Positive Affect and Pro-environmental Behavior: A preregistered experiment *

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*All data related to this study are available at <https://osf.io/cwyze/>.

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Abstract

In recent years, correlational evidence has accumulated in support of a positive relationship between positive affect and pro-environmental behavior. In contrast, it remains unclear whether the induction of positive affect can causally promote pro-environmental behavior. Previous attempts to examine the effects of experimental affect induction were constrained by the difficulty to study pro-environmental behavior under controlled laboratory conditions. Here, we address this limitation by examining the effect of a validated affect-induction procedure on a recently validated laboratory measure of pro-environmental behavior. Participants in our preregistered experiment ($N = 178$) watched and rated video clips pretested to induce either positive or neutral affect before completing 24 trials on the Pro-Environmental Behavior Task (PEBT). Results did not reveal any evidence in support of a positive effect of positive affect on PEBT behavior. This result illustrates the need for further systematic and cumulative research on the complex relationship between affect and pro-environmental behavior.

Keywords: pro-environmental behavior; conservation (ecological behavior); positive affect; subjective well-being; happiness; Pro-Environmental Behavior Task

1. Introduction

Although many pro-environmental behaviors (PEBs) involve considerable costs in terms of time, money, and effort, they do not seem to relate to a joyless existence of hardship and deprivation. To the contrary, engaging in costly PEBs has repeatedly been linked to happiness benefits (Coelho, Pereira, Cruz, Simões, & Barata, 2017; Kasser, 2017; Schmitt, Aknin, Axsen, & Schwom, 2018; Welsch & Kühling, 2010). The largely correlational nature of this literature does not allow for a clear explanation of the mechanisms causing PEB to correlate with happiness. PEB might bring about significant personal benefits or only relate to happiness via common associations with third variables. Another intriguing possibility would be a causal effect of happiness on PEB.

In his recent review of these different (though not mutually exclusive) pathways, Kasser (2017) called for future research to “determine whether experimental manipulations that put people into a pleasant (versus neutral or unpleasant) mood increase the likelihood that they express concern for the environment or engage in PEBs” (p. 7). In the meantime, the first experimental studies of the effect of positive affect on PEB have generated promising results. Chatelain and colleagues (2018) found a positively valenced message to increase participant’s willingness to show PEB in a hypothetical scenario when compared to a message designed to induce negative affect. Similarly, Ibanez, Moureau, and Roussel (2017) observed a trend towards larger pro-environmental donations following the presentation of positively valenced pictures.

One factor that limits the conclusiveness of these studies pertains to the measurement of PEB. The lack of consequences in hypothetical scenarios (such as the one used by Chatelain et al., 2018) relates to serious validity problems (e.g., Klein & Hilbig, 2019) and the donation measure used by Ibanez and colleagues (2017) seems to be subject to floor effects that compromise its sensitivity. In addition, both measures were created specifically for the

research question at hand and have not undergone psychometric evaluation. Hence, it remains unclear to what extent they are valid measures of PEB.

In the present study, we address this limitation by examining the effect of a validated affect-induction procedure on a validated measure of actual PEB. Participants viewed videos pretested to induce either positive or neutral affect before they completed the Pro-Environmental Behavior Task (PEBT, Lange, Steinke, & Dewitte, 2018). The PEBT involves a series of consequential choices between a pro-environmental and an environmentally harmful response option. Choices relate to actual consequences for participants and for the environment. Choosing the pro-environmental option prolongs the time participants have to wait until the next trial starts (and thus the time participants spend on the task). However, choosing the faster, but environmentally harmful option turns on a series of USB-controlled lights (and thus wastes energy and emits greenhouse gases). In a series of validation studies (Lange et al., 2018), PEBT choice behavior was found sensitive to manipulations of the individual cost of choosing the pro-environmental option and of its environmental impact. In addition, the multi-trial structure of the PEBT provides a reliable aggregate measure that significantly relates to participants' self-reports of pro-environmental behavior in everyday life (Lange et al., 2018; Lange & Dewitte, 2019a). In the present study, we used this measure to address the following primary hypothesis of our study:

Hypothesis 1: Induced positive affect leads to more PEB as compared to neutral affect. Participants will make a larger number of environmentally friendly choices on the PEBT after having watched positive affect videos than after having watched neutral affect videos.

In addition, the multi-trial structure of the PEBT allowed us to examine the temporal course of affect effects on PEB. Based on data suggesting the effect of affect manipulations to cool off over time (Schwartz & Loewenstein, 2017), we hypothesized that:

Hypothesis 2: The effect of induced positive affect on PEB declines over time. The difference in the number of environmentally friendly PEBT choices between participants in the positive affect condition and participants in the neutral affect condition will be larger in early as opposed to later trials of the PEBT.

Finally, we aimed to contribute to the individual difference literature by relating PEBT performance to self-report measures of trait positive affect, happiness, and satisfaction with life. Most existing research on this relationship analyzed correlations between self-report measures of both well-being and PEB, which may be inflated by common-method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Addressing this possibility, we tested the following hypothesis:

Hypothesis 3: Trait positive affect, happiness, and satisfaction with life are positively related to PEB. The number of environmentally friendly PEBT choices will correlate positively with participants' self-ratings of trait positive affect, happiness, and satisfaction with life.

All hypotheses and the associated analysis strategy were preregistered (<https://osf.io/nh95x>). We confirm that we have reported all measures, conditions, data exclusions, and how we determined our sample size. The study was approved by the local ethics committee (G-2016 12 694).

2. Methods

2.1 Participants

We determined our sample size to be large enough to detect a medium-sized ($d = 0.50$) main effect of experimentally induced positive affect with a statistical power of 95% (given $\alpha = .05$, one-tailed). Power analysis (G*Power 3.1.9.2, Faul, Erdfelder, Lang & Buchner, 2007) yielded a target sample size of $N = 176$. Due to conservative overbooking, this target sample size was slightly exceeded and, as preregistered, data from these additional participants were kept, resulting in a sample size of $N = 183$.

Participants were instructed to hand over their phones for the time of the experiment. Despite this instruction, one participant was observed with a phone in the testing cubicle and, as preregistered, this participant was excluded from all analyses. In addition, four participants in the neutral affect condition were excluded because one of the neutral affect videos caused the experimental software to crash. This technical problem was not anticipated and we did not preregister the respective exclusion criterion.

Of the final sample (59 male, 119 female), 86% were students and 61% named Dutch as their first language. Participants' age ranged from 18 to 64 years ($M = 24.03$ yrs, $SD = 6.19$ yrs). The majority of participants indicated having a bicycle (87%) and a driver's license (67%), while 21% reported to have a car. Participants were tested in groups of up to six people and they received €10 for their participation.

2.2 Procedure

The experiment took place in March 2019. Upon arrival at the laboratory, participants were asked to provide informed consent before they were shown to one of six partially enclosed testing cubicles. The assignment of participants to the testing cubicles was random (i.e., participants drew lots). Three cubicles each were assigned to each of the two experimental conditions (with the assignment of cubicles to conditions being counterbalanced across participants). This ensured similar numbers of participants in both conditions (positive affect: $n = 91$; neutral affect: $n = 87$).

In the testing cubicle, participants were informed that they would participate in two different studies and that these studies would be preceded by a general setup check to make sure that all procedures work as they should. They then received task-specific instructions before completing two practice trials on the video rating task and two PEBT practice trials. The two parts of the study were portrayed as independent to allow studying the effect of incidental affect on pro-environmental behavior without provoking demand effects.

2.2.1 Affect induction. For the video-based induction of affect, we selected video clips from the validated film library created by Samson, Kreibig, Soderstrom, Wade, and Gross (2016). Across their validation studies, these authors identified 41 video clips that were consistently rated to have positive valence and 45 video clips that were consistently rated to have neutral valence. For our study, we excluded 16 positive and 20 neutral videos for involving animals, nature scenery, or means of transportation. Two of the remaining neutral valence videos were selected as practice videos (displayed in both conditions) and two of the remaining positive valence videos were randomly selected for exclusion to ensure equal numbers of videos in both conditions.

This selection procedure resulted in a final stimulus pool of 23 video clips per affect condition. Note that one of the neutral affect videos was removed from the video pool after having caused software crashes in four participants. For each participant, ten video clips were randomly drawn from the condition-specific subset of stimuli.

Each video played for a duration of 20 to 30 seconds. After a video had stopped playing, participants were presented with four 6-point Likert-type rating scales, asking them to evaluate the overall quality and valence of the video, as well as how aroused they were by the video and whether they understood what the video was about. After the tenth video, they rated the overall quality of the videos. Mean ratings for all included videos can be found in the Supplementary Materials.

2.2.2 Measurement of pro-environmental behavior. After the video-rating task, participants completed 24 trials on the PEBT. On each trial, participants had to choose between two options, labelled “car” and “bicycle”. Participants were explicitly informed about the waiting periods associated with the two options and about the waiting-time difference between the options. Waiting times for the PEBT trials are displayed in the Supplementary Materials. Choosing the car option illuminated an array of twelve USB-

powered lights, located under the desk of the participant, for the duration of the waiting period. At the beginning of the task and on every trial, participants were informed about the number of lights that would be turned on by choosing the car option and the approximate amount of CO₂ emissions produced by powering the lights (i.e., 9000 mg/hr).

PEBT trials were divided into four blocks of six trials for analytical purposes only (i.e., the trials were presented as a continuous series of 24 trials). Mean additional waiting-time cost associated with choosing the bicycle option was held constant across these four blocks to allow meaningful between-block comparisons.

2.2.3 Self-report scales. After the final PEBT trial, participants responded to a number of exploratory measures before completing self-report scales of trait affect, happiness, and satisfaction with life. They indicated to what extent they generally experience positive and negative affect states on the International Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007). The sum score across the five positive affect items (Cronbach's $\alpha = .55$) was considered an indicator of trait positive affect. Participants further responded to the five items of the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; $\alpha = .85$) and the four items of the Subjective Happiness Scale (SHS; Lyubomirsky & Lepper, 1999; $\alpha = .85$).

2.3. Preregistered Analyses

Mean valence (as a manipulation check) and arousal ratings (for exploratory purposes) for the ten videos of the video-rating task were compared (using one-tailed Welch's *t*-tests) between affect conditions. The other two rating items functioned as filler questions to increase the credibility of the video rating task.

The proportion of choices of the bicycle option on the PEBT served as the dependent variable in the experimental design testing Hypothesis 1 and Hypothesis 2 and as criterion

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variable in the correlational design testing Hypothesis 3. The level of significance was set to $\alpha = .05$.

Hypothesis 1 was tested using an one-tailed Welch's *t*-test comparing the overall proportion of bicycle choices between affect conditions. Significantly higher proportions of bicycle choices in the positive affect condition than in the neutral affect condition would be considered as evidence for Hypothesis 1.

Hypothesis 2 was tested by evaluating the interaction of the between-subjects factor Affect (positive vs. neutral) and the within-subject factor Block (first vs. second vs. third vs. fourth) in a 2×4 mixed-design ANOVA. A significant interaction with numerically larger differences in the proportion of bicycle choices between the affect conditions (in favor of the positive affect condition) in earlier as opposed to later blocks of PEBT trials would be considered as evidence for Hypothesis 2. For this analysis, Greenhouse-Geisser correction was applied. In case of a significant interaction, the two affect groups were compared at each level of the factor Block by means of Bonferonni-corrected simple effects tests.

Hypothesis 3 was tested by evaluating Pearson correlation coefficients (with one-tailed significance tests) between the overall proportion of bicycle choices on the PEBT and 1) the sum score across the positive affect items of the I-PANAS-SF, 2) the sum score of the SHS, and 3) the sum score of the SWLS. The level of significance was set to $.05/3 = .0167$ to adjust for the number of examined correlations. For all three measures, significant positive correlations with the overall proportion of bicycle choices would be interpreted as evidence for Hypothesis 3.

3. Results

Participants in the positive affect condition rated the valence of the videos they watched to be significantly more positive ($M = 4.25$, $SD = 0.62$) than participants in the neutral affect condition ($M = 2.94$, $SD = 0.61$), $t(1, 175.77) = 14.25$, $p < .001$, $d = 2.13$, 95% CI [1.76, 2.50]. Videos were also rated to be more arousing in the positive affect condition ($M = 3.26$, $SD = 1.07$) compared to the neutral affect condition ($M = 2.18$, $SD = 0.78$), $t(1, 164.81) = 7.70$, $p < .001$, $d = 1.15$, 95% CI [0.83, 1.47].

Similar group differences were not found with regard to participants' performance on the PEBT. The proportion of bicycle choices was not significantly larger in the positive affect condition ($M = .63$, $SD = .29$) than in the neutral affect condition ($M = .67$, $SD = .22$), $t(1, 167.01) = -0.88$, $p = .811$, $d = -0.13$, 95% CI [-0.43, 0.16].

The 2×4 mixed-design ANOVA revealed a significant main effect of Block, $F(2.47, 434.54) = 42.33$, $p < .001$, $\eta_p^2 = .19$, 95% CI [0.13, 0.25], with the proportion of bicycle choices decreasing from the first to the fourth PEBT block (Figure 1). More importantly, this main effect was qualified by a significant Block $\times$ Affect interaction, $F(2.47, 434.54) = 5.80$, $p = .002$, $\eta_p^2 = .03$, 95% CI [0.01, 0.07]. In accordance with Hypothesis 2, this interaction can be attributed to the group difference between affect conditions being largest in the first PEBT block. However, in contrast to Hypothesis 2, the proportion of bicycle choices was larger in the neutral affect condition as opposed to the positive affect condition during these early PEBT trials, $p_{(\text{Bonferroni-corrected simple effects test})} = .046$, $d = -0.30$, 95% CI [-0.60, 0.00]. PEBT choice behavior did not differ significantly between affect groups in the other three PEBT blocks, all $p > .266$, all $|d| < 0.17$. Controlling for arousal ratings (not preregistered) did not markedly change the results.

Figure 1. Proportion of bicycle choices made on the Pro-Environmental Behavior Task (PEBT) as a function of affect condition and task block. Each block consisted of six trials. Vertical bars indicate 95% confidence intervals.

Pearson correlation coefficients for the relationships between the proportion of PEBT bicycle choices and self-report measures of trait affect, happiness, and satisfaction with life are displayed in Table 1. In contrast to Hypothesis 3, none of the correlations of interest were positive, all one-tailed $p > .720$. In fact, correlations of PEBT performance with I-PANAS-SF and SHS scores would even be significantly negative when tested with a two-tailed test.

Supplementary analyses (not preregistered) did not reveal any correlations of PEBT performance with the negative affect items of the I-PANAS-SF or with participants' valence and arousal ratings of the videos, neither in the whole sample, nor in the separate experimental groups, all $|r| < .17$, all two-tailed $p > .111$.

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Table 1.

Pearson correlation coefficients for relationships between pro-environmental behavior and self-reported positive affect

	whole sample ($N=178$)				positive affect condition ($n=91$)				neutral affect condition ($n=87$)			
	M (SD)	PA	SWLS	SHS	M (SD)	PA	SWLS	SHS	M (SD)	PA	SWLS	SHS
PA	17.66 (2.50)	-			17.56 (2.52)	-			17.76 (2.48)	-		
SWLS	23.09 (5.86)	.21	-		23.21 (6.00)	.13	-		22.97 (5.74)	.31	-	
SHS	19.10 (4.36)	.38	.53	-	19.22 (4.21)	.39	.55	-	18.98 (4.53)	.38	.51	-
PEBT	.65 (.26)	-.15	-.04	-.21	.63 (.29)	-.19	-.02	-.26	.67 (.22)	-.11	-.08	-.15

Note. Correlations of relevance for testing Hypothesis 3 are highlighted in bold. PA = sum score across the positive affect items of the International Positive and Negative Affect Schedule Short Form, SWLS = sum score of the Satisfaction with Life Scale, SHS = sum score of the Subjective Happiness Scale, PEBT = proportion of bicycle choices on the Pro-Environmental Behavior Task.

4. Discussion

Using validated procedures to induce positive affect and to assess PEB under controlled laboratory conditions, we did not find empirical support for a causal effect of positive affect on PEB. Of course, the absence of an effect in our design does not rule out the existence of affect effects on PEB in general. Possibilities to manipulate positive affect (Westermann, Speis, Stahl, & Hesse, 1996) and to measure PEB (Lange & Dewitte, 2019b) are manifold, and the conceptual relations within each class of procedures are still a long way from being clarified. It appears likely that different types of positive affect differentially relate to PEB (see also Ibanez et al., 2017) and that PEBs differ in their susceptibility to affect manipulations. As such, our results should not be taken as a definitive discouragement of research on affect effects on PEB, but rather as one informative piece in a complex puzzle.

Along the lines of our experimental findings, we did not find evidence for a positive correlation between PEB and self-report measures of trait affect, happiness, and satisfaction with life. Such correlations are likely to depend on the degree of variation in the sample, and in this context, it is important to note that our student-dominated sample is not representative of the population to which we would ultimately like to generalize our results. In addition, we

only assessed one particular type of PEB and the external validity of our experimental results depend on the degree to which everyday PEBs involve the same contingencies as the PEBT (Lange, Brick, & Dewitte, 2020). Finally, it may be tempting to conclude that our study did produce evidence of a relationship between positive affect and PEB, but in contrast to our predictions, this relationship was negative. Critically, however, our data was generated to test the directed hypothesis of a positive relationship and thus it cannot be taken to test another, data-driven hypothesis without inflating the risk of producing a false positive. If some types of positive affect can have negative effects on PEB remains for future studies to test. Given the present findings and state of the literature, we do not see sufficient support for an effect in either direction and, as detailed above, this situation should promote rather than discourage systematic research efforts in the field.

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Supplementary Materials

Table S1

Waiting times associated with the two PEBT options in seconds

Block	Car	Bicycle	Difference (WTD)
1	5	10	5
	10	20	10
	15	30	15
	15	35	20
	10	40	30
	20	80	60
2	15	20	5
	5	15	10
	20	35	15
	20	40	20
	5	35	30
	10	70	60
3	20	25	5
	15	25	10
	10	25	15
	10	30	20
	15	45	30
	5	65	60
4	10	15	5
	20	30	10
	5	20	15
	5	25	20
	20	50	30
	15	75	60

Note. Trials were allocated to blocks to ensure that a) mean car-waiting time, mean bicycle-waiting time, and mean waiting-time difference (WTD) were constant across blocks, b) each WTD level was presented exactly once per block, and c) each car-waiting-time level was presented at least once and not more than twice per block. The six trials allocated to each block were presented in random order.

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Table S2
Participants' ratings of the 23 videos used to induce positive affect

		valence			arousal		quality		understanding	
	<i>n</i>	<i>Mean</i>	<i>SD</i>		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
pos_babybitesbrosfinger.avi	43	5.00	0.95		3.86	1.52	4.77	1.00	5.56	0.93
pos_babycontrolscheers.avi	46	4.83	1.20		3.54	1.56	3.87	1.00	4.76	1.49
pos_babydance50cent.avi	40	4.60	1.17		3.43	1.45	3.80	1.20	5.30	1.09
pos_babydancebeyonce.avi	44	4.86	1.15		3.55	1.53	3.93	0.87	5.57	0.87
pos_babydancingtornb.avi	36	4.33	1.24		3.06	1.24	3.44	1.21	4.72	1.11
pos_babydoesntlovehisdaddy.avi	38	3.95	1.14		2.92	1.28	3.84	1.00	5.18	1.09
pos_babyeatslemon.avi	40	4.63	1.29		3.25	1.41	4.30	0.94	5.75	0.44
pos_babyevileye.avi	47	4.74	1.19		3.64	1.48	3.72	1.23	4.91	1.41
pos_babyfailshulahoop.avi	38	4.55	1.18		3.79	1.49	3.84	1.22	5.47	0.80
pos_babyscaredbyhisownflatulence.avi	39	3.21	1.38		2.23	1.27	2.23	0.74	3.13	1.59
pos_babyshiccupandlaugh.avi	36	4.17	1.40		3.00	1.51	3.06	1.29	4.78	1.42
pos_beatboxbabydance.avi	41	4.68	1.19		3.51	1.50	4.24	1.02	5.39	0.95
pos_bridelaughingduringvows.avi	35	4.63	1.03		3.40	1.59	3.09	1.17	4.06	1.83
pos_bridethrowsflowersatbridesmaid.avi	34	4.47	1.02		3.71	1.40	3.82	1.00	5.53	0.83
pos_cookiebaby.avi	39	4.18	1.30		3.31	1.42	3.87	1.22	5.13	1.34
pos_dancingaccidentkick.avi	43	3.63	1.43		3.19	1.59	2.95	1.21	4.86	1.23
pos_escalatorspinning.avi	36	3.72	1.11		2.78	1.15	2.31	1.12	5.17	1.16
pos_failtreadmilledance.avi	40	4.18	1.41		3.25	1.60	3.25	1.21	4.25	1.58
pos_girlhitsherheadbowling.avi	38	3.66	1.36		2.82	1.35	1.76	1.00	5.34	0.94
pos_girlthrownintobasketballhoop.avi	45	3.82	1.28		3.13	1.50	2.04	1.09	4.89	1.27
pos_mancrashesintoglassdoor.avi	38	3.79	1.14		3.03	1.57	2.50	1.01	5.42	1.03
pos_weddingphotographerfails.avi	35	4.51	1.40		3.60	1.48	3.54	1.17	5.80	0.41
pos_womanruinsweddingwithpole.avi	39	3.49	1.45		2.82	1.59	2.64	1.29	5.13	1.24

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Table S3
Participants' ratings of the 23 videos used to induce neutral affect

		valence		arousal		quality		understanding	
	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
neu_assembly.avi	30	3.27	1.14	2.27	1.28	3.60	1.16	4.17	1.21
neu_boydrinkingtea.avi	44	1.93	1.13	1.36	0.61	2.41	1.19	2.25	1.62
neu_centralstationNY.avi	33	2.52	1.12	1.61	0.90	1.79	1.08	3.48	1.52
neu_diving.avi	44	2.59	0.95	1.89	0.99	1.93	1.00	2.80	1.53
neu_eatingpizza.avi	46	2.61	1.11	2.04	1.25	2.87	1.05	2.63	1.62
neu_eatingwithchopsticks.avi	43	3.74	1.24	3.23	1.60	3.60	1.14	5.65	0.72
neu_girlsbrushingteeth.avi	44	2.27	1.11	1.82	1.24	3.52	1.19	3.77	1.89
neu_grout.avi	32	3.09	0.96	2.06	1.11	3.09	1.09	3.97	1.60
neu_hairwashing.avi	37	2.95	1.00	2.24	1.19	3.30	1.05	3.97	1.71
neu_inthekitchen.avi	33	2.97	1.10	2.18	1.21	2.91	0.91	3.30	1.19
neu_knit.avi	4	2.00	1.41	1.25	0.50	1.25	0.50	3.75	2.22
neu_knitting.avi	35	4.37	0.91	3.51	1.44	4.37	0.94	5.66	0.73
neu_mall.avi	46	3.39	1.18	2.41	1.50	4.13	1.13	3.24	1.64
neu_museum.avi	49	2.37	0.93	1.39	0.61	2.88	1.20	1.76	1.20
neu_origami4.avi	43	2.81	1.07	2.07	1.14	2.47	1.14	4.65	1.19
neu_pancakesII.avi	41	4.29	0.87	3.37	1.55	4.51	0.93	5.51	0.71
neu_pillow.avi	35	3.37	1.14	2.37	1.37	3.89	0.99	4.80	1.59
neu_scrapbook.avi	39	2.74	1.12	1.77	0.87	2.69	1.32	2.64	1.56
neu_sittingonthesofa.avi	40	1.98	0.83	1.50	0.82	2.13	0.94	1.65	1.19
neu_swimlaps.avi	45	3.24	1.23	2.40	1.34	2.93	0.96	4.33	1.67
neu_tea.avi	38	2.74	0.98	1.87	1.04	2.55	1.25	3.58	1.67
neu_treadmill.avi	32	3.44	1.16	3.25	1.50	3.53	1.22	5.22	1.10
neu_vangoghmuseum.avi	37	2.62	0.92	1.89	0.91	2.49	1.02	3.76	1.59

Note. The video neu_knit.avi was removed after it had repeatedly caused the experimental software to crash.