Giggling in the Shower: Humor Increases the Acceptance of Technology-mediated Behavioral Interventions.

TILL MARIA JÜRGENS, University of Siegen, Germany

MARC HASSENZAHL, University of Siegen, Germany

LARA CHRISTOFORAKOS, Ludwig-Maximilians-University, Germany

MATTHIAS LASCHKE, University of Siegen, Germany

One way to achieve sustainability is to adopt resource-saving practices. This often requires giving up cherished routines, which can be challenging. Behavior Change Technologies or automation can facilitate this, but will inevitably introduce friction that can be perceived as unpleasant or annoying. To alleviate this, we suggest humor as a promising design element. In an explorative study (N=349), we gathered participants' responses (e.g., experience of humor, evaluation, and affect) when confronted with verbal descriptions of different interventions that interrupt the shower routine by stopping water in a humorous way. We found that the participants' preferred style of humor was related to their experience of humor, with a focus on self-related rather than interpersonal humor. More importantly, the experience of humor was positively associated with the evaluation of the intervention and the resulting affective experience. This suggests that experience of humor can make a potentially neutral or slightly negative situation positive.

CCS Concepts: • **Human-centered computing** → **Empirical studies in interaction design**;

Additional Key Words and Phrases: behavior change technology, humor, sustainability

1 INTRODUCTION

Technology plays a central role in numerous daily routines, from enjoying a long, hot shower to commuting by car, or starting the washing machine before heading out. These routines are strongly shaped by technology. Thus, the design of a technology may change routines by introducing, removing, emphasizing, or hiding functions and features [6]. Daily routines mediated by technology carry societal implications, particularly concerning energy-intensive routines, as individual energy consumption is a critical factor. For instance, in the European Union, individual households are responsible for 24% of the annual energy consumption [9]. Consequently, adopting energy-efficient routines to reduce individual energy consumption may be one way to mitigate climate change. For example, a shorter shower duration, i.e.

Authors' addresses: Till Maria Jürgens, till.juergens@uni-siegen.de, University of Siegen, Interaction Design for Sustainability and Transformation, Siegen, Germany; Marc Hassenzahl, marc.hassenzahl@uni-siegen.de, University of Siegen, Ubiquitous Design / Experience & Interaction, Siegen, Germany; Lara Christoforakos, lara.christoforakos@psy.lmu.de, Ludwig-Maximilians-University, Department Psychology, Munich, Germany; Matthias Laschke, matthias.laschke@uni-siegen.de, University of Siegen, Interaction Design for Sustainability and Transformation, Siegen, Germany.

establishing a different routine, can have a significant impact when you consider that hot water consumption in private households accounts for 15% of energy consumption (e.g., in Germany [8]).

However, changing already established and often cherished routines presents a challenge, as they are performed almost automatically, controlled by the impulsive system [21] where individuals follow patterns without thinking consciously in the access-conscious sense [3]. Additionally, changing these routines is not easy, as they are often very pleasant and less time-consuming. Just think of a colder and shorter shower in the morning. Furthermore, in the context of sustainability, interventions can quickly be perceived as patronizing, instructive, joyless, and moralizing. Imagine a shower that stops the water flow and asks for more coins while your hair is still full of soap, or a display with real-time feedback telling you that your showering behavior is about to kill a polar bear [28]. The desire to maintain a comfortable and immediately gratifying routine, in contrast to abstract long-term sustainability goals, can create a kind of inner friction and tension. This may even lead to psychological reactance, which is the resistance individuals feel when their freedom of choice is perceived as threatened or eliminated (e.g., Brehm [4]).

This dilemma presents a challenge in the design of interactive technologies for behavior change in sustainability. On the one hand, technology can shape, comment on, or even change routines. For example, modifications to the shower head, faucet and cubicle can significantly change the morning shower routine. Visualizing water and energy consumption levels within the shower, pinpointing excess usage, may lead to an automatic shutdown of the water flow. On the other hand, while such changes could contribute to energy conservation, they may also evoke feelings of paternalism and potential rejection. This prompts the question of how technology can foster change without being perceived as patronizing and subsequently rejected. We believe it is crucial to find the right balance between an appropriate tone and a certain amount of friction (e.g., Hassenzahl and Laschke [11]; Laschke et al. [16, 17]). As stated by Kneile, Jürgens, et al. [14], humor might serve as a potential means to reduce tension caused by the interruption. Moreover, humor appears to complement the overall experience positively while interacting with technology [7]. In general, the use of humor can have positive impacts such as motivating behavioral change, or mitigating situations that could potentially undermine individual wellbeing, as demonstrated by previous research (see e.g., Martin [18]; Mesmer-Magnus et al. [20]; Mulder and Nijholt [22]).

Humor is commonly viewed as difficult to understand and grasp. Especially when a technology is supposed to generate humor through its interaction with individuals. However, there are various theories that attempt to explain how it arises or can be generated. For instance, Yu and Nam [29] introduce a framework of design principles that could be used to design humorous products. For example, if a product incorporates one of the three principles such as shape incongruity, unconventional use, or unexpected function, it is likely to be perceived as humorous. These results are consistent with other humor theories, such as the Incongruity Theory as described by Mulder and Nijholt [22] that defines humor as the perception of unexpected or unusual changes in a situation.

In HCI, only a few studies address humor in the design of technologies. They also incorporate the principles of Yu and Nam [29] to positively influence users' experiences and emotions. For example, Helms and Fernaeus [12] use humor in the narrative process of design fiction to provoke reflection around sustainability. Additionally, Niculescu et al. [25] conducted a workshop on developing services for behavioral change using humor, for instance, for promoting healthy eating. Building on the positive results of these studies, the present work investigates whether integrating humor into interactions with technology, intended to interrupt energy-intensive daily routines for behavior change, can result in decreased rejection and a more positive perception of the situation. Additionally, the study explores whether various humor styles, reflecting preferences for types of humor, impact the perception of the situation. To this end, we conducted a vignette study, to investigate whether participants who perceive the described interventions as humorous

in their interactions experience them as more attractive and evaluate them more positively. Specifically, we asked participants to vividly imagine using hypothetical showers that use humor to interrupt the shower routine and fill out questionnaires about their imagined experiences. We measured the evaluation of the situation as well as important experiential aspects such as positive and negative affect. We developed a new scale consisting of three items to measure the perceived humor of the situation, i.e. whether and to what extent the situation created by the shower and the intervention was perceived as humorous.

Although the study explores non-existent applications in the form of descriptions, it is a valuable first step in understanding the effect of the experience of humor on the evaluation and affect during a disrupted shower routine. The study thus contributes to the design of interactive technologies in the field of sustainability, especially when it comes to breaking routines and reducing emerging rejection due to a perceived limited autonomy.

2 METHOD

2.1 Participants and procedure.

We conducted a vignette study online with SurveyMonkey. Participants were recruited through Prolific, an online recruitment platform. Participants received 2 Euros for participation to meet the national minimum wage of 12 Euros/h. Three-hundred forty-nine of 364 participants completed the 10-minute survey and provided full data (123 female, 220 male, 6 non-binary; age: $18 - 73$, $M = 30.5$, $SD = 9.7$). The study used a between-person research design and randomly assigned participants to one of six vignettes ($n_{(V1)} = 55$, $n_{(V2)} = 60$, $n_{(V3)} = 55$, $n_{(V4)} = 57$, $n_{(V5)} = 61$, $n_{(V6)} = 61$) to ensure balanced data. The screening was based on the language (fluent German) and place of residence in Germany (88%), Austria (9%) or Switzerland (3%). This was done because follow-up studies in the field are planned to be conducted in German language as well. The reported professional status was working (58%), student (30%), unemployed (6%), pupil (2%), pensioner (1%), parental leave (1%), unable to work (1%), and housewife*husband (1%). The participants stated that their highest vocational qualification was a university degree (61%) as well as vocational training (17%), no qualification (11%), a technical college degree (6%), a doctorate (4%) and others (1%).

The survey started with a brief introduction, followed by one of six text vignettes and an invitation to put yourself in the situation described. After participants rated their experience of humor using terms like "humorvoll" ("humorous"), "charmant" ("charming"), and "lustig" ("funny"), subsequent questions focused on product perception and personal attributes, such as the use of humor.

2.2 Vignettes.

A vignette is a brief and methodically arranged portrayal of a situation, object, or other research items [2]. Thus, the six vignettes described shower scenarios in a uniform structure: first, the individual prepares to shower and then follows their personal routine. After six minutes of water usage, the routine is interrupted by a technology-mediated intervention. This results in the individual having to decide whether to continue showering or come to an end, thereby reducing hot water consumption. The aim was to interrupt routines through an interactive technology with varied humor characteristics. To gather different ideas for such a disruptive as well as humorous technology, we conducted a 1.5-hour workshop with seven PhD students from the field of HCI. In the workshop we introduced the problem and three principles by Yu and Nam: shape incongruity, unconventional use, and unexpected function [29]. During the workshop participants created 41 tentative ideas. Based on this, we developed 16 vignettes. With an internal short

Table 1. Vignettes describing a shower situation (translated from German).

Vignette	You shower at your usual time and follow your personal shower routine. After six minutes of running water, ...
1	... the shower head automatically moves away from you and directs the water jet in a different direction. You try to follow it, whereupon it turns away again. Some water misses you. You are now faced with the decision of accepting the interruption to your routine and following the water jet to continue showering or slowly coming to an end and thereby reducing the hot water consumption for this shower.
2	... a fine, cold jet of water suddenly comes out of the shower hose. You cover the hole with one hand and continue showering. A moment later, a second hole appears and cold water sprays at you, you hold it closed with your second hand. Cold water then gushes out in more and more places. You are now faced with the decision to accept the interruption to your routine and accept the cold splashes in order to continue showering or to slowly come to an end and thus reduce the hot water consumption for this shower.
3	... the shower curtain slowly pulls away on its own, pushes back again slightly, only to pull away completely in jerky movements. You are now faced with the decision to accept the interruption to your routine and ignore the open curtain to continue showering or to slowly come to an end and thus reduce the hot water consumption for this shower.
4	... a written warning appears on the display in front of you, supported by a single signal tone, that you have now used too much hot water and informs you about the CO2 emissions caused by your behavior. You are now faced with the decision to accept the interruption to your routine and ignore the warning to continue showering or to slowly come to an end and reduce your hot water consumption for this shower.
5	... foam slowly spreads out in the shower cubicle. Initially only on the floor, then more and more. The foam envelops you and rises higher and higher. You are now faced with the decision to accept the interruption to your routine and continue showering in the foam or to slowly come to an end and thus reduce the hot water consumption for this shower.
6	... the shower hose inflates. Slowly at first, then more and more. The hose takes up space and literally pushes you out of the shower cubicle. You are now faced with the decision to accept the interruption to your routine and somehow use the remaining space to continue showering or to slowly come to an end and thereby reduce the hot water consumption for this shower.

survey, we selected five variations of humorous situations and one non-humorous situation, as shown in Table 1. It is important to note that we included non-humorous vignette 4 (Table 1) to ensure variance.

2.3 Measures.

2.3.1 Experience of humor. After reading one of the six vignettes, participants were presented with three self-designed items on a five-point Likert scale ranging from "1 – strongly disagree" to "5 – strongly agree" to assess their experience of humor when imagining the situation described. A discussion among the authors was held to determine the most appropriate terminology to describe the experience of humor in the scenarios. The three items were phrased as, "I found the interruption to the routine...": "...to be humorous", "...to be charming", and "...to be funny". The three items had a high internal consistency and could be averaged per person to compute a single scale value (M = 2.5; SD = 1.1; Cronbach's α = .88).

2.3.2   Evaluation of the situation. To evaluate the experience of the situations described in the vignettes, we used the AttrakDiff2 [10] questionnaire. AttrakDiff2 contains 28 seven-point semantic differential items ranging from -3 to +3 for pragmatic quality, hedonic quality, and attractiveness. In order to evaluate the experience of the situation, we only incorporated the sub-scale for attractiveness (ATT). It consists of the following word pairs: "pleasant – unpleasant", "ugly – beautiful", "appealing – unappealing", "rejecting – inviting", "good – bad", "repulsive – attractive", and "motivating – discouraging". The items had a high internal consistency (ATT: M = -0.8; SD = 1.2; Cronbach's α = .92). We calculated the scale value as the average of the corresponding items per person. Note that we applied the AttrakDiff2 which is commonly used to evaluate products to assess a situation involving a product.

2.3.3   Affect balance. We measured the positive (PA) and negative affect (NA) with a German version of the positive and negative affect schedule (PANAS) [5]. It consists of 20 items with responses on a five-point intensity scale, ranging from "1 – not at all" to "5 – extremely". It asks for feelings and sensations participants experienced in the imagined situation ("Please indicate how you would feel at that moment in the situation."). For each PA and NA it offers 10 items: "active", "interested", "excited", "strong", "inspired", "proud", "enthusiastic", "alert", "determined", "attentive" (PA), and "distressed", "upset", "guilty", "scared", "hostile", "irritable", "ashamed", "nervous", "jittery", "afraid" (NA). The internal consistency of the items for PA (M = 2.6; SD = 0.7; Cronbach's α = .84) and NA (M = 2.2; SD = 0.9; Cronbach's α = .89) were high. We computed a scale value for PA and NA by averaging the respective items per person. We then calculated affect balance (PA - NA) for further ease of interpretation. It resulted in a scale ranging from only negative affect -4 to only positive affect 4 (M = 0.3; SD = 1.2).

2.3.4   Humor styles. We used the German version of the Humor Styles Questionnaire (HSQ) [27] to assess the humor styles preferred by the participants. The HSQ, developed by Martin et al [19], is a widely used self-report measure [15] that captures different ways in which people use humor in their daily lives [19]. It helps to understand potential individual differences in the responses to the different vignettes. The questionnaire consisted of 32 seven-point Likert items ranging from "1 – totally disagree" to "7 – totally agree", and was further divided into four subscales: Affiliative Humor as a style that is used in groups for amusement (M = 42.5; SD = 8.2; Cronbach's α = .86), Self-Enhancing Humor as a style that is used for solitary amusement (M = 35.9; SD = 7.8; Cronbach's α = .83), Aggressive Humor as a style that is used in groups as differentiation from others (M = 28.9; SD = 7.7; Cronbach's α = .75), and Self-Defeating Humor as a style that is used to belittle oneself (M = 29.4; SD = 8.1; Cronbach's α = .80). Each had an acceptable to high internal consistency. Following the original application, we calculated the sum score for each style, which ranged from 8 to 56.

2.3.5   Immersion level. Limitations of a vignette study (e.g., discussed by Neuhaus et al. [23]) arise from the imagination required to envision the described situation and the lack of real-world consequences resulting from a decision. To address this, we evaluated the immersion of the depicted scenarios using a self-designed five-point Likert item ("I was able to empathize with the situation described.") ranging from "1 – strongly disagree" to "5 – strongly agree" (M = 3.9, SD = 1.0). Based on the mean, we assume that participants comprehended the vignettes.

2.3.6   Sustainability attitude. Attitudes towards sustainability may be related to the perception of the water saving situation. Therefore, we measured the attitude towards sustainability using two self-designed five-point Likert items ranging from "1 – strongly disagree" to "5 – strongly agree": "Sustainability is important to me," and "I make an effort to conserve energy at home." The internal consistency was acceptable (M = 3.9; SD = 0.9; Cronbach's α = .76), suggesting a reliable scale. Therefore, we computed the scale value as the average of the two items per person.

2.3.7   Technology acceptance. Finally, we employed the technology commitment four-item subscale to assess technology acceptance [24]. The four items feature the following statements: "I am very curious about new technical developments," "I quickly take a liking to new technical developments," "I am always interested in using the latest technical equipment," and "If I had the opportunity, I would use technical products much more often than I currently do." Responses were given on a on a five-point Likert scale ranging from "1 – not true at all" to "5 – completely true". The internal consistency was high (M = 3.7; SD = 0.9; Cronbach's α = .87) and we computed the technology acceptance as the average of the four items per person.

The survey concluded with demographic questions regarding gender, age, country of residence, professional status, and highest level of education. All items were originally in German and can be obtained from the authors upon request. The data was analyzed in Jamovi [26]. For moderation and mediation analyses we used the package medmod within Jamovi. Comparisons of correlations were conducted using StatistikGuru [13].

3   RESULTS

3.1   Relationship between experience of humor and humor styles.

The individual's self-focused style of humor (Self-Enhancing Humor and Self-Defeating Humor) and the experience of humor were weakly positively correlated, in both cases $r(347)$ = .17, p = .001. However, there was no significant correlation in group-focused humor styles, including Affiliative Humor, $r(347)$ = .00, p = .989, and Aggressive Humor, $r(347)$ = .00, p = .992, and their experience of humor. This means that the more participants have self-focused humor style the more they responded to the vignettes in a humorous way.

3.2   Relationship between experience of humor and evaluation of the situation as well as affect balance.

We found a strong positive correlation between experience of humor and the evaluation of the situation, $r(347)$ = .56, p < .001. The more people experienced humor in the given situation, the more positive the situation appeared to them. Additionally, the analysis revealed a significant, albeit weaker, positive correlation between experience of humor and affect balance, $r(347)$ = .27, p < .001. The more humor, the more positive the experience. Not surprisingly, we found a substantial positive correlation between evaluation and affect balance, $r(347)$ = .48, p < .001. While this shows a certain overlap between evaluation and affect, it is still low enough to hint at certain differences between both measures.

When we controlled for affect balance, the partial correlation between experience of humor and evaluation remained almost the same, $r(347)$ = .51, p < .001. However, controlling for evaluation in the relationship between experience of humor and affect balance resulted in a non-significant partial correlation of $r(347)$ = .00, p = .968. The relationship between experience of humor on affect balance disappears given the overlap with evaluation is removed. This hints at a mediation. Therefore, a mediation analysis was conducted to evaluate the role of evaluation as a mediator between the experience of humor and affect balance. Findings indicate that the total effect of experience of humor on affect balance was significant (B = 0.29, 95% CI [.18, .40], p < .001). Nevertheless, with the inclusion of the mediating variable (evaluation), the direct impact of experience of humor on affect balance was found non-significant (B = 0.00, 95% CI [-.19, .12], p = .967). The indirect effect of experience of humor on affect balance through evaluation was significant (B = 0.29, 95% CI [.21, .37], p < .001). This shows that the relationship between experience of humor and affect balance is fully mediated by the evaluation. In other words, whether humor leads to positive affect depends on how positive the situation was evaluated. Positive affect is thus not a direct response to humor per se, but a consequence of how positive the given situation was perceived.
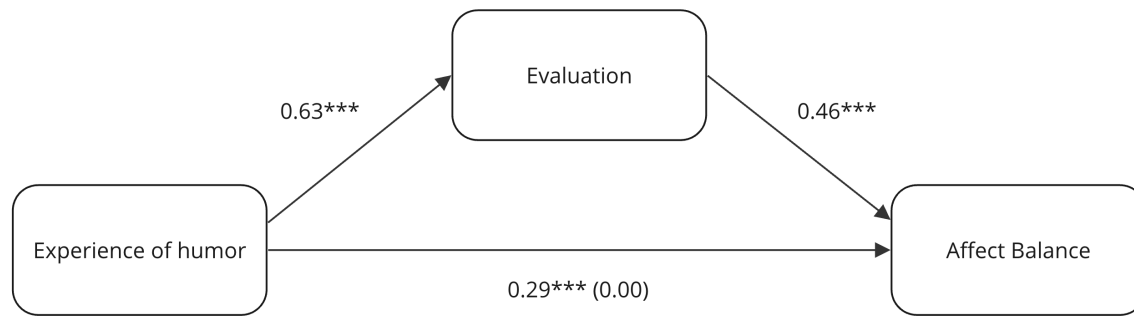
Fig. 1. Mediation model showing the effect of experience of humor on affect balance as mediated by the evaluation of the situation. Unstandardized coefficients are presented. On the direct path, the value outside of the parentheses represents the total effect, while the value inside the parentheses indicates the direct effect. (Note: *** $p < .001$).

3.3 Effect of immersion level on the relationship between experience of humor and perception of the situation.

Controlling for immersion in the relationship between experience of humor and the evaluation of the situation revealed a partial correlation of $r(347) = .55$, $p < .001$. The calculated Fisher's z for this correlation coefficient when compared to the correlation without controlling for immersion (correlation experience of humor and evaluation as described above) was $z = -0.17$, $p = .864$. The non-significant p-value suggests that there is no statistically significant difference between the two correlation coefficients. Controlling immersion in the relationship between experience of humor and affect balance yields similar results when comparing the partial correlation, $r(347) = .25$, $p < .001$, to the correlation without controlling (correlation experience of humor and affect balance as described above): $z = -0.35$, $p = .725$. The analysis shows that the level of immersion in the given situation does not significantly affect the relationship between the experience of humor and evaluation, as well as affect balance.

3.4 Effect of sustainability attitude on the relationship between experience of humor and perception of the situation.

We found a small correlation between sustainability attitude and experience of humor, $r(347) = .12$, $p = .026$, and investigated the interaction effects of moderator sustainability attitude and predictor experience of humor on the dependent variables evaluation and affect balance. Experience of humor demonstrates a significant positive effect on evaluation ($B = 0.62$, 95% CI [.52, .72], $p < .001$) and affect balance ($B = 0.28$, 95% CI [.17, .39], $p < .001$) as well as the moderator sustainability attitude exhibits a significant positive effect on evaluation ($B = 0.13$, 95% CI [.01, .29], $p = .038$) and affect balance ($B = 0.16$, 95% CI [.02, .29], $p = .021$). In contrast to the individual effects, the interaction between experience of humor and sustainability attitude yields a non-significant coefficient of $B = -0.04$, 95% CI [-.15, .08], $p = .543$ (evaluation) and $B = -0.01$, 95% CI [-.14, .11], $p = .823$ (affect balance). In both analyses, the relationship between experience of humor and evaluation, as well as affect balance, is not significantly moderated by sustainability attitude. In other words, a high sustainability attitude does not influence the experience or perception of the given situation.

Table 2. Correlations between experience of humor (EH), evaluation of the situation (ES), affect balance (AB), and humor styles.

| | EH | ES | AB | Humor styles | | | |
				Affiliative	Self-Enhancing	Aggressive	Self-Defeating
EH	—						
ES	.56***	—					
AB	.27***	.48***	—				
Affiliative	.00	-.00	.07	—			
Self-Enhancing	.17**	.18***	.23***	.45***	—		
Aggressive	.00	-.03	-.09	.19***	.10	—	
Self-Defeating	.17**	.05	-.08	.15**	.10	.24***	—

Note: * p < .05, ** p < .01, *** p < .001

3.5   Effect of technology acceptance on the relationship between experience of humor and perception of the situation.

Although technology acceptance does not present any substantial connection with experience of humor, $r(347) = .03$, $p = .582$, evaluation of the situation, $r(347) = -.03$, $p = .623$, or affect balance, $r(347) = .07$, $p = .196$, we examined the interaction effects of moderator technology acceptance and predictor experience of humor on evaluation and affect balance. The experience of humor predictor exhibits a significant positive impact on both the dependent variable evaluation ($B = 0.63$, 95% CI [.53, .73], $p < .001$) and the dependent variable affect balance ($B = 0.29$, 95% CI [.18, .40], $p < .001$). Meanwhile, the moderator technology acceptance shows no substantial effect on either evaluation ($B = -0.05$, 95% CI [-.17, .07], $p = .426$) or affect balance ($B = 0.09$, 95% CI [-.05, .22], $p = .209$). Additionally, the interaction between experience of humor and technology acceptance does not significantly contribute to the observed variation in the dependent variables evaluation ($B = 0.09$, 95% CI [-.02, .20], $p = .127$) and affect balance ($B = 0.06$, 95% CI [-.07, .18], $p = .368$). This demonstrates that the relationship between the experience of humor and evaluation, as well as affect balance, is not significantly moderated by technology acceptance.

4   DISCUSSION

We asked participants to imagine one of six vignettes and report their experience of humor. Additionally, a profile was created containing their humor style, perception of the situation, and accompanying emotions. We found a weak but significant correlation between individuals' experience of humor when envisioning one of the situations and their self-focused styles of humor (Self-Enhancing and Self-Defeating Humor). We assume, without theoretical guidance, that this is based on the fact that showering is typically an individual activity and not group-oriented. Since, the correlation between experience of humor and group-focused styles of humor (Affiliative and Aggressive Humor) was found to be non-significant. Furthermore, no differences emerged between the humor style dimensions that promote well-being (i.e., Affiliative and Self-Enhancing as humor styles that have the intent to be perceived as positive) and those that are less benign (i.e., Aggressive and Self-Defeating as humor styles that have the intent to be perceived as negative). Personal preference for positive or negative humor may not have affected the experience of humor in the given situations. The more individuals experienced humor during the hypothetical scenario presented, the more they perceived the situation as attractive. However, the experience of humor did not directly correlate with more positive emotions as shown in the affect balance. Rather, their affect became more positive, the more they perceived the situation as attractive. In the

context of the study, humor should not elicit emotions (positive or negative affect) that are unrelated to the situation. Instead, it should have an impact by assessing the situation (e.g., as attractive). For example, if a routine is interrupted by a shower hose inflating and pushing the person out slowly, they may find it humorous. Consequently, the individual perceives the interruption as attractive, which elicits more positive emotions. However, it is important to note that the situation itself does not directly elicit emotions in this context. We intend to incorporate technology in future field studies with a household panel, thus the finding that technology acceptance did not significantly affect the correlation between the experience of humor and the evaluation of the situation is noteworthy. Additionally, our findings suggest that the attitude towards sustainability may play a subordinate role in the composition of such a panel.

Although the results of this explorative study provided additional insights related to our research interest, a vignette study has some trade-offs. In the between-person design, not all participants are exposed to the same vignettes; rather, they are distributed equally. This can lead to respondent-specific differences in judgments [2]. To address this issue, a within-person or mixed design may be applied in future work. A critique by Aguinis and Bradley [1] of the between-person design is that it does not provide a comparison of the vignettes, which would allow participants to contextualize their responses and avoid inaccurate judgments. They recommend that ample baseline information should be given to participants to establish a similar contextual background for everyone. To achieve this, we outlined the shower scenarios using a standardized structure: 1. introduction of the routine, 2. interruption via an active technology intervention, and 3. end of the shower. Considering that the experience and perception of humor might be highly context-dependent, in future research we will control (e.g., by priming in the introduction of the vignette) for the context of the shower (e.g., in the morning, after sports) and the emotional state (e.g., a relaxing shower, after a stressful day at work). This makes the effect of technology and humor more comparable.

Our findings will provide a foundation for future research on using humor as a mean to reduce rejection of an intervention. This is vital because it remains unclear whether humor can positively impact technology-driven behavioral change towards sustainability.

5   RESEARCH OUTLOOK

According to the positive results of the present study, we will conduct a subsequently vignette study to replicate and supplement the present study, focusing on participant acceptance and decision-making after experiencing the hypothetical scenario. Our goal is to investigate potential effects on behavior change caused by interventions, that provide an experience of humor. In addition, we plan to develop prototypes for distribution in a smaller panel as part of a field study based on the findings of the present vignette study. In such a future study, we will assess not only the experience of humor and the evaluation of the situation but also the effectiveness of the intervention in changing behavior (e.g. by saving hot water) and ultimately in saving energy.

Overall, it can be stated that humor is a promising approach to address the friction caused by an interactive technology that disrupts (energy-intensive daily) routines. The results suggest that the humor theory of incongruity is a promising approach here. In the long term, the findings of our research have potential applications in the design of smart energy-saving systems. For instance, they could be used in smart shower appliances, such as a shower tap that automatically switches the water stuttering on and off to indicate high water consumption in a humorous way. Additionally, beyond the domain of showering, they could be applied in a smart heating system that uses humor to make energy-saving recommendations more acceptable, such as reducing the room temperature. We believe that this research could offer valuable insights for HCI.

ACKNOWLEDGMENTS

REFERENCES

[1] Herman Aguinis and Kyle J. Bradley. 2014. Best Practice Recommendations for Designing and Implementing Experimental Vignette Methodology Studies. *Organizational Research Methods* 17, 4 (Oct. 2014), 351–371. https://doi.org/10.1177/1094428114547952

[2] Christiane Atzmüller and Peter M. Steiner. 2010. Experimental Vignette Studies in Survey Research. *Methodology* 6, 3 (Jan. 2010), 128–138. https://doi.org/10.1027/1614-2241/a000014

[3] Ned Block. 1995. On a Confusion about a Function of Consciousness. *Behavioral and Brain Sciences* 18, 2 (June 1995), 227–247. https://doi.org/10.1017/S0140525X00038188

[4] Jack W. Brehm. 1966. *A Theory of Psychological Reactance.* Academic Press.

[5] B. Breyer and M. Bluemke. 2016. Deutsche Version der Positive and Negative Affect Schedule PANAS (GESIS Panel). *Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS)* (2016). https://doi.org/10.6102/ZIS242

[6] Jenny L. Davis and James B. Chouinard. 2016. Theorizing Affordances: From Request to Refuse. *Bulletin of Science, Technology & Society* 36, 4 (Dec. 2016), 241–248. https://doi.org/10.1177/0270467617714944

[7] Pieter M A Desmet. 2012. Faces of Product Pleasure: 25 Positive Emotions in Human-Product Interactions. (2012), 30.

[8] Destatis. 2022. Press Release No. 542 of 16 December 2022. https://www.destatis.de/EN/Press/2022/12/PE22_542_85.html

[9] Eurostat. 2022. Energy Consumption in Households. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_consumption_in_households#Energy_consumption_in_households_by_type_of_end-use

[10] Marc Hassenzahl, Michael Burmester, and Franz Koller. 2003. AttrakDiff: Ein Fragebogen Zur Messung Wahrgenommener Hedonischer Und Pragmatischer Qualität. In *Mensch & Computer 2003*, Gerd Szwillus and Jürgen Ziegler (Eds.). Vol. 57. Vieweg+Teubner Verlag, Wiesbaden, 187–196. https://doi.org/10.1007/978-3-322-80058-9_19

[11] Marc Hassenzahl and Matthias Laschke. 2015. Pleasurable Troublemakers. In *The Gameful World*, Steffen P. Walz and Sebastian Deterding (Eds.). The MIT Press, 167–196. https://doi.org/10.7551/mitpress/9788.003.0011

[12] Karey Helms and Ylva Fernaeus. 2018. Humor in Design Fiction to Suspend Disbelief and Belief. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction.* ACM, Oslo Norway, 801–818. https://doi.org/10.1145/3240167.3240271

[13] W. Hemmerich. 2017. StatistikGuru: Korrelationen Statistisch Vergleichen. https://statistikguru.de/rechner/korrelationen-vergleichen.html

[14] Madlen Kneile, Till Maria Jürgens, Lara Christoforakos, and Matthias Laschke. 2023. The Thing That Made Me Think: Navigating Challenges and Embracing Opportunities of (pro-) Active Technology for Behavior Change in the Context of Sustainability. *i-com* 22, 2 (Aug. 2023), 161–171. https://doi.org/10.1515/icom-2023-0019

[15] Nicholas A. Kuiper. 2016. Humor Styles Questionnaire. In *Encyclopedia of Personality and Individual Differences*, Virgil Zeigler-Hill and Todd K. Shackelford (Eds.). Springer International Publishing, Cham, 1–4. https://doi.org/10.1007/978-3-319-28099-8_39-1

[16] Matthias Laschke, Sarah Diefenbach, and Marc Hassenzahl. 2015. "Annoying, but in a Nice Way": An Inquiry into the Experience of Frictional Feedback. *International Journal of Design* 9 (2015), 129–140.

[17] Matthias Laschke, Sarah Diefenbach, Thies Schneider, and Marc Hassenzahl. 2014. Keymoment: Initiating Behavior Change through Friendly Friction. In *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational.* ACM, Helsinki Finland, 853–858. https://doi.org/10.1145/2639189.2670179

[18] Rod A. Martin. 2018. *The Psychology of Humor: An Integrative Approach* (second edition ed.). Academic Press, an imprint of Elsevier, San Diego, CA.

[19] Rod A. Martin, Patricia Puhlik-Doris, Gwen Larsen, Jeanette Gray, and Kelly Weir. 2003. Individual Differences in Uses of Humor and Their Relation to Psychological Well-Being: Development of the Humor Styles Questionnaire. *Journal of Research in Personality* 37, 1 (Feb. 2003), 48–75. https://doi.org/10.1016/S0092-6566(02)00534-2

[20] Jessica Mesmer-Magnus, David J. Glew, and Chockalingam Viswesvaran. 2012. A Meta-analysis of Positive Humor in the Workplace. *Journal of Managerial Psychology* 27, 2 (Feb. 2012), 155–190. https://doi.org/10.1108/02683941211199554

[21] Janet Metcalfe and Walter Mischel. 1999. A Hot/Cool-System Analysis of Delay of Gratification: Dynamics of Willpower. *Psychological Review* 106, 1 (1999), 3–19. https://doi.org/10.1037/0033-295X.106.1.3

[22] M.P. Mulder and Antinus Nijholt. 2002. Humour Research: State of Art. *CTIT Technical Report Series* No. 02-34 (2002). http://www.ub.utwente.nl/webdocs/ctit/1/0000009e.pdf

[23] Robin Neuhaus, Ronda Ringfort-Felner, Shadan Sadeghian, and Marc Hassenzahl. 2024. To Mimic Reality or to Go beyond? "Superpowers" in Virtual Reality, the Experience of Augmentation and Its Consequences. *International Journal of Human-Computer Studies* 181 (Jan. 2024), 103165. https://doi.org/10.1016/j.ijhcs.2023.103165

[24] F. J. Neyer, J. Felber, and C. Gebhardt. 2016. Kurzskala Technikbereitschaft (TB, technology commitment). *Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS)* (2016). https://doi.org/10.6102/ZIS244

[25] Andreea Niculescu, Bimlesh Wadhwa, and Anton Nijholt. 2018. Designing Humour in Interaction: A Design Experience. (2018).

Manuscript submitted to ACM

[26] The Jamovi Project. 2023. Jamovi (Version 2.3). https://www.jamovi.org

[27] Willibald Ruch and Sonja Heintz. 2016. The German Version of the Humor Styles Questionnaire: Psychometric Properties and Overlap with Other Styles of Humor. *Europe's Journal of Psychology* 12, 3 (Aug. 2016), 434–455. https://doi.org/10.5964/ejop.v12i3.1116

[28] Verena Tiefenbeck, Lorenz Goette, Kathrin Degen, Vojkan Tasic, Elgar Fleisch, Rafael Lalive, and Thorsten Staake. 2018. Overcoming Salience Bias: How Real-Time Feedback Fosters Resource Conservation. *Management Science* 64, 3 (March 2018), 1458–1476. https://doi.org/10.1287/mnsc.2016.2646

[29] Yeonsu Yu and Tek-Jin Nam. 2014. Let's Giggle!: Design Principles for Humorous Products. In *Proceedings of the 2014 Conference on Designing Interactive Systems*. ACM, Vancouver BC Canada, 275–284. https://doi.org/10.1145/2598510.2598557