort inherently meaningful might serve as an adaptive way to sustain effortful growth, we also believe there are some other appealing candidate explanations for our findings worth considering.

We might ascribe value to effort as a means of justifying effortful exertion in contexts where it feels aversive^{94–96,108–110}. It is unlikely that cognitive dissonance explains the experimental results, as participants randomly assigned to conditions have no choice requiring justification and even if participants felt the need to justify their

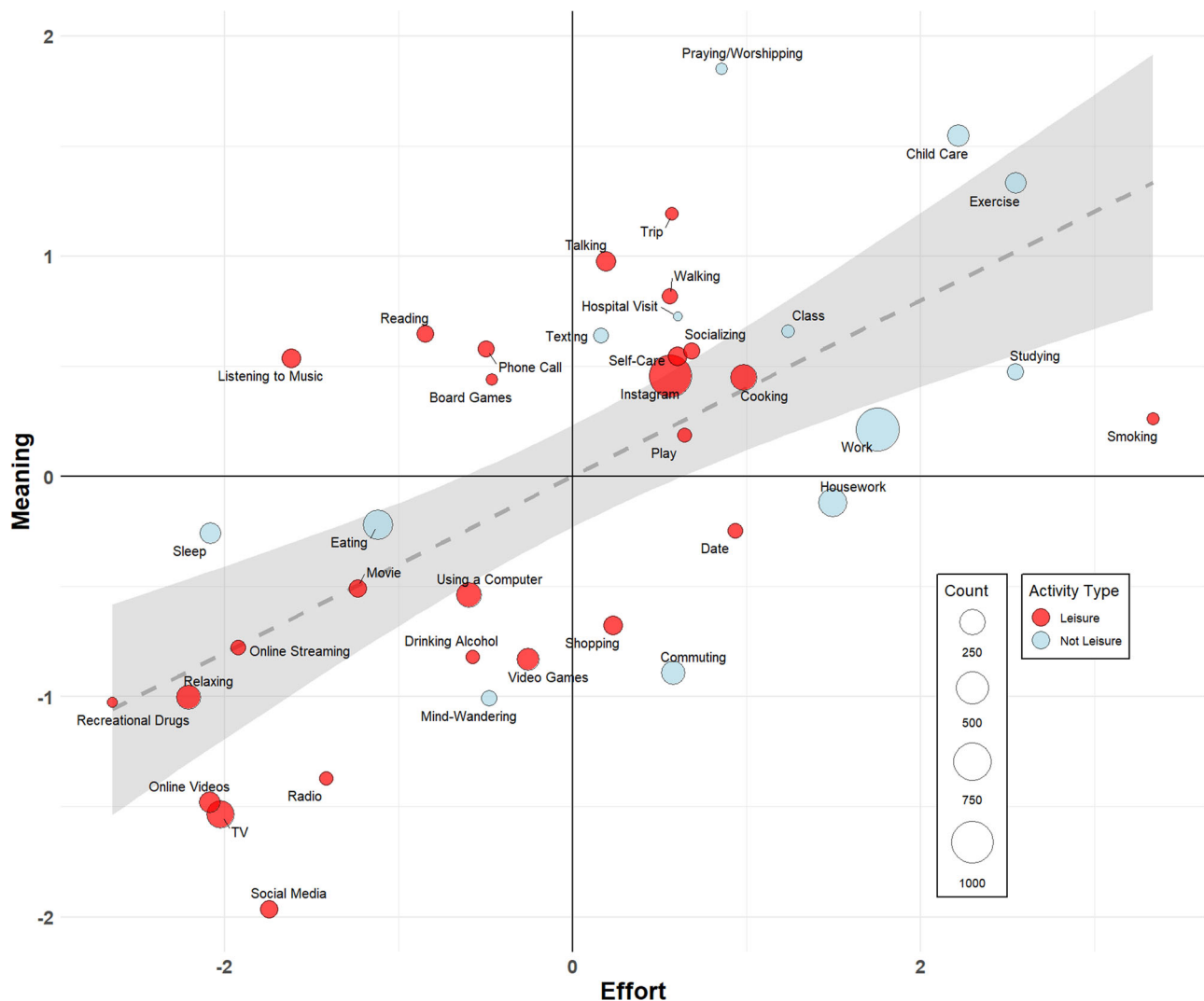


Fig. 8 | Plot of Grand-Mean Centered Effort by Grand-Mean Centered Activity Meaningfulness per Activity. *Note.* Bubble size scales proportionally with the number of times an activity was reported. Bubble color corresponds with whether an activity was rated as leisure a majority of the time (i.e., 3 or more ratings out of 5). Red

denotes a leisure activity; blue denotes a non-leisure activity. Line of best fit for Grand-mean centered activity ratings with shaded area representing standard error around the mean presented in the background ($n = 40$ activities). For a plot with lines of best fit split by activity type, see Supplemental Materials.

actions, financial compensation has been effective in reducing the need to justify in lab settings^{110,111}. Nonetheless, it is possible that dissonance reduction explains the broader effort-meaning link to some extent. Meaning is highly subjective, and difficult to tie to a concrete sensation¹¹². Because of this, judgments of meaning often occur unconsciously¹¹³. Meaning then, might be the perfect value-enhancing candidate for effortful experiences as enjoyment and positive affect are more accessible to conscious experience. Because leisure is autonomously chosen, it is more likely that people will feel a need to justify whatever costs are associated¹¹¹. Though we did not find evidence that effortful leisure feels particularly unpleasant or aversive.

It is also possible that we have a learned association between effort and meaningful outcomes⁹³. We readily reward achievements requiring significant efforts as a means of motivating future efforts^{114,115}. Additionally, those very achievements act as rewards for our efforts^{116–118}. If recognizing these effort-meaningful reward contingencies leads to greater future rewards^{119,120}, it would not be surprising that through these consistent pairings many begin to associate their efforts with meaningful experiences.

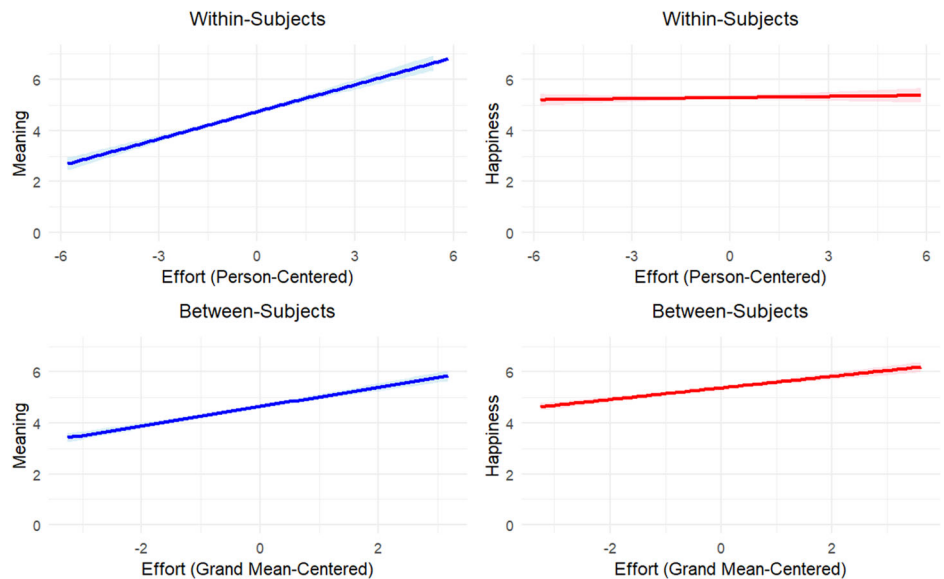
We also found mixed evidence that more effortful tasks can feel more enjoyable in the right contexts, though it is difficult to know if they are enjoyable because of effort or in spite of effort. Certain challenging tasks,

like learning the piano, can feel frustrating at first, but with practice become more enjoyable. Yet, this might be because the practice and pursuit of mastery makes the task itself less effortful, and thus less aversive¹²¹. In fact, evidence suggests that people still choose to avoid effortful leisure, including puzzles, simply because it is effortful¹²². Though an exciting branch of research has provided evidence that it may be possible to train people to value effortful tasks more—or at least willingly engage with them more often^{123,124}.

Future directions

The most immediate and useful extension of our findings would be to begin identifying causal mechanisms for why effort specifically lends itself to meaningful leisure and activities broadly. It would also be useful to investigate the causal effects under a number of different contexts as it is very possible that reasons effort feels meaningful depends on the activity. We compared two popular types of leisure, puzzling and entertaining videos, but of course these are not the only forms of leisure people could engage with. We saw in Study 4 that activities similar to those we chose as conditions in Studies 2a and 2b tend to mirror the effects we observed: Puzzling, board games, and general play tend to be effortful and meaningful, whereas watching TV and online videos tend to be less so. Future research should seek to expand the contexts under which effort varies across highly similar

Fig. 9 | Plot of Within and Between-Subjects Effort Predicting Meaning and Happiness Across Leisure Activities in Study 4. Note. Shaded region represents the Standard Error (SE) around the mean ($n = 260$ participants for between-subjects effects and $n = 2899$ for within-subjects effects).



tasks. We provided one such replication in Study 3, taking two similar active game-like tasks varying in effort to demonstrate the relationship outside of a passive-active comparison, but further investigations could look at other types of tasks such as effortful versus less-effortful reading.

It is also worth investigating the contexts under which effortful leisure might feel enjoyable or not. The idea that certain tasks can bring about positive experiences once challenges reach an ideal level, matched to the skill of the individual, have long been discussed with regards to flow¹²⁵. Tasks that produce flow might be challenging to study in this context as flow is regularly defined as effortless attention – a state where real and perceived effort seem to disconnect^{126–128}. Thus, while people experiencing flow may be objectively exerting significant effort, they may be perceiving significantly less effort. However, recent investigations into the mechanisms of flow cast doubt on the role in the experience of flow¹²⁹. It might be that the people who pursue effortful leisure also tend to experience effort as less aversive. The *Rage to Master* describes a unique set of people prone towards avidly pursuing and enjoying effortful deliberate practice in the pursuit of mastery within a particular domain¹³⁰. Similarly, recent evidence suggests those higher in conscientiousness feel effort as less aversive¹³¹.

Relatedly, it would be interesting to understand what types of effort leads to rewarding feelings such as meaning and enjoyment versus effortful experiences that frustrate us. Frustration may be an inherent part of the experience of effort¹³², which might explain why, at some point effortful experiences detract from meaning, as suggested by our correlational curvilinear findings. It might be that when tasks require too much effort, they lead to failure which becomes difficult to derive meaning from. While we found no evidence that poor performance adversely affects meaning, participants were relatively successful within our tasks. Exploring the upper bounds of effortful experiences might elucidate why effort might bring about positive experiences in some contexts, but also high levels of aversion in others.

Finally, we wonder about the effects of effortful leisure in populations where leisure time is abundant. For example, retirees have ample free time to allocate, typically only spending non-leisure time on housework and basic physical necessities (e.g., eating and sleeping). Do they spend this additional time on effortful or effortless leisure? Further, does more time spent on effortful leisure lend itself to better mental or physical wellbeing in these populations?

Limitations

Our studies also have a few relevant limitations worth acknowledging. First, the causal evidence provided in Studies 2a and 2b does not purely isolate

effort. This was a conscious sacrifice in order to compare more ecologically valid tasks against each other, but it also means that we did not completely rule out all potential confounds. Third variables exist in all causal test, where the eventual goal is to replicate effects across all contexts¹³³. Yet, a tighter test of the dependent variable could be conducted if more artificial tasks were used. Study 3 addresses many of the potential confounds that were present in Studies 2a and 2b, but we also emphasize the importance of testing these effects under alternative circumstances.

Relatedly, the manipulation used in Study 3 provides all participants with two active tasks which share the same overall visual structure and end goal. Yet, in the Click-to-Reveal task, participants likely do not experience the rewarding “Aha!” or penny-drop moments that frequently accompany puzzles such as the Sudoku¹³⁴. These experiences are typically associated with feelings of enjoyment or pleasure, though it is quite possible that a sense of meaning also accompanies them^{134,135}. Additionally, though the end goal was the same, the primary goals of either task may have been different. Those in the Sudoku condition likely predominantly focused on solving the puzzle where as clicking all tiles would be the primary goal for those in the click-to-reveal task. A useful extension might involve using a task such as paint-by-numbers to avoid the rewarding breakthroughs that occur with puzzling while still being an active and relatively effortful task.

Across Studies 2a, 2b, and 3 we are only able to provide correlational evidence that effort and meaning take on a curvilinear shape, as we relied on subjective measures of effort to test this. Thus, it is not possible to definitively claim whether or not effort and meaning share a curvilinear or linear relationship. We only sought to provide preliminary evidence for this and believe an explicit experimental test using highly similar tasks widely varying in effort demands is necessary to establish the exact shape of the relationship.

Studies 1 and 4 also use a relatively blunt definition of leisure, which forces activities into a generalized dichotomy (leisure or non-leisure). It is possible that for some people or at some times an activity, such as cooking, can be leisurely, whereas under other circumstances it is non-leisure. While we re-ran analyses using many categorizations of leisure, we could not account for this kind of fluidity. A more in-depth categorization allowing for these contextual fluctuations in defining what leisure is would be a helpful follow-up to replicate our findings across these two studies.

Additionally, our samples were exclusively from “WEIRD” (i.e., Western, Educated, Industrialized, Rich, and Democratic) societies¹³⁶. Even if our samples were diverse, they do not necessarily reflect the global population and the specific effects we tested have yet to be tested in any other context.

Conclusion

Across five studies we demonstrated that people assume effortful activities, both leisure and non-leisure, are more meaningful but less pleasurable and that this assumption is only partially correct. Effortful leisure was an exception, feeling more meaningful and just as enjoyable as less effortful leisure. We observed a linear trend between how effortful and meaningful activities felt; though we saw correlational evidence that this relationship may be curvilinear in some contexts. Extending this further, we provided causal evidence that it is effort that drives this relationship. When an activity requires more effort, it feels more fulfilling, at least up to a certain point. Effortful leisure provides a powerful opportunity to supplement the threats to eudaimonic wellbeing that any future labor-hour shortages might pose. Thus, in a world with little work and plentiful leisure, our findings suggest that people can still find purpose through effortful play.

Data availability

Data, codebook, materials, preregistrations, and supplemental materials are available at <https://osf.io/s9v5h/>.

Code availability

Code for analyses are available at <https://osf.io/s9v5h/>.

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Author contributions

Aidan Campbell planned the project, designed the studies, collected data for Studies 1, 2a, 2b, and 3, analyzed data for Studies 1, 2a, 2b, 3 and 4, and wrote and revised the manuscript. Gregory Depow collected and cleaned data for Study 4 and revised the manuscript. Srishti Agarwal assisted with task design and data collection for Studies 2a and 2b. Michael Inzlicht supervised the project and revised the manuscript. All authors approved the final manuscript.

Competing Interests

The authors acknowledge a potential competing interest related to this project. Amuse Labs, a company that develops puzzles for commercial and personal use, partnered with the research team to create the Sudoku puzzles used in Studies 2a and 2b and provided their platform for data collection. As part of this collaboration, a software engineer from Amuse Labs, Srishti Agarwal, was included as a co-author. All analyses and interpretations were

conducted independently by the academic authors, who have no financial ties to Amuse Labs. While Amuse Labs may benefit commercially from findings that support the value of effortful leisure, including puzzling, their involvement was limited to the provision of materials and data collection tools, and they did not influence the research outcomes.

Additional information

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