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BRIEF REPORT

Evidence for mixed feelings of happiness and sadness from brief moments in time

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Theorists disagree about whether valence is a basic building block of affective experience or whether the positive and negative substrates underlying valence are separable in experience. If positivity and negativity are separable in experience, people should be able to feel happy and sad at the same time. We addressed limitations of earlier evidence for mixed feelings by collecting moment-to-moment measures of happiness and sadness that required participants to monitor their feelings only occasionally. In Study 1, participants were occasionally cued to press one button if they felt happy and another if they felt sad. Participants spent more time reporting mixed feelings (i.e., simultaneously pressing both buttons) during bittersweet scenes than non-bittersweet scenes. In Study 2, participants reported their feelings only once. Participants spent more time reporting mixed feelings when cued during a bittersweet, as opposed to non-bittersweet, scene. These results extend earlier evidence that happiness and sadness can co-occur.

Keywords: Mixed feelings; Mixed emotions; Ambivalence; Bittersweet; Happiness; Sadness.

A hallmark of emotional experience is that it is valenced: we feel good, we feel bad. Despite being central to emotional experience, the nature of the valence dimension ranging from pleasant states (e.g., happiness) to unpleasant states (e.g., sadness) remains unclear. Just as a chemical compound cannot be both an acid and a base, Bain (1859) contended that pleasure and displeasure are so antagonistic that, “the presence of the one destroys the property of the other” (p. 441; see

also, Wundt, 1896). In a contemporary elaboration of Bain’s position, Russell and Carroll (1999) contended that happiness and sadness are mutually exclusive. By such accounts, at any point in time an individual’s emotional state must fall at a single point on the valence dimension, thereby making valence a basic building block of emotional experience (Barrett, 2006). In contrast, Socrates (Plato, trans. 1975), Hume (1739/2000), Ebbinghaus (1902; cited in Wolgemuth,

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We thank Clyde Hendrick for suggesting that we conduct Study 1.

1919), and Cacioppo and Berntson (1994) have contended that the positive and negative substrates underlying valence are separable in experience. This contention yields the hypothesis that happiness and sadness can co-occur (Larsen, McGraw, & Cacioppo, 2001).

A variety of evidence indicates that some positive and negative feelings can co-occur (e.g., Diener & Iran-Nejad, 1986), but Carroll and Russell (1999; cited in Russell & Carroll, 1999) were the first to test the competing hypotheses about the co-occurrence of happiness and sadness, in particular. They asked people in classroom settings dichotomous (i.e., yes/no) closed-ended questions about their current feelings, including “Do you feel happy?” and “Do you feel sad?” Only 10% of people said “yes” to both questions. With allowance for measurement error, these data are consistent with the hypothesis that happiness and sadness are mutually exclusive. Larsen et al. (2001) used similar measures, however, and found that people were more likely to report mixed feelings of happiness and sadness after watching the tragicomic film *Life is Beautiful* than before the film (44% vs. 10%).¹ Similar studies indicate that a range of stimuli including pictures (Schimmack, 2001, 2005; Schimmack & Colcombe, 2008) and music (Hunter, Schellenberg, & Schimmack, 2008) can also elicit mixed feelings of happiness and sadness.

One possibility is that participants in these studies failed to indicate how they were feeling at the precise moment they were surveyed and instead reported summaries of how they had been feeling over some preceding period of time. This raises the alternative interpretation that participants merely vacillated between happiness and sadness without ever experiencing both simultaneously (Barrett & Bliss-Moreau, 2009; Larsen, McGraw, Mellers, & Cacioppo, 2004). Evidence against this *vacillation hypothesis* comes

from findings that people report mixed feelings after seeing pairs of opposite-valence pictures alternating for as little as 4 s (Schimmack & Colcombe, 2008) and that reducing the delay between measures of positive and negative affect does not reduce the intensity of reported mixed feelings (Schimmack, 2005). Carrera and Oceja (2007) eliminated that delay altogether by developing moment-to-moment measures of happiness and sadness.² They asked one group to watch a six-minute film clip containing scenes that were at once both pleasant and unpleasant. Afterwards, participants indicated whether they felt happy and whether they felt sad as they watched the clip. Participants who reported mixed feelings then drew two separate curves to chart the intensity of their happiness and their sadness at each moment of the clip. As assessed by whether their happy and sad curves both cleared the floor at any point in time, participants in that group were more likely to report simultaneously mixed feelings than those in a control group who watched a clip containing exclusively unpleasant followed by exclusively pleasant scenes.

Retrospective measures of affect like those of Carrera and Oceja (2007) can be less accurate than measures collected in real time because it can be difficult for people to remember how they felt in the past (e.g., Fredrickson & Kahneman, 1999). Larsen and McGraw (2011) extended the work of Carrera and Oceja (2007) by collecting real-time moment-to-moment measures as participants watched scenes from the tragicomic film *Life is Beautiful*. Participants’ task was to press one button whenever they felt happy, another button whenever they felt sad, neither button if they felt neither happy nor sad, and both buttons if they felt both happy and sad (Larsen et al., 2004). Participants who watched a clip containing bittersweet scenes (e.g., a boy’s reunion with his mother after his father’s death)

¹ We have referred to “mixed emotions” (Larsen & McGraw, 2011), but adopt the term “mixed feelings” to highlight that our focus is on the structure of what Russell and Carroll (1999) termed “core affect” (i.e., the conscious experience of affect), rather than the occurrence of discrete emotions.

² We use the terms “moment-to-moment” (Woltman Elpers, Wedel, & Pieters, 2003) and “real-time” as Larsen and McGraw (2011) used the terms “continuous” and “online,” respectively. We have revised our terminology for the sake of clarity.

spent more time pressing both buttons simultaneously than did those who watched a control clip containing unambiguously pleasant and unpleasant scenes from before and during the family's imprisonment, respectively. Thus, Larsen and McGraw's button-press measures provided additional evidence that people can simultaneously feel happy and sad (see also Larsen & Stastny, 2011).

Though Larsen and McGraw's (2011) button-press measures allowed participants to report their feelings as they unfolded, they may suffer from the very limitation that led Carrera and Oceja (2007) to rely upon retrospective measures. Specifically, they required participants to spend nearly 20 minutes constantly monitoring whether they felt happy and/or sad, which raises the possibility that they were *reactive* (Rosenthal & Rosnow, 1999). That is, they may have disrupted or distorted participants' affective experience. By way of analogy, consider the futility of measuring a river's flow with some device that blocks its flow.

In sum, potential limitations of measures that have provided evidence against the vacillation hypothesis make it difficult to conclude that happiness and sadness can co-occur. As a result, it remains unclear whether valence is a basic building block of affective experience or whether the positive and negative substrates underlying the valence dimension are separable in experience. We conducted two studies to address earlier studies' limitations. Following Larsen and McGraw (2011), we asked participants to press the left and right mouse buttons to indicate whether they felt happy and sad, respectively, as they watched film clips. To reduce the amount of time that participants needed to monitor their feelings, we asked participants to complete the button press measures only occasionally, rather than constantly.

STUDY 1

In Study 1, we cued participants to complete the button press measures for 20 brief (5 s) epochs scattered throughout bittersweet and non-bittersweet

film scenes. If happiness and sadness are mutually exclusive and Larsen and McGraw (2011) only obtained evidence for mixed feelings because their task required participants to constantly monitor their feelings for 20 minutes, we would expect participants to spend no more time simultaneously pressing both buttons during bittersweet scenes than during non-bittersweet (e.g., happy, sad) scenes. Alternatively, if people can feel happy and sad at the same time even when they need not monitor their feelings for long periods, we would expect participants to spend more time simultaneously pressing both buttons during bittersweet scenes.

Method

Participants. Forty undergraduate women at Texas Tech University participated for partial course credit. We only included women because even though the women in Larsen and McGraw's (2011) studies spent no more time reporting mixed feelings during a bittersweet clip from *Life is Beautiful* than men did, they did report mixed feelings during particular scenes more consistently.

Procedure. We told participants that they would watch clips from subtitled Italian films as part of a language comprehension study, that emotions can affect language comprehension, and that one of their tasks would be to report how they were feeling for 5 s whenever they heard the occasional high tone. Following Larsen and McGraw (2011), we asked participants to press the left mouse button when they felt happy, the right button when they felt sad, neither button if they felt neither happy nor sad, and both buttons if they felt both happy and sad.

Participants watched a 23-minute subtitled clip from *Life is Beautiful* and a 4-minute clip from *The Garden of the Finzi-Continis* in counter-balanced order. The *Life is Beautiful* clip was adapted from Larsen and McGraw's (2011) 20-minute clip to include several additional brief scenes intended to improve the clip's narrative

flow and ended with a 45-second montage of particularly evocative scenes from earlier portions of the clip. (During the montage the original audio track was replaced with music from the film.) A series of tones embedded into the two clips' soundtracks served as cues. A 200 ms, 262 Hz tone indicated that the response window had opened; five seconds later, a 200 ms, 524 Hz tone indicated that the response window had closed. We embedded 15 cues into the *Life is Beautiful* clip. On the basis of a pilot study in which 16 women provided moment-to-moment ratings of their happiness and sadness as they watched the clip with the evaluative space grid (Larsen, Norris, McGraw, Hawkey, & Cacioppo, 2009), we embedded five *happy cues* into scenes that elicited intense happiness but negligible sadness, five *sad cues* into scenes that elicited intense sadness but little happiness, and five *bittersweet cues* into the scenes that were rated as eliciting the most mixed feelings (as indexed by the MIN index; Schimmack, 2001). As is typically the case (e.g., Diener & Iran-Nejad, 1986; Larsen & McGraw, 2011; Schimmack, 2001), the reported intensity of mixed feelings during these scenes tended to be fairly modest. Adjacent cues were separated by 25–317 s ($M = 97.8$ s).

One possibility is that participants would feel compelled to press the happy and/or sad buttons to indicate they had heard the cue even if they felt neither happy nor sad. Including cues in completely neutral scenes would be ideal for assessing how often participants made such responses, but eliciting neutral affect is challenging (K. G. Gasper, personal communication; November, 2010). The best options for neutral film clips tend to be somewhat boring (i.e., unpleasant) or relaxing (i.e., pleasant; see Rottenberg, Ray, & Gross, 2007). In lieu of identifying completely neutral clips, we embedded five *control cues* at irregular intervals of 29–70 s ($M = 47.5$ s) into a four-minute subtitled clip depicting a casual daytrip from the melodramatic film *The Garden of the Finzi-Continis*. The pilot study indicated that this clip elicited mild happiness and negligible sadness.

Results

A preliminary goal was to determine whether participants recognised that they had the opportunity to press neither button. If so, we would expect them to spend more time pressing neither button during the control cues embedded in the uneventful clip from *The Garden of the Finzi-Continis* than they did during the happy, sad, and bittersweet cues embedded in the more evocative *Life is Beautiful* clip. To evaluate this hypothesis, we submitted the amount of time that subjects pressed neither button during each type of cue to a Friedman test with Cue Type (control, happy, sad, bittersweet) as the independent variable. The Friedman test is the nonparametric analogue to the within-subjects one-way analysis of variance (ANOVA) and tests for differences among mean ranks (cf. mean scores). We report nonparametric tests throughout because, as in similar studies (e.g., Larsen & McGraw, 2011), many of our distributions were J-shaped and could not be transformed into normal distributions. The Friedman test was significant, $\chi^2(3; N = 40) = 32.30, p < .001$. As shown in Table 1, follow-up Wilcoxon signed-ranks tests, which test for differences between mean ranks, indicated that

Table 1. Median number of seconds that Study 1's participants pressed neither button, the happy button, the sad button, and both buttons at the same time during the control, happy, sad, and bittersweet cues

Button(s)	Cue type			
	Control	Happy	Sad	Bittersweet
Neither	15.8 _a	12.6 _b	10.4 _c	12.3 _b
Happy	8.7 _a	11.6 _b	0.0 _c	7.0 _a
Sad	0.0 _a	0.0 _a	14.4 _b	6.6 _c
Both	0.0 _a	0.0 _a	0.0 _a	0.0 _b

Notes: All control cues were embedded in the clip from *The Garden of the Finzi-Continis*; all other cues were embedded in the *Life is Beautiful* clip. Durations could range from 0 to 25 s. To correct for familywise error rate, we set $\alpha = .05/6 = .008$. Entries within all rows with different subscripts were significantly different, as evaluated by Wilcoxon signed-ranks tests (all $Z_s > 2.68$). Entries in the bottom row with different subscripts were also significantly different, as evaluated by paired sample sign tests.

participants spent more time pressing neither button during control cues than during all other cues, all $ps < .008$. These findings indicate that participants did not feel obligated to press one of the buttons simply in response to hearing the cues even when they felt neutral.

To further examine participants' affective experience during each cue type, we calculated how long they reported happiness (regardless of whether they reported sadness) and sadness (regardless of whether they reported happiness) during each set of cues (see Table 1). Friedman tests revealed significant effects of cue type on duration of happiness and duration of sadness, $\chi^2(3; N=40) = 72.52$ and 110.72 , respectively, both $ps < .001$. As shown in Table 1, follow-up Wilcoxon tests indicated that participants spent more time reporting happiness during happy cues than during all other cues; they also spent more time reporting happiness during control and bittersweet cues than during sad cues, all $ps < .001$.³ Participants spent more time reporting sadness during sad cues than during all other cues; they also spent more time reporting sadness during bittersweet cues than during control and happy cues, all $ps < .001$.

Table 1 indicates that the median participant spent time reporting happiness and reporting sadness during the bittersweet cues, but this does not imply that participants ever felt simultaneously mixed feelings of happiness and sadness. They may have felt exclusively happy at some moments and exclusively sad at others, but never both happy and sad. Following Larsen and McGraw (2011), we quantified the amount of time that participants experienced mixed feelings as the amount of time they simultaneously pressed both the happy and sad buttons during each type of cue (see Figure 1A).

All medians were 0.0 s (see Table 1) because only 40% of participants ever reported simultaneously mixed feelings, but all 16 of those participants reported simultaneously mixed feelings during bittersweet cues and only five did so during any other cue. A Friedman test revealed a significant effect of cue type on duration of mixed feelings, $\chi^2(3, N=40) = 44.10$, $p < .0001$. Follow-up Wilcoxon tests indicated that subjects spent more time reporting mixed feelings during bittersweet cues than during control, happy, and sad cues, all $ps < .0001$ (see Figure 1A). Most observations in these Friedman and Wilcoxon tests were tied at 0.0 s, which makes their exact p -values suspect. We therefore conducted a series of paired sample sign tests to further examine whether participants were significantly more likely to spend more (as opposed to less) time reporting mixed feelings during the bittersweet cues than during the happy cues, sad cues, and control cues. All three sign tests were significant, $p < .0001$.

The duration of mixed feelings data indicates that people spent more time experiencing mixed feelings during bittersweet cues, but it is possible that subjects only briefly and unintentionally pressed both buttons at the same time during bittersweet cues. To the contrary, the median report of mixed feelings lasted 2.8 s. Even after removing the six episodes (15%) that lasted < 1.0 s, the Friedman test, $\chi^2(3, N=40) = 41.20$, and follow-up tests indicated that participants spent more time reporting mixed feelings during bittersweet cues than during all other cues, all $ps < .001$.

Discussion

Participants spent more time reporting mixed feelings of happiness and sadness during occasional brief cues embedded in bittersweet scenes

³A 2 (Order: *Life is Beautiful* first; *The Garden of the Finzi-Continis* first) \times 4 (Cue Type: control, happy, sad, bittersweet) ANOVA on the duration of happiness data revealed a significant Order \times Cue Type interaction, $F(3, 36) = 4.13$, $p = .01$. Among participants who watched *The Garden of the Finzi-Continis* first, all the significant differences shown in Table 1 were replicated. Participants who watched *Life is Beautiful* first spent more time reporting happiness during happy ($Mdn = 9.1$ s), control ($Mdn = 9.3$ s), and bittersweet ($Mdn = 6.2$ s) cues than during sad cues ($Mdn = 0.0$ s; all $ps < .001$), but spent no more time reporting happiness during happy cues than during control and bittersweet cues. Contrast effects may have produced these order effects. For instance, *Life is Beautiful*'s tragic scenes may have made the uneventful clip from *The Garden of the Finzi-Continis* seem more pleasant.

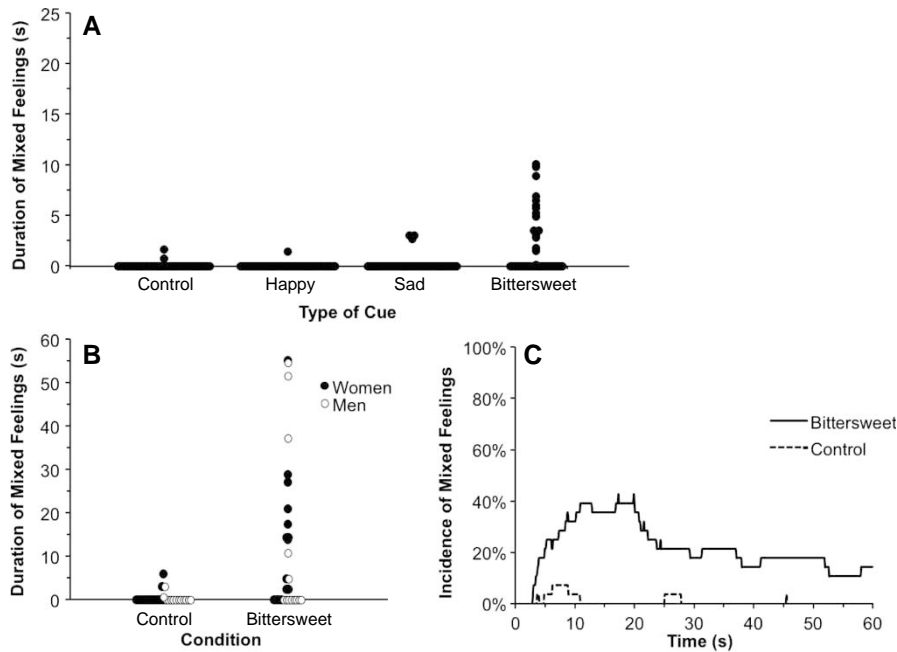


Figure 1. (A) Number of seconds that each participant in Study 1 reported mixed feelings (i.e., pressed both the happy and sad buttons at the same time) during the control, happy, sad, and bittersweet cues. (B) Number of seconds that each participant in Study 2's control and bittersweet conditions reported mixed feelings. (C) Incidence of reported mixed feelings over the course of the response window in Study 2's control and bittersweet conditions.

than during cues embedded in other scenes. These data extend earlier findings involving real-time moment-to-moment measures of happiness and sadness (Larsen & McGraw, 2011) by providing evidence for simultaneously mixed feelings even when the task does not require participants to constantly monitor their feelings.

STUDY 2

Study 1's participants knew from the outset that they would occasionally be asked to report their feelings, so they may have monitored their feelings even when they were not being asked to report them. We addressed this concern in Study 2 by making no mention of emotion until we asked participants to begin reporting whether they felt happy and sad. Moreover, we only asked participants to report their feelings once, as opposed to 20 times. We did so by asking some participants to report whether they felt happy and

sad during a bittersweet scene but others to do so during an unambiguously unpleasant control scene. Such between-subjects designs can reduce the likelihood of reactive measurement (Lana, 1969).

There were two other notable changes in Study 2. First, we widened the response window from 5 s to 60 s because (i) it would take participants some amount of time to read the questions and (ii) there was no reason to be concerned that a longer response window would threaten the validity of reports during subsequent windows because there were no subsequent windows. Finally, we included men in the sample to address any concerns about potential gender effects.

Method

Participants. Participants were 65 undergraduates, but data from six participants (9%) were unavailable or unusable due to computer error and

data from another four participants (6%) who apparently pressed the mouse buttons randomly as they watched the clip were discarded. The final sample contained 55 participants (53% women).⁴

Procedure. After receiving the language comprehension cover story, participants were told that pairs of questions about the film or their reactions to it would occasionally appear in the bottom corners of the screen. They were told to press the left and right mouse buttons to respond “yes” to the left and right questions, respectively. They were also told that each pair of questions would remain on the screen for 60 s and that they should press or release the buttons throughout those 60 s if their answers changed. To familiarise participants with the task, we first showed them the four-minute clip from *The Garden of the Finzi-Continis*. Participants were forewarned that the questions “Do you hear talking?” and “Do you hear laughing?” would appear at some point on the bottom left and right corners, respectively. These questions appeared at $t=7$ s. (Due to a programming error, they disappeared 3 s prematurely at 64 s.)

After watching the clip from *The Garden of the Finzi-Continis*, participants were given an opportunity to ask clarification questions and then watched Study 1’s *Life is Beautiful* clip. They were not told how many pairs of questions would appear or what the questions would be. Two pairs of filler questions (“Do you feel alert?”/“Do you feel tired?” [$t=45-105$ s]; “Do you hear talking?”/“Do you hear music?” [$t=715-775$ s]) preceded the target questions (i.e., “Do you feel happy?”/“Do you feel sad?”). In the bittersweet condition, the target questions appeared during the boy’s reunion with his mother following his father’s death ($t=1,332-1,392$ s). In the control condition, the target questions appeared several minutes earlier during unambiguously unpleasant scenes (e.g., the father’s death; $t=1,100-1,160$ s).

Results

Both the bittersweet and unambiguously unpleasant control scenes were quite evocative, as evidenced by the finding that participants in both conditions spent little time pressing neither button ($Mdn_{\text{Bittersweet}}=6.3$ s; $Mdn_{\text{Control}}=11.1$ s), Mann–Whitney $U=314.5$, $p=.28$. (The Mann–Whitney U is similar to the between-subjects t -test, but tests for differences in mean ranks.) Though participants in the bittersweet condition spent more time reporting happiness ($Mdn=22.7$ s) than did those in the control condition ($Mdn=0$ s), $U=108.0$, $p<.0001$, they did not spend significantly less time reporting sadness ($Mdn_{\text{Bittersweet}}=29.8$ s; $Mdn_{\text{Control}}=47.1$ s), $U=303.5$, $p=.21$.

Most important, participants in the bittersweet condition spent more time simultaneously reporting both happiness and sadness ($Mdn=3.5$ s) than did those in the control condition ($Mdn=0.0$ s), regardless of whether the three reports of mixed feelings lasting <1.0 s were included ($U=200.0$, $p=.0006$; see Figure 1B) or excluded ($U=188.0$, $p=.0002$). Figure 1C displays the incidence of reported mixed feelings across the 60-second response window. The median participant in the bittersweet condition took 17 s to report mixed feelings, but data-driven exploratory analyses indicated that participants in the bittersweet condition had spent significantly more time reporting mixed feelings than did those in the control condition within 4.0 s of the questions’ appearance, $U=310.5$, $p=.02$.

Follow-up analyses provided limited evidence for gender effects. When episodes of mixed feelings <1.0 s were included, the effect of condition was significant for women ($U=37.0$, $p=.001$), but not men ($U=64.0$, $p=.20$). When those episodes were excluded, however, the effect of condition was significant for both women ($U=37.0$, $p=.001$) and men ($U=56.0$, $p=.048$). Moreover, Figure 1B reveals that men in the bittersweet condition were 2.5 times more likely

⁴ All reported effects remained significant when data from the six participants (11%) who reported having previously seen *Life is Beautiful* were removed.

to report mixed feelings (38%) than those in the control condition (15%) and that all five men in the bittersweet condition who reported mixed feelings spent more time doing so (range = 4.8–54.6 s) than did the two men in the control condition who reported mixed feelings (range = 0.6–3.0 s). On balance, the evidence suggests that both men and women experienced more simultaneously mixed feelings in the bittersweet condition.

GENERAL DISCUSSION

We collected moment-to-moment measures of happiness and sadness in real time (cf. Carrera & Oceja, 2007) without requiring participants to constantly monitor their feelings (cf. Larsen & McGraw, 2011) and found that people spent more time reporting simultaneously mixed feelings during bittersweet scenes than other scenes. These data provide further evidence against the vacillation hypothesis and for the contention that people can feel happy and sad at the same time. Study 2's results are particularly telling. Participants did not know they were going to be asked about their feelings, but those in the bittersweet condition spent more time reporting mixed feelings within moments of the questions' appearance.

Barrett and Bliss-Moreau (2009) have noted that it is difficult to know exactly what people mean when they report feeling happy and sad at the same time. We share this concern and have addressed it with increasingly sophisticated measures of emotion. Even so, the available evidence fails to provide incontrovertible proof against the vacillation hypothesis. Our measures required participants to monitor their feelings only on occasion, but indirect measures of affect (i.e., those in which participants are not asked about their feelings) require no monitoring whatsoever. Unfortunately, making inferences from indirect measures of affect (e.g., facial expressions) can be challenging. Indeed, smiling can index happiness, but sometimes people smile to express positive affective states other than happiness and sometimes they even smile to express *negative* affect

(Harris & Alvarado, 2005). Such complex relationships make it difficult to treat evidence that smiles can accompany frowns (Griffin & Sayette, 2008; Harris & Alvarado, 2005) as evidence that happiness and sadness can co-occur.

Whatever future research involving indirect measures of happiness and sadness reveal, the available data from direct measures indicate that the positive and negative substrates underlying valence are separable in experience. A chemical compound cannot be both acidic and basic, but the evidence suggests that people can feel happy and sad at the same time.

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