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Affect and self-efficacy infuse the experience of ambivalent photographs

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Ambivalent pictures offer several interpretations of different valence—e.g., some photographs by Claudia Otto document scenes which can be perceived as sad or happy, dangerous or sweet, and so on. We show that task experiences influence the experienced valence of these images. Previous work already documented that responses to images are task-dependent and self-created insights heighten pleasure. A resulting positive mood and high self-efficacy might broaden attention to positive valence. In contrast, low self-efficacy leads to the prediction of negative task experiences and strengthens the salience of a positive experience. In our study, participants rated the valence of ambivalent photographs to be more positive after positive feedback regarding the accomplishment of a precedent puzzle. We revealed a trend of positive feedback being more effective when it followed negative experiences. The experience of ambivalent images is strongly linked to mood and self-efficacy and both is influenced by task-experiences in psycho-aesthetic studies.

Keywords: Empirical Aesthetics, Ambivalence, Photography, Valence, Self-efficacy, Affect, Art & Science

Highlights:

- Ambivalent photographs appear more positive after positive feedback to preceding task
- Positive feedback broadens attention to positive facets of ambivalence
- Theoretical models from social psychology are compatible with data pattern

Ambivalent pictures allow for several interpretations of different valence. Some photographs by Claudia Otto, for instance, document scenes which can be interpreted as being either sad or happy, dangerous or sweet, and so on

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(see Figure 1). The construct of *Semantic Instability* (*SeIns*, Muth & Carbon, 2016) refers to different phenomena in art that similarly hinder easy perception of determinacy (like multistability, dichotomy, experience of hidden images or visual indeterminacy). Besides other interesting aspects of the aforementioned photographs, we can focus on their multistability: they allow for several quite clear but mutually exclusive interpretations of the scene (e.g., a man greets someone or bids farewell, respectively). As this multistability specifically refers to an oscillation between valences, e.g. being sometimes positive and sometimes negative, we can refine the concept towards the construct of ambivalence.

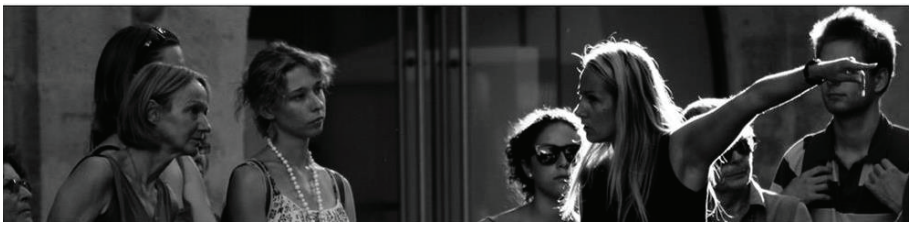

Figure 1. "Weg.weisend"; photograph by Claudia Otto. Note that due to legal issues we cannot show the original stimulus material here but see http://www.fotocommunity.de/user_photos/907351?page=3&folder_id=291324.

As we will describe in the following, whether we focus rather on positive or negative aspects of the documented social scenes might be dependent on various (interactive) factors. Generally, responses to images are influenced by the according context (e.g., a task) provided to participants. For instance, perceiving reflective symmetric patterns leads to positive responses (smiling) if they are the target in a task but the same accounts for random patterns (Makin, Wilton, Pecchinenda, & Bertamini, 2012). Here, presumably, the fulfillment of a task influenced the physiological reaction and not (only) the symmetry of the patterns itself (but reflective patterns are often intuitively chosen as target, see Makin et al., 2012). Self-efficacy (originally introduced by Bandura, e.g., 1977) seems to be a relevant construct here if we understand it as a dynamically changing feeling of one's own ability to cope with tasks and to reach goals. General self-efficacy is a highly relevant competence regarding confidence and happiness in life, mental health, and the coping with potential stressors (e.g., Schwarzer & Jerusalem, 1995). The feedback of mastering a task or failing it might affect this variable at least for a short time: positive task experience can enhance self-efficacy whereas negative task experience can reduce it (e.g., Bandura & Locke, 2003). The effect of a task accomplishment on affective responses as shown by Makin et al. (2012) might furthermore be connected to the so called Aesthetic Aha effect (Muth & Carbon, 2013): pleasure gained during the perception of images is influenced by feelings of (self-created) insight. The Aesthetic Aha effect is especially relevant for art perception as artworks often challenge perceptual habits but also allow for the active creation of insights at the same time. Similar (mis-)attributions of characteristics of people's own states

and processing characteristics to evaluations of an object were described in the realm of the fluency hypothesis which assumes that the experience of ease (or fluency) of processing creates a positive affect which is (mis-)attributed to the object in question (e.g., Reber, Schwarz, & Winkielman, 2004, but see Albrecht & Carbon, 2014). It can therefore be assumed that an increased self-efficacy by task fulfilment or insight has an impact on the affective state of the perceiver and on the evaluation of objects that have been involved in the task or insight.

Persons might not only transfer their affective state to evaluated preferences for objects but to changes in the perceived valence of objects and events as well. The so called "Affect Infusion Model" (*AIM*, Forgas, 1995) attempts to explain how affect influences judgmental processes (especially in the social domain) that can even be about an unconnected target. It states that affect has a mood-congruent impact especially when the judged stimulus is not passively approached but elaborated in a rather open and extensive manner—e.g., if it is a rather complex object. Ambivalent pictures like the ones introduced in the beginning might be such cases that require intense active and constructive processes, so called "high-infusion strategies" (Forgas, 1995). In such cases, the infusion might happen indirectly via effects on attention and the priming of associations (according to the "affect-priming principle"; Forgas, 1995). For instance, positive mood was shown to lead to a wider attentional scope and an increased usage of heuristics whereas negative mood seems to lead to more systematic approaches (e.g., one considers the quality of arguments more), accompanied by a narrower focus (Tiedens & Linton, 2001). This means that positive mood would widen the scope of perception and cognition and allow for creative thinking—it has a "broadening" effect (Fredrickson, 2004)—whereas negative emotions would narrow attention (e.g., when it is focused on threatening stimuli in case of anxiety). Affect could itself be described as a kind of heuristic to help forming a judgement (according to the rationale "if I feel positive about it, it could be the right thing to do", see Tiedens & Linton, 2001). Again, a misattribution underlies this impact as "judges apparently 'misattribute' their mood as if it were informative about their reactions to the target" (Forgas, 1995, p. 43).

Other research complicates an easy link between positive or negative mood and broadening or narrowing of attention (e.g., Bruyneel et al., 2013 did not find a general broadening effect by positive affect in a flanker task). Whereas—as suggested by Forgas (1995) and shown for aesthetic evaluations by Locher, Frens, and Overbeeke (2008)—to be infused by affect, the evaluated object has to be processed substantively instead of heuristically, it seems to be crucial for attentional broadening that the positive affect itself is not linked to the motivation to approach an object; otherwise, the attentional scope would be narrowed even if affect is positive (Gable & Harmon-Jones, 2008). Second, the "broadening" effect in cases of affect-priming—e.g., an attentional openness to positive valence because of a positive mood—seems to be specific to the valence of the judged and experienced events or objects: For instance, Wadlinger and Isaacowitz (2006) showed in an eye tracking study that people in positive mood

attend more to positive stimuli presented in the periphery and avoid negative ones (matched regarding arousal level). In the case of ambivalent photographs like the ones introduced above, we might consequently assume a positivity bias: people in a positive mood might attend more to the positive interpretations that the picture allows for than to negative ones.

Self-efficacy and affect/mood are connected in multiple ways: repeated positive task experience might lead to positive affect and mood as well as to higher self-efficacy: the expectation of further successful mastery and therefore further positive experiences. Here, it is worth to include a perspective on effects of expectation as examined in studies on decision framing by "gain" or "loss" scenarios. One line of reasoning from this research field assumes a "counter-regulation principle": when people experience or expect positive events, negative stimuli are more salient and if they experience or expect negative events, they attend more to positive information and this would "prevent emotional and motivational extremities, impulsivity, and rigidity" (Schwager & Rothermund, 2013, p. 112). The authors explain the effect that people rather choose a risky option if they are in a loss frame than if they are in a gain frame (Kahneman & Tversky, 1984) by the counter-regulation principle: the gain frame would be related to a focus on positive outcomes and therefore the attention allocation to negative valence whereas the loss frame would make us focus on positive valence as shown by a stronger positivity bias in the loss frame and a stronger (but nonsignificant) negativity bias in the gain frame.

How can we combine effects of affect, self-efficacy and expectations of "gain" and "loss"? A gain is the experience of change from negative to positive events and a loss a change from positive to negative events. Considering affect, the experience of a negative event has different effects based on the state of the perceiver: it has a greater effect if the current state is positive than if it is negative. Self-efficacy might be a moderator in this regard (Chiou & Wan, 2007).

Methods

Rationale of the study

Artworks are often semantically unstable, posing challenges to perceptual habits and allowing for multiple interpretations. Photographs by Claudia Otto, for instance, can be interpreted in various ways as the depicted social scenes are not determinate with regard to valence. We asked how the actual affective state of an observer influences the experience of such ambivalent pictures and tested this via a manipulation of task experience. As summarized above, literature suggests that a positive task experience goes along with a positive effect on affect (defined in the following as short-termed experience and display of positive or negative feelings) and, in contrast, with negative affect in case of negative feedback. In the present study, we manipulate task experience by faked positive or negative feedback to a puzzle of the target pictures. When in a mode of intense elaboration as with Otto's ambivalent pictures, such affect-priming would lead to a focus on positive interpretations (broadening effect). Furthermore, after sufficient initial repeated or strongly positive task

experience, mood (defined in the following as prolonged experience of either positive or negative feelings) and self-efficacy (defined as feeling of one's own ability to cope with tasks and to reach goals) is expected to increase together with the anticipation of further (even more) positive experiences by future successful mastery of similar tasks. This anticipation might resemble a "gain" framework which according to the counter-regulation principle should lead to a heightened response to negative aspects of experience in case of positive mood. Therefore subsequent negative experiences might lead to a greater negativity bias than in cases when people experience negative feedback and have a low self-efficacy. In case of a negative task experience, we anticipate a negative effect on mood (although no attentional bias is expected), which subsequently leads to decreased self-efficacy. This may increase the expectation of further negative experiences and frames ones state of mind in a "loss" mode. A subsequent positive experience might therefore produce a positivity bias leading to heightened response to positive aspects of experiences, which might be even reinforced by a broadening effect (see Table 1).

Table 1
Hypothesized effects of positive and negative task experience.

	mood	attention	self-efficacy	frame	subsequent antagonistic experience
pos. task experience	pos.	positivity bias/ broadening	increase	"gain"	negativity bias
neg. task experience	neg.	no bias	decrease	"loss"	positivity bias

Participants

Thirty-three participants took part in the study; data of two persons had to be excluded due to errors in conducting the experiment. The remaining 31 persons (25 female; M_{age} = 22.3 years, SD_{age} = 5.88) were randomly assigned to two groups (n_{group1} = 17, n_{group2} = 14). Some of them were undergraduate students of psychology and gained course credit for participation; the others were recruited via word-of-mouth. A Snellen Eye chart test and a sub set of the Ishihara color cards were used to exclude potential cases of strong vision or color vision deficiencies. All participants were naïve to the purpose of the study.

Apparatus and stimuli

Ten grayscale images by photographer Claudia Otto were used to create digital puzzles (with 15–16 pieces depending on the picture's ratio; for an example see Figure 1). These images were selected from a pool of 40 images based on an online survey in which 11 participants (6 female; M_{age} = 38.5 years, SD_{age} = 19.6) rated them on valence on a 7-point Likert scale. We selected only pictures which were not consistently rated to be of high positive or negative valence to avoid ceiling effects when task experience would increase or decrease their valence and to avoid inhomogeneous distribution of initial valence (using only those that scored within 0.5 *SD*s above or below the total mean value of valence). Puzzles were created via the puzzle generator program "Mein FotoPuzzle 2.0". Participants completed the puzzle on a laptop but received feedback and evaluated pictures on a second screen. The feedback bars that were presented in response to the duration of puzzling (but faked in valence, see next section on "Procedure"), consisted of a green-to-red gradient with an arrow pointing to the seemingly achieved result and an addition "below average" or "above average" ("*überdurchschnittlich*" or "*unterdurchschnittlich*"; see Figure 2). The position of the arrow was flexible and differed from trial to trial.

Procedure

Pictures were puzzled and evaluated twice, each time grouped to blocks in a random order. Between the blocks a distraction task was accomplished (coloring Mandalas). Each trial consisted of first completing a puzzle of one photograph on the laptop. Then the participants were asked to type in the time of completion that was displayed on the laptop to an empty field on the screen of a second computer. After a short faked "processing time" ("please wait while your results are analyzed") a manipulated feedback was displayed indicating either above or below average results (see Figure 2). The participants then were prompted to rate the valence of the picture on a 7-point scale from 1 (negative) to 7 (positive). During this evaluation, the picture was present on screen until the according key was pressed. The same 10 images were puzzled and evaluated in the second block again; however participants were provided the opposite feedback than the one they had previously received. The order of the (faked) feedback-valence differed between the two groups of participants: group 1 received positive feedback first (below average puzzle time) and then below, group 2 first negative and then positive faked feedback. Note that the arrow pointing to the (fake) result varied in height for each trial.

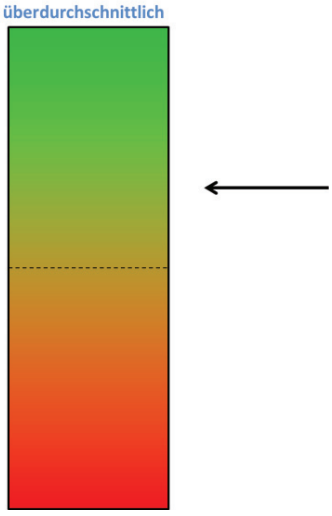

Figure 2. Example of a positive feedback screen. The graphic was added by the explication that the achieved result was above average ("überdurchschnittlich").

After the two blocks of evaluation, participants were asked if they had encountered any problems during the procedure and if they had an idea on what the experiment was about. In the end, they were debriefed: the aim of the study was revealed and, very important, it was explained how we manipulated and biased the feedback. Concretely, it was made clear that this feedback was not at all related to their performance in the puzzle task. The entire process lasted about 40 minutes.

Results

First, we compared ratings on valence between both *feedback* conditions (*negative* vs. *positive*) via two paired *t*-tests with data being averaged over the ten stimuli or 31 participants, respectively. Data yielded mean ratings of valence

of M = 4.26 (SD = 0.59) for the blocks with negative feedback and M = 4.51 (SD = 0.66) for the blocks with positive feedback. Participants rated the valence of the photographs significantly more positive when they were presented after an above average feedback, t (30) = 2.70, p = .011, Cohen's d = 0.485. And a stimulus' valence was more positive when the image followed above average feedback as compared to below average feedback, t (9) = 4.11, p = .003, Cohen's d = 1.300.

To furthermore examine the effect of antagonistic experiences, we conducted a mixed Analysis of Variance (ANOVA) on average valence evaluations per participant with *feedback* (*negative* vs. *positive*; within-participants manipulation) and *order* of feedback as factors (*neg←pos*: first positive than negative vs. *neg→pos*: first negative than positive; between-participants manipulation). As expected, feedback had a significant impact on the ratings of valence, F (1,29) = 8.62, p = .006. This effect (η_p^2 = .229) was signified by more positive ratings on valence for positive compared to negative feedback (see Figure 3). The interaction between feedback and order failed to reach significance although there was a trend for valence being most positive when positive feedback was given during the second block, F (1,29) = 2.91, p = .099, *n.s.*, η_p^2 = .091; see Figure 3). Order did not have a significant effect on ratings of valence.

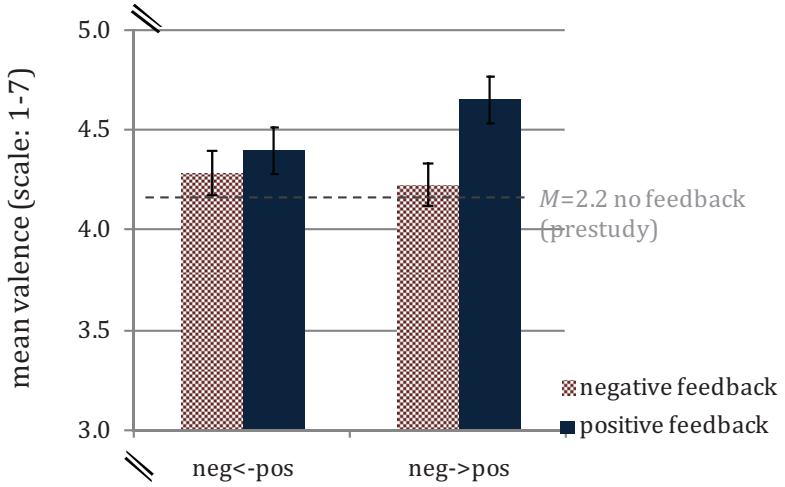

Figure 3. Ratings of valence after positive and negative feedback depending on order of feedback; "neg←pos" means that participants got positive feedback first and negative feedback during the second block; "neg→pos" means that they got negative feedback first and positive feedback during the second block. Error bars mark +/– 1 standard error of the mean calculated for both types of feedback separately. Dashed line represents average valence based on data of the prestudy (valence without feedback, 11 participants).

Of 31 participants nine mentioned after the study that they had not trusted the authenticity of the feedback and assumed it to be manipulated experimentally. For an exploratory view, we ran analyses for the subset of 22 participants who did not report being suspicious about the experimental design (of these 22 participants, 14 got positive feedback first and negative feedback during the second block. The other eight participants got negative feedback first and positive feedback during the second block). The main effect of feedback on valence was again significant, F (1,20) = 10.88, p = .004, η_p^2 = .352—the effect size was even a bit larger. With this reduced participant pool, the effect of order on valence was significant with generally more positive ratings of valence if positive feedback followed negative feedback, F (1,20) = 6.76, p = .017, η_p^2 = .253. The interaction between feedback and order failed to reach significance but again showed a trend for valence being most positive when positive feedback was given during the second block, F (1,20) = 3.36, p = .082, *n.s.*, η_p^2 = .144. Table 2 shows average ratings of valence depending on feedback, order, and naïvety. Note, however, that the results of these additional analyses are of restricted validity due to their pooled nature.

Table 2
Average ratings of valence for naïve and not naïve participants.

feedback	order	not naïve	naïve	difference (not naïve – naïve)
negative	pos->neg	4.80 (n = 3)	4.18 (n = 14)	0.62
	pos<-neg	3.82 (n = 6)	4.54 (n = 8)	-0.72
	average	4.31 (n = 9)	4.36 (n = 22)	-0.05
positive	pos->neg	4.63 (n = 3)	4.35 (n = 14)	0.28
	pos<-neg	4.00 (n = 6)	5.14 (n = 8)	-1.14
	average	4.32 (n = 9)	4.74 (n = 22)	-0.43
averaged	pos->neg	4.72 (n = 3)	4.26 (n = 14)	0.45
averaged	pos<-neg	3.91 (n = 6)	4.84 (n = 8)	-0.93
	difference (pos->neg – pos<-neg)	.81	-.57	

General Discussion

We examined how self-efficacy, affect and mood influence the experience of ambivalent pictures. Our study shows that the valence of an ambivalent photograph is more positive after a preceding positive task experience than after a negative task experience—here via a manipulation of self-efficacy and affect: a positive or negative feedback to having accomplished a puzzle of the photograph. This finding adds to previous evidence for effects of experimental tasks on responses to visual stimuli. Whereas a control condition with a neutral feedback is required to clarify the mechanism, this finding is in accordance with the idea that the broadening effect is specific to the valence of affect. It cannot strictly be decided based on our data if positive affect triggered a broadening effect of attention to neutral or positive aspects of events—as previous literature revealed—or if negative feedback narrowed

attention to positive aspects of the pictures. We would still argue for an according broadening to positive aspects based on average ratings of valence collected in the prestudy (see dashed line in Figure 3). Though this is far from clear cut due to the differences in sample (and sample-size: 31 participants in the experiment vs. 11 participants in the prestudy) and due to the absence of feedback in this condition, this average valence approximately equals the evaluations after negative feedback and clearly lies below those after positive feedback. It is furthermore possible that task accomplishment (completing the puzzle) positively influenced affect in all conditions (positive *and* negative feedback), so that valence evaluations after negative feedback might be slightly higher in this case than when affect would have been manipulated without the link to a task and connected feelings of accomplishment. Similarly, it was found that Gestalt detection leads to higher appreciation even if the detected Gestalt is of negative valence (Chetverikov & Filippova, 2014).

A trend points to an additional potential effect that needs further empirical clarification: We assumed that a repeated positive feedback increases self-efficacy and therefore the expectation of further positive task experiences and vice versa for negative feedback lowering self-efficacy. When the expectation of negative task experience after repeated negative feedback was violated by giving positive feedback instead in a second experimental block ("neg→pos" group), the effect of positive feedback was even greater than the other way round (but note that this has to be investigated in more detail as this interaction was non-significant). Such an increased response to antagonistic valence could be expected based on previous findings regarding contrast effects in "gain" and "loss" frameworks (Schwager & Rothermund, 2013). As hypothesized, the broadening effect might have added to the counter-regulation effect of positive feedback after having experienced negative feedback repeatedly.

It is important to note that nine participants were suspicious about the (indeed) faked feedback. However, further analyses taking only the participants into account which did not report any suspicion affirmed the revealed main effect, even with a larger effect size. Although it strengthens reliability of the first finding, we should still be cautious about the issue as we cannot exclude that differences regarding one's trust in the authenticity of feedback correlate with personality-related factors which again might be relevant when it comes to the estimation of valence and affective responses to positive feedback. The pronounced effect might be an indication of this. Follow-up studies should meet this challenge of the feedback's trustfulness by either introducing an alternative preceding task or an alternative cover story. Furthermore, it could be checked if the effect of positive feedback specifically influenced the valence of the picture or if it induced a more positive evaluation of various features of the photographs. The stimulus material would also allow for testing the broadening effect by an additional collection of ratings of ambivalence and—in a qualitative manner—a collection of all potential individual interpretations of the photographs. This way we could disentangle if broadening of attention takes place in general (higher number of perceived interpretations) or if it is specific to positive and neutral interpretations (higher number of perceived *positive* interpretations only). Furthermore, it would be highly interesting to examine our assumption that the

ambivalence of the photographs induced an active, intense processing mode as according to the *AIM* (Forgas, 1995) the impact of mood is dependent on the processing strategy (e.g., heuristic vs. extensive processing) which is again strongly bound to the specifics of the stimulus (like familiarity or complexity), judge and context. The experience and evaluation of overall valence in ambivalent photographs by Claudia Otto might therefore be infused by affect because of attentional mood-congruent priming whereas we might stick to a more direct "how does it feel?" when we make decisions in a heuristic manner. It therefore seems worth to examine if indeed the revealed effects would not come about in cases of either rather passive or heuristic processing strategies. Additionally, it was proposed that not the valence of affect in general is relevant for the infusion on cognitive processes but rather the feeling of (un-)certainty. For instance, Tiedens and Linton (2001) claim that (un)certainty strongly varies among different emotions and moods and is the major drive here. This might explain why there are differences between emotions beyond mere valence concerning the effects of attention and processing. For instance, although being a negative emotion, anger leads to usage of heuristics as well because anger, unlike sadness, is strongly and positively linked to certainty (Tiedens & Linton, 2001). When investigating effects of mood on experienced valence, we therefore have to be more specific about the kind of mood we induce and how it affects feelings of safety (which was shown to even influence preference for innovative design, Carbon, Faerber, Gerger, Forster, & Leder, 2013). Manipulation of episodic contexts might shed further light on this specific effect. Hereby, one major challenge will be to introduce a measure of control to assess the quality and change of affective states and self-efficacy (without influencing them).

We examined changes in the experience of ambivalence—which besides other forms of *SeIns* (Muth & Carbon, 2016) is often inherent to aesthetic stimuli—via a manipulation of self-efficacy and affect. Our findings show that feedback about task accomplishment has the potential of influencing the experienced valence of stimuli associated with that task. This finding once again shows that to investigate people's experiences and interpretations of objects we need a multi-faceted perspective on situation and person-related factors. Further research studying aesthetic phenomena might shed more light on this broader perspective when considering the actual state of observers regarding level of self-efficacy, affect and mood, their processing strategies (passive, active, heuristic, etc.) as well as the episodic context potentially inducing changes in both of them (e.g., task or situational features like safety or time pressure).

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