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The aesthetic paradox
in processing conventional and non-conventional metaphors
- a reaction time study-

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Running head: The aesthetic paradox in metaphor processing

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The aesthetic paradox
in processing conventional and non-conventional metaphors
- a reaction time study-

Abstract

This study focuses on the relationship between cognitive effort and aesthetic-emotional evaluation in the processing of conventional and non-conventional metaphors. We postulate that an increased cognitive load – which is normally perceived as stressful – is evaluated positively when processing non-conventional metaphors. We have called this contradictory suspense ‘aesthetic paradox’. The aesthetic paradox was tested in two studies that differed in degree of processing demand. In study 1 (low processing demand) participants (N = 40) read (non-)conventional metaphors, judged the adequacy of two metaphor paraphrases and assessed their own interpretation process. In study 2 (high processing demand) the same procedure was applied with the exception that participants (N = 40) evaluated the appropriateness of one metaphor paraphrase. The results of both experiments confirm that non-conventional metaphors require longer reading and longer processing times than conventional metaphors, and they confirm the postulated paradoxical effect: the increase of cognitive effort in processing non-conventional metaphors is evaluated positively, provided that a satisfactory interpretation is found.

Keywords: (non-)conventional metaphors, aesthetic paradox, aesthetic evaluation, cognitive effort, metaphor processing, aesthetic reception attitude

The Cognitive Processing of Metaphors

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56

57 During the last three decades, metaphor comprehension and understanding has been the
58 subject of intensive debate in psycholinguistics. The main focus has been on the question of
59 whether the processing of metaphors is more difficult and requires more effort than the
60 processing of literal utterances. The origin of this debate was the standard pragmatic view
61 proposed by Grice (1975) and Searle (1979). According to this view, processing a metaphor
62 comprises three stages: Firstly, the literal meaning is analyzed; secondly, it is ascertained that
63 the literal meaning is contextually inappropriate and, in the third step, the metaphorical
64 meaning is derived by means of specific inference rules (conversational non-standard
65 implicatures). As a consequence, when comprehending a metaphor in comparison to a literal
66 utterance, the listener must perform an additional processing step, which implies additional
67 cognitive effort. Accordingly, it was assumed that the comprehension of metaphors, and of
68 figurative language in general, must require more effort than the comprehension of literal
69 language, and that the literal meaning is always activated before the figurative meaning is
70 derived.

71 This standard pragmatic model of figurative language is contrasted (Grice, 1975; 1989) with a
72 psycholinguistic direct access model (Gibbs, 1984), which postulates that figurative
73 utterances are comprehended directly from the situation or the context without activating the
74 inadequate literal meaning (Gibbs, 1984; overview: Gibbs, 1994; Giora, 2003). This view is
75 also supported by proponents of relevance theory (Sperber & Wilson, 1986; Wilson &
76 Sperber, 2002) who, as a matter of principle, question the usefulness of the concept of literal
77 meaning. According to these views, the comprehension of metaphors does not require any
78 additional processing steps, which is the reason why metaphors are understood as quickly as
79 literal language.

80 This controversy surrounding the cognitive processing of figurative language has stimulated a
81 considerable number of empirical investigations into the cognitive processing of metaphors,
82 indirect speech acts, idioms, metonymy and irony, with a multitude of processing tasks being
83 used (e.g. reading times, verification and decision times, priming and latency times in
84 paraphrasing tasks; for a survey see Gibbs, 1994; 2002; Giora, 2002; 2003; 2009; Katz, 1996).
85 These studies primarily examined whether the comprehension of figurative language is
86 accompanied by an increase in processing times and therefore also an increase in the
87 cognitive effort compared to the comprehension of literal language.

88 The results of this research, however, have been inconsistent and conflicting (survey:
89 Christmann & Groeben, in press). Apart from a few studies that have provided evidence for
90 longer processing times for figurative compared to literal utterances (e.g. Dews & Winner,
91 1997; Janus & Bever, 1985; Schwoebel, Dews, Winner, & Srinivas, 2000; Temple & Honeck,
92 1999; survey: Christmann & Groeben, in press), there is increasing evidence that metaphors
93 and other forms of figurative language are processed just as quickly as literal utterances,
94 assuming that they are embedded in a sufficiently rich linguistic context. Additionally, much
95 of this evidence shows that it is not necessary to take the indirect route via the literal meaning
96 (e.g. Glucksberg & Keysar, 1993; Hillert & Swinney, 2001; Inhoff, Lima, & Carroll, 1984;
97 Ortony, Schallert, Reynolds, & Antos, 1978; Pickering & Frisson, 2001; Williams, 1992;
98 survey: Gibbs, 1994; 2002; Giora, 2003).

99

100 Giora's (1997; 2003) graded salience theory showed a potential solution to the controversy
101 surrounding the role of literal meaning in figurative language comprehension. According to
102 Giora, the comprehension of figurative and non-figurative language is guided by a general
103 salience principle. Salient, i.e., frequent, familiar, and conventional metaphors are processed
104 directly because they are coded in the mental lexicon and hearers can therefore retrieve them
105 automatically. Non-salient meanings, on the other hand, are not coded in the mental lexicon

106 but have to be generated on the fly by means of additional inferences. The level of
107 conventionality (of figurative language) plays the key role in this process. Conventional
108 figurative speech acts are indeed processed directly; non-conventional ones, however, are
109 processed via the literal-first detour. Thus, non-conventional metaphors require a longer
110 processing time than conventional ones, due to the activation of the literal meaning (e.g.
111 Brisard, Frisson, & Sandra, 2001; Giora & Fein, 1999). The same holds true for irony
112 (Pexman, Ferretti, & Katz, 2000; Schwoebel et al., 2000) and for idioms (Katz & Ferretti,
113 2001; Schweigert, 1991). Therefore, the amount of cognitive effort required to understand
114 these figurative utterances depends on their level of (non-)conventionality.

115 The relevance of the level of non-conventionality to figurative language processing is widely
116 accepted, even by proponents of the direct access model (Gibbs, 1984) and of pragma-
117 linguistic relevance theory (Wilson & Sperber, 2002, p. 624). Gibbs (2002; see also Gibbs &
118 Tendahl, 2006, p. 384) concedes that the comprehension of creative metaphors can require a
119 greater amount of effort than the comprehension of non-figurative language. According to
120 relevance theory, conventional and non-conventional metaphors differ in their number of
121 implicatures. Conventional metaphors convey a single, strong implicature which the hearer
122 can retrieve directly from their mental lexicon, whilst non-conventional metaphors
123 communicate several weak (but nevertheless acceptable) implicatures, which constitute the
124 semantic richness and poeticity of metaphors and which have to be recovered by the listener
125 (Pilkington, 2000; Sperber & Wilson, 1995, 2008; empirically: Lemaire & Bianco, 2003;
126 Noveck, Bianco, & Castry, 2001). With an increasing number of implicatures, the listener has
127 several semantic options that have to be understood and compared, thus demanding greater
128 processing effort roughly in proportion to the number of weak implicatures (Sperber &
129 Wilson, 1986, p. 204).

130 Therefore, the processing of non-conventional metaphors implies a greater cognitive effort,
131 but these additional costs are rewarded by additional effects. This has been proven in

132 particular for puns and newspaper headlines with deliberate ambiguity (Brône & Coulson,
133 2010; Nerlich & Clarke, 1999; van Mulken, van Enschoot-van Dijk, & Hoeken, 2005; Yus,
134 2003), which - provided that they were discovered - led to humorous effects and enjoyment.
135 In summary, according to the current state of research, there exists an empirically based
136 consensus that non-conventional metaphors are inherently polyvalent (i.e., semantically open)
137 and that their processing is cognitively more demanding than the processing of conventional
138 metaphors or non-figurative language. Which cognitive processes require the extra amount of
139 effort and which additional (cognitive and emotional) effects are triggered (Gibbs & Tendahl,
140 2006; Tendahl, 2009) is a question that remains unanswered.

141

142 **The Aesthetic-Emotional Evaluation: A Neglected Dimension and its Theoretical** 143 **Modelling**

144 Previous research on the understanding of metaphors is cognitively biased, because it has
145 almost exclusively dealt with the cognitive aspects of processing, such as cognitive costs and
146 cognitive effects. However, with this focus on cognitive processes, only one half of the
147 relevant comprehension processes are covered; the other half involve emotional-aesthetic
148 processes, which have rarely been discussed in previous research and which are not
149 sufficiently taken into account, either theoretically or empirically. Even in the large-scale
150 rating study by Katz et al. (1988), in which 450 literary and non-literary metaphors were
151 evaluated on ten psychological dimensions, the dimension of emotional-aesthetic evaluation
152 was lacking. The study by Gibbs (2002) of the recognition and appreciation of poetic
153 metaphors is certainly an exception. The author demonstrated that the recognition and
154 identification of a metaphor in a poem influences aesthetic appreciation: correctly recognized
155 metaphors are appreciated as more aesthetic than unrecognized metaphors¹. The aesthetic

¹Note, however, that Csátár, Pethő and Tóth (2006) failed to replicate this effect

156 evaluation was measured using a bipolar item (like vs. dislike). In recent times, a
157 consideration of the emotional-aesthetic evaluation is to be found in only a few studies
158 investigating the processing of figurative puns in advertising contexts (Brône & Coulson,
159 2010; van Mulken et al., 2005). Here again, aesthetic pleasure is normally ascertained by only
160 one single item (not at all witty vs. very witty).

161 Assuming that non-conventionality is a relevant factor in the processing of figurative
162 language (see above), simply neglecting the emotional-aesthetic dimension is unsatisfactory.
163 On one hand, figurative language forms have been quantified since ancient times as features
164 of an appealing language which are considered to be aesthetically attractive. On the other
165 hand, the use of non-conventional figurative utterances counts as an important feature of
166 literariness (e.g. Pilkington, 2000; Sperber & Wilson, 2008; Winko, 2009); that is, non-
167 conventional metaphors at the very least have the potential to be experienced and evaluated as
168 literary, poetic or aesthetic.

169 Taking the example of metaphor, irony and idioms, we have recently empirically
170 demonstrated the aesthetic attraction of non-conventional figurative language: non-
171 conventional variants of figurative language were evaluated as more aesthetically pleasing
172 than conventional variants (Wimmer, Christmann, & Schuler, submitted). At the same time,
173 non-conventional figurative utterances were evaluated as being cognitively more demanding
174 than conventional figurative utterances. This leads to a tension between cognitive effort and
175 aesthetic pleasure: are non-conventional figurative utterances evaluated as more aesthetic,
176 despite the higher cognitive processing effort? We could also show this empirically, as an
177 interaction effect: cognitive effort reduces aesthetic pleasure in conventional figurative
178 utterances but enhances aesthetic pleasure in non-conventional figurative language (see
179 Wimmer et al., submitted). We have called this contradictory suspense between positive
180 emotional quality and cognitive effort the “aesthetic paradox”, and we have developed the

181 hypothesis that an increased cognitive load (which is normally perceived as stressful) is
182 evaluated positively when processing non-conventional figurative language, provided that the
183 processing result is pleasing. Thus, we extend the assumptions made by relevance theory,
184 which postulates that greater cognitive effort is accepted, as it leads to greater cognitive
185 effects. The difference between the “aesthetic paradox” and relevance theory comprises in
186 particular the following three points: (1) As a basic attitude, relevance theory presupposes a
187 drive towards minimizing cognitive processing effort; by contrast, in the aesthetic paradox,
188 the drive towards minimizing cognitive effort is suspended and replaced by the willingness to
189 engage in cognitive effort. (2) In relevance theory, the additional effect that is achieved by
190 greater cognitive effort is described as a cognitive effect; the aesthetic paradox, however,
191 specifies this effect as an emotional one, which results from the aesthetic pleasure
192 experienced when processing aesthetic objects. In this respect, we continue recent extensions
193 of relevance theory which postulate that the processing of deliberate ambiguity (e.g. in puns)
194 requires more cognitive effort, but also leads to additional humorous effects, which are worth
195 the extra cognitive costs (Brône & Coulson, 2010; van Mulken et al., 2004; Yus, 2003). While
196 in these approaches the effect variable is tested with only one or two items, we use more
197 complex rating scales validated by factor analysis. (3) The most important difference,
198 however, is that the aesthetic paradox also includes evaluation of the comprehension process
199 as aesthetically attractive. Thus, a level of reflexive self-evaluation is implied that – to our
200 knowledge - has not yet been theoretically modelled.

201 The relationship between cognitive load and aesthetic-emotional evaluation can, however,
202 only be modelled heuristically because of the exclusion of the aesthetic-emotional dimension
203 in previous research. The question of cognitive effort in information processing is usually
204 dealt with in theories of working memory capacity (Baddeley, 1997; Baddeley & Hitch, 1974)
205 and in cognitive load theory (Sweller, 1988; 1989). Working memory is the cognitive system
206 in which information is maintained, processed and manipulated. The primary function is to

207 store and coordinate task-relevant information and, in particular, to inhibit interference from
208 task-irrelevant information. In principle, it is assumed that working memory limits the amount
209 of information that can be processed. If the cognitive load exceeds working memory capacity,
210 negative effects on information processing quality are predicted. The impact of working
211 memory capacity on cognitive performance (e.g. reading, problem solving and scientific
212 learning) has been impressively demonstrated (survey: Yuan, Steedle, Shavelson, Alonzo, &
213 Oppezzo, 2006). The processing of metaphors is also affected by working memory, as
214 explicitly predicted in the Predication Model by Kintsch (2001), which assumes that when
215 processing metaphors, more semantic neighbours of the predicate have to be activated (and
216 inhibited if they are not in the semantic neighbourhood of the argument) than when
217 processing literal language. Following this model, subjects with a low memory capacity may
218 have difficulties in understanding metaphors, either because they do not have enough capacity
219 to activate a rich semantic neighbourhood or because they fail to inhibit properties that cannot
220 be attributed to the argument. According to Chiappe and Chiappe (2007), it must be assumed
221 that processing non-conventional metaphors places higher demands on working memory than
222 processing conventional metaphors or literal language. If a metaphor has several meanings,
223 the properties associated with the vehicle have to be activated, maintained, and compared
224 (Miyake, Just, & Carpenter, 1994) and distracting properties of the semantic neighbourhood
225 have to be suppressed (Chiappe & Chiappe, 2007; Gernsbacher, Keysar, Robertson, &
226 Werner, 2001; McGlone & Manfredi, 2001). It can be demonstrated, for example, that
227 subjects with a high working memory capacity generate better, deeper and more detailed
228 interpretations of metaphors with higher speed, and produce more apt metaphors than subjects
229 with lower memory capacity (Blasko, 1999; Chiappe & Chiappe, 2007; Kazmerski, Blasko, &
230 Dessalegn, 2003). In addition, Chiappe and Chiappe (2007) found that this result is primarily
231 due to the executive as opposed to the storage mechanism of working memory, with the

232 executive mechanism being responsible for controlling attention and the inhibition of
233 distracting information (Baddeley, 1997).

234 Overall, it can be assumed that working memory load increases proportionally with the
235 complexity of the language material to be processed. This idea is explicitly taken up by
236 cognitive load theory (Sweller, 1988), which basically distinguishes between intrinsic,
237 extrinsic and germane cognitive load. The intrinsic load refers to the complexity of the
238 learning material (the number of interacting information elements that have to be activated in
239 working memory during task performance); the extrinsic load relates to the structure and
240 presentation of the learning material and the germane load to the learning activity, such as
241 schema acquisition and automation (Sweller, 2010). Previous research has so far concentrated
242 on the reduction of extrinsic load by an adequate instructional design of the learning material.
243 In the course of the empirical investigation of cognitive load theory, researchers sometimes
244 also collect the subjective evaluation of task difficulty and the perceived mental effort
245 (Brünken, Seufert, & Paas, 2010). However, neither cognitive load theory nor working
246 memory theory take the emotional evaluation of the perceived mental load into account, either
247 theoretically or empirically.

248

249 So, how can the empirically demonstrated positive evaluation of cognitive load in non-
250 conventional figurative language (Wimmer et al., submitted) be explained? We suggest that
251 non-conventional figurative language automatically activates an implicit aesthetic reception
252 attitude, i.e., an expectation, based on general knowledge and experience, that literary texts in
253 general and, in much the same way, quasi-literary language in everyday communication,
254 convey potentially polyvalent messages. This reflects the so-called polyvalence convention,
255 which has so far been primarily investigated in the empirical study of literature. The
256 polyvalence convention results from the aesthetic convention, which is relevant for
257 participating in the literature system of our society and which refers to the norm that works of

258 art are not subject to a fact demand (i.e. they must not refer to real facts) but may portray
259 fictional spaces and other potential worlds (Groeben & Schreier, 1992; Jannidis, 2003;
260 Schmidt, 1982). This play with meaning variations is also reflected in quasi-literary language
261 by the recipients (for further differentiations and operationalizations of polyvalence see
262 Groeben & Schreier, 1992, which also provides empirical validations of both quantitative and
263 qualitative aspects of polyvalence). It could be demonstrated, for example, that fictional texts
264 contained more changes to the frames of reference than factual texts, and that these were
265 evaluated positively (e.g. Meutsch & Schmidt, 1985). Likewise, it could also be demonstrated
266 that summaries of the same text contained more unspecific metatextual and metacognitive
267 elaborations when subjects were told that it was a fictional-literary text, but, contrastingly,
268 more specific text-based elaborations if they were told it was a non-literary text (Meutsch,
269 1987). In the same vein, Zwaan (1993) found that under a literary reading perspective
270 compared to a news perspective, participants read the same text more slowly, established a
271 stronger representation of the surface structure and were less irritated by counterfactual
272 information. These results emphasize the power of the genre: texts are processed differently
273 according to the expectation of the genre.

274 Based on these findings, we assume that the polyvalence expectation also holds for the
275 reception of non-conventional metaphors that deviate from ordinary everyday language by
276 their unusual composition and/or wording and that have a special, quasi-literary quality. This
277 has the effect that the recipient is immediately looking for several potentially meaningful
278 alternatives and suitable interpretations. Thus, for the non-conventional metaphor “Deep is
279 the well of the past” (the beginning of Thomas Mann’s tetralogy, “Joseph and his brothers”),
280 several meaning alternatives can be generated: (1) The past is an inexhaustible source of
281 memories; (2) Some people draw their purpose in life from the past; (3) We don't have access
282 to many parts of the past any longer.

283 Thus, the aesthetic paradox is to be modelled heuristically in three steps: (1) The aesthetic
284 reception attitude suspends the habitual striving for minimizing cognitive effort as far as
285 possible and replaces it by striving for a more complex comprehension process. (2) The effect
286 intended by this process refers to the emotional-aesthetic pleasure taken in aesthetic objects;
287 this pleasure is the intended satisfactory result of the interpretation process. (3) On the basis
288 of this satisfactory result, the comprehension process itself is experienced positively; that is,
289 the process itself also has an aesthetic quality, as it is evaluated as being aesthetically
290 attractive. The main difference between our approach and the previous style of research is that
291 our focus is not on the aesthetic object as, for example, in Giora's theory of an optimal
292 innovation of aesthetic stimuli, which is an optimization of novelty and recoverability (Giora,
293 et al. 2004). The concern of the aesthetic paradox is rather with the positive emotional
294 evaluation of one's own reception process with regard to one's own aesthetic decoding
295 competence. We think that the term "paradox" is justified because people normally like the
296 minimization of cognitive effort (cf. relevance theory and cognitive load theory), whilst in the
297 case of an aesthetic reception attitude, people appreciate a maximization of cognitive effort
298 and may even (albeit temporarily) appreciate a cognitive overload.

299 In sum: The aesthetic reception attitude is that in aesthetic objects a playful mode of
300 processing is chosen. With this mode of processing complexity and polyinterpretability are
301 expected and are evaluated positively. This is the reason why the resulting cognitive overload
302 is not experienced as stress but as pleasure. The prototypical core of the aesthetic reception
303 attitude refers to fictional literary texts; their fictionality signals are the decisive trigger for the
304 aesthetic reception attitude (see Henrich & Iser 1983; Nickel-Bacon, Groeben & Schreier
305 2000). The complexity and polyinterpretability of these texts can be so high (in particular
306 within the framework of modern aesthetics since the beginning of the 20th century: see
307 Friedrich 1956; Plumpe 1993) that an unambiguous and definite comprehension product is not
308 possible. Nevertheless, the process of reception is reflexively experienced and evaluated

309 positively, even if the text itself is not liked, e.g. because an anti-hero is in the focus (see the
310 example of the ‚nouveau roman‘: Sturrock 1969), or because it does belong to a category of
311 objects that can no longer be associated with the ‘fine arts’ (Jauß, 1968). In this vein, the
312 interpretation of modern texts is frequently understood as a deconstruction of an unambiguous
313 text meaning and consequently as an endless, interminable comprehension process (Culler
314 1982; Derrida 1976; de Man 1979) which, as a matter of principle, is nevertheless
315 experienced as satisfying. In this potential falling apart of the evaluation of the text and the
316 reception process, the shift of levels inherent in the concept of the aesthetic paradox becomes
317 most clearly manifest: It is not the evaluation of the text that is important, but rather the
318 evaluation of one’s own reception process. For this reason, the classical theories of aesthetics
319 (from Wundt to Berlyne and to Zajonc) which all refer to the aesthetic object, do not apply
320 here because in these theories the comprehension process is only the instrument but not the
321 subject of the evaluation. And, in contrast to relevance theory, the satisfactory result of the
322 comprehension process can even consist in the impossibility of achieving a result (a further
323 ‘paradoxical’ aspect: see Hörisch, 1988). This does, however, particularly apply to highly
324 complex fictional texts and not to simpler speech acts in everyday communication such as the
325 metaphors we used in our studies. In this case a (relatively unambiguous) result of the
326 comprehension process is possible and leads to a positive, self-reflexive evaluation of the
327 comprehension process. In this respect, this first pilot study of the postulated aesthetic
328 paradox (still) shows a relatively large overlap with relevance theory, but, together with the
329 focus shift to the level of reflexive self-evaluation, it also introduces an extension that will be
330 intensified by the inclusion of more complex fictional literary objects.

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Methodological Consequences and Hypotheses

334 The assumption of polyvalence expectation has specific methodological consequences: ,The
335 first consequence is that, if the interpretation of non-conventional metaphors is principally
336 open, then it is crucial for the reception process that participants find an adequate,
337 subjectively satisfying solution. This implies that there should be no narrow time limit for
338 finding a satisfying interpretation. The second methodological consequence relates to the
339 question of the contextual embedding of the material. Generally, the context plays an
340 important role in meaning generation in metaphor comprehension. The ease of metaphor
341 comprehension is primarily determined both by the length of the supporting context and by
342 the relationship between context and metaphor (Inhoff et al., 1984). For this reason,
343 metaphors can be processed as fast as non-figurative utterances, provided enough context is
344 given (e.g. Ortony et al., 1978; Pollio, Fabrizi, Sills, & Smith, 1984; survey: Gibbs, 1994;
345 Giora, 2003). The context functions as a schema, which generates expectations, prepares the
346 interpretation of the metaphor and turns it in a specific direction. But what does this mean for
347 the processing of non-conventional metaphors? In spite of the openness of meaning
348 characteristic of non-conventional metaphors, the amount of possible meaning alternatives is
349 constrained by a disambiguating context. This undoubtedly facilitates the interpretation of the
350 metaphor, but, at the same time, also reduces the aesthetic effect. To put this in the
351 terminology of relevance theory, the number of weak implicatures is reduced by a
352 disambiguating context. As the degree of poeticity depends on the number of weak
353 implicatures (according to Sperber and Wilson (1986)), poeticity is therefore also reduced and
354 along with it the possibility of aesthetic experience.

355 The aesthetic experience involves examining the variety of possible meanings and selecting a
356 single meaning that is subjectively considered adequate and therefore satisfying. For this
357 reason a disambiguating context reduces the variety of potential meanings. The range of weak
358 implicatures is experienced most intensively if a non-conventional metaphor is presented with
359 as little context as possible. According to cognitive load theory, a contextual facilitation

360 would correspond to a reduction of the extrinsic load. In contrast to the latter, we model the
361 comprehension of non-conventional metaphors as an irreducible intrinsic load. This implies
362 that, in our studies, we will present metaphors without facilitating context. This is ultimately
363 the simple methodological realization of the feature of non-conventionality, which becomes
364 manifest as surprise (also in everyday communication) resulting from a loosening of
365 contextual predictability.

366

367 To us, the decisive question is how this load is evaluated. We propose that with an aesthetic
368 reception attitude the increased cognitive load is not evaluated negatively but positively,
369 provided that the search for meaning leads to a satisfactory result – what we have called the
370 “aesthetic paradox”. This proposal implies, however, that the participants are able to assess
371 their processing effort adequately, that the cognitive load is rated higher in non-conventional
372 than in conventional metaphors; and that this assessment is consistent with the objective
373 measures of the cognitive effort. Thus, the following hypotheses are derived:

374

375 (1) The subjective assessment of cognitive effort correlates with objective measures of
376 processing (reading and processing times).

377 (2) The non-conventionality of metaphors correlates with objective and subjective measures
378 of cognitive effort.

379 (3) Cognitive effort is evaluated positively when non-conventional metaphors are
380 satisfactorily processed.

381

382

Measures

383

384 To assess the cognitive effort involved in the processing of conventional and non-
385 conventional metaphors we used both objective and subjective measures. Objective effort was

386 assessed by reading as well as by processing times; subjective effort was assessed by using a
387 set of semantic differential items.

388 To obtain a measure of reading time that is as pure as possible, participants were asked to
389 judge as quickly as possible whether or not they knew the metaphor. We have chosen this
390 procedure because, in the case of metaphors, the traditional instruction to finish reading
391 (pressing a key as soon as the sentence has been understood) would not have allowed for a
392 valid separation between reading and processing; it is quite possible that some participants (in
393 particular with non-conventional metaphors) might have reflected about the potential meaning
394 of the metaphor for quite some time. For this reason, the simplest criterion to finish the
395 reading process appeared to be the decision about whether the participants knew the metaphor
396 or not. By doing so, we ensured as far as possible that reading times were not adversely
397 affected by interpretative processes.

398 In contrast to reading times, processing times provided information about the amount of time
399 participants needed to grasp the meaning of the metaphor. To assess processing time,
400 participants were asked to judge the appropriateness of metaphor paraphrases. To vary the
401 degree of processing demand, we planned two studies: Study 1 involves a less demanding
402 recognition task and study 2 a more demanding task of meaning generation. We deemed this
403 variation of processing demands necessary in order to ensure that our results cannot be
404 considered a methodological artefact of a particularly easy or particularly difficult processing
405 task.

406 In study 1 (low processing demand), participants received a suitable and clearly wrong
407 paraphrase of a metaphor and were requested to judge, as quickly as possible, which of the
408 two paraphrases was more appropriate. In constructing the paraphrases, care was taken to
409 ensure that the wrong paraphrases nevertheless made sense in the context of the sentence.
410 This procedure was meant to ensure that participants were indeed forced to grasp the meaning
411 and were not able to recognize at a glance which paraphrase made more sense. Processing

412 time was determined as the span between accessing the paraphrases and making the decision
413 as to which was appropriate (by pressing a button). The presentation time for both
414 paraphrases was limited to 60 seconds. Initial tests had shown that this time was entirely
415 sufficient for the judgement task. The length of the presentation time implies that we also
416 intended to tap late processing stages which, according to recent studies (see Resta, Bambini,
417 & Grimaldi, 2011), are particularly crucial for the comprehension of non-conventional
418 metaphors. If the participants had not come to a decision after 40 seconds, they were
419 reminded that there was a time limit and they were given the opportunity to review the
420 metaphor together with the two paraphrases. By providing this option after 40 seconds, we
421 aimed not only to minimise potential memory effects, but also to gain an additional indication
422 of increased processing effort. When exploring different potential meaning variants, it may
423 assist in the decision-making process regarding the appropriate paraphrase, if we compare
424 these potential variants with the precise wording of the metaphor; such an exploration of
425 meaning variants can only be expected for non-conventional metaphors and this is the reason
426 why the review of the metaphor can be used as a further indicator of the complexity of the
427 comprehension process.

428 In study 2 (high processing demand), participants only received one paraphrase of a metaphor
429 and were asked to assess whether this paraphrase adequately described the meaning of the
430 metaphor. The paraphrase presented was either an appropriate paraphrase of the metaphor or a
431 clearly wrong paraphrase. This task required a higher processing effort than the assessment of
432 two paraphrase variants (study 1), because in this case a relatively detailed meaning
433 representation of the metaphor must be constructed and compared with the presented
434 paraphrase. In principle, the comparison of two paraphrases (in study 1) was a (less
435 demanding) recognition task, whereas the decision about the correctness of a single
436 paraphrase (in study 2) required an active process of meaning generation, and was therefore

437 more demanding. By design, we ensured that the metaphors were not presented twice to the
438 same participant (see below: study 2, procedure).

439 The subjective evaluation of the processing effort, processing evaluation and satisfaction with
440 the decision process were measured using a set of 13 seven-point bipolar semantic differential
441 items that were presented on the computer screen immediately after the assessment of each
442 metaphor.

443

444 **Study 1 (Low Processing Demand)**

445 **Method**

446 **Participants.** In study 1, 40 participants (30 female and 10 male) participated in the
447 experiment; 39 of them were university students and one had already finished his/her studies.
448 Thirty participants were majoring in psychology, 9 in other subjects. Their ages ranged from
449 18 to 40 with a mean of 21.83 and a standard deviation of 3.81. Participants were randomly
450 assigned to one of two experimental groups of equal size. All of the participants were native
451 German speakers. They could choose between either attending the experiment to fulfil a
452 course requirement or receiving a small reimbursement of € 7.

453

454 **Material.** The material consisted of 15 conventional and 15 non-conventional metaphors
455 taken from Wimmer et al. (submitted), as well as of two paraphrases of each metaphor (60
456 paraphrases overall).² A metaphor was defined as conventional if it had only a figurative
457 meaning, that is, if the figurative meaning was used as a lexicalized set unit (i.e., as an
458 idiomatic metaphor) (*When he was reading his grandmother's diary, he suddenly saw the*
459 *light*). The conventional metaphors were originally taken from online journals and metaphor
460 collections. We defined a metaphor as non-conventional if it had a non-lexicalized figurative
461 meaning, and if its components were compiled freely (not as a set unit) (e.g. Life is building

² An overview of the complete set of materials used in both studies is given in Appendix 1.

462 bridges over fading rivers). Non-conventional metaphors were also taken from online journals
463 and from a compilation of poetic metaphors by Schumacher (1997) (e.g., I am lying under
464 your smile; Else-Lasker-Schüler). All metaphors were presented as full sentence metaphors
465 with identifiable topic and vehicle. With regard to the quality of metaphors, we would like to
466 stress once more that it is not the linguistic and aesthetic structure of the metaphors that is the
467 focus of our study, but rather the aesthetic reception attitude triggered by the non-
468 conventional language use and the (reflexive) evaluation of the comprehension process. For
469 this reason, it seemed pointless to analyze the metaphors in more detail and to select them
470 according to their originality, aptness or other quality criteria (e.g. Blasko & Connine, 1993;
471 Chiappe, Kennedy, & Chiappe, 2003; Jones & Estes, 2006). On the contrary, particularly
472 when considering the non-conventional metaphors, as many different structures and quality
473 levels as possible should be included to ensure that the studies are as valid as possible for
474 everyday communication. Hence, we intentionally have chosen purposive metaphor samples,
475 so to speak, whose main and decisive discriminating feature is their level of conventionality.
476 The fact that the metaphors included in the studies differ significantly with regard to this
477 feature and with regard to aesthetic pleasure had been validated in the described preliminary
478 study (Wimmer et al., submitted).

479 For each metaphor, two paraphrases were constructed by the authors. In each case, one of the
480 paraphrases was thought to express the metaphor's meaning adequately, whereas the other
481 gave a clearly wrong description. Nevertheless, the wrong paraphrase was not intended to be
482 meaningless (e.g., Metaphor: An embarrassing break occurred, because the speaker had lost
483 the thread. More appropriate paraphrase: An embarrassing break occurred, because the
484 speaker had forgotten the sequence of his arguments. Less appropriate paraphrase: An
485 embarrassing break occurred, because the speaker got heated and emotional.). The face
486 validity of this discrimination is – in our opinion – ensured by the production process; a
487 further validation (e.g. by an expert rating) was not carried out, as it is also the case here that

488 it is not the structure of metaphors and their evaluation which were the subject of the present
489 study but the comprehension process uncovered with the aid of the differing paraphrases.
490 As a subjective measure, a series of 13 seven-point bipolar rating scales was used to assess
491 the processing experience. Based on previous studies, items that assessed the aesthetic
492 pleasure of figurative language (Kraft, 1990; Christmann & Mischo, 2000) included the
493 following pairs: interested – bored; resolved quickly – took time to resolve; challenging – not
494 challenging; certain – uncertain; resolved successfully – not resolved successfully; expensive
495 – inexpensive; with a definite result – with a temporary result; aesthetic – unaesthetic;
496 underchallenging – overchallenging; convenient – inconvenient; required effort – did not
497 require effort; complex – simple; required consideration – didn't require consideration.

498

499 **Procedure.** The data were collected in individual, computer-based sessions. The reaction
500 time experiment was implemented using the Java-based Toolkit WebLAB by Mengel &
501 Blümke³. The study included two tasks to be dealt with consecutively: Task one aimed to
502 record the reading times of the metaphors, whereas task two was carried out to measure the
503 processing times of both conventional and non-conventional metaphors and the subjective
504 evaluation of this processing. To avoid learning effects, the metaphors used in task one were
505 not used in task two. This resulted in two sets of material: Metaphors used for task one in set
506 one were used for task two in set two and vice versa. Task one included metaphors only; task
507 two also included the related paraphrases.

508 In task one, participants were presented with 15 metaphors, one at a time. For each of the
509 items, the participants were required to decide as quickly as possible whether they were
510 familiar with them or not. They were instructed to press the “s” key if they knew the
511 metaphor, and to press the “1” key, if they didn't know it. A practice block of four trials of the
512 same type as the experimental trials preceded the experiment to familiarize the participants

³<http://knut.psi.uni-heidelberg.de/index.php>

513 with the procedure. To evaluate reading times, we recorded the time taken between first
514 accessing each metaphor and pressing the “s” or “l” key, as well as which button was pressed.
515 Task two, which was designed to evaluate the processing times for metaphors, was
516 subdivided into two parts, a and b. In task a, the participants were required to judge which of
517 two paraphrases (one appropriate, one not) gave an adequate explanation of the related
518 metaphor’s meaning. The 15 metaphors were again presented one at a time. The participants
519 were instructed to press the space bar as soon as they had read the metaphor in order to access
520 the paraphrases. If the spacebar had not been pressed after 10 seconds, the paraphrases were
521 displayed automatically. The participants were required to press the “s” key if they considered
522 the first paraphrase to be appropriate, and the “l” key, if the second one seemed to them the
523 fitting one. To avoid any possibility of memory effects and to gain an additional indication of
524 increased processing effort the participants could view the related metaphor again by pressing
525 Enter. In this case, the metaphor re-appeared alongside the related paraphrases. Altogether,
526 the participants were given 60 seconds to make a decision on the metaphor’s meaning. After
527 40 seconds, they were automatically reminded that there were still 20s left for the decision
528 and that they could re-access the metaphor by pressing Enter. The processing time was
529 measured by recording the time delay between accessing the paraphrases and pressing the “s”
530 or “l” key, serving as an objective measure of the cognitive effort invested. The button
531 pressed (“s” or “l”) was also logged. We abstained from a permutation of the „s“ and „l“ keys,
532 because a comparison of the reaction times collected by this measure was not important to us;
533 instead we concentrated on the comparison between the conventional and non-conventional
534 metaphors; this means that potential differences between „right“ and „left“ reaction times
535 constituted a negligible constant, which was not confounded with the theoretically relevant
536 experimental conditions.

537 In task b, for each metaphor, the participants were asked to assess the process of deciding
538 which of the two paraphrases was the appropriate one by using the previously described

539 seven-point bipolar rating-scales. The participants were given instructions not to assess the
540 metaphor itself, but instead to evaluate their own process of finding the better fitting meaning.
541 The rating scales were also presented on the computer screen. The participants had to indicate
542 their evaluation by clicking on the appropriate value. As opposed to task a, task b was
543 designed as a subjective measure.

544 A practice session comprising four units, each containing an example of both subtasks,
545 preceded the actual experiment to ensure that the participants understood the procedure.

546 After both tasks had been completed, some demographic information was also collected from
547 the participants. The overall duration of the experiment was about 20 minutes.

548

549 **Results**

550 To test hypothesis 1, which proposes significant covariation between subjective measures of
551 cognitive effort, readings times and processing times, we first determined the factorial
552 composition of the subjective measure. To extract the dimensions underlying participants'
553 assessment of their own decision process, an exploratory factor analysis of the set of semantic
554 differential items was conducted. To enable comparison of the two samples, we combined the
555 semantic differential data sets of study 1 and study 2. After an initial extraction of the
556 principal components, the eigenvalue, scree test, and interpretability supported a three-factor
557 solution. We subsequently applied an oblique rotation method (Oblimin Rotation), as we
558 expected to see correlations between the dimensions. Appendix 2 shows the related structure
559 matrix.

560 The analysis yielded three factors, accounting for 73.84% of the total variance. The first factor
561 obviously represents the amount of cognitive effort required for processing the metaphors.
562 The highest loadings on this factor were for the items “required effort – did not require
563 effort”, “challenging – not challenging”, “rather overchallenging – rather underchallenging”,
564 and “required consideration – did not require consideration”. As a first core item we chose

565 “required effort – did not require effort”, as this pair displays the highest loading on this
566 factor and because it labels factor 1 as theoretically adequate. The two items with the next
567 highest loadings (“challenging” and “overchallenging”) were not taken as core items, as they
568 also displayed loadings higher than .5 on factor 3. For this reason we chose “required
569 consideration – did not require consideration” as a second core item, as this pair displays a
570 high loading of .824 on factor 1 and a low loading of .310 on factor 3. The critical items in
571 factor 2 appeared to be “certain – uncertain”, “resolved successfully – not resolved
572 successfully” and “with a definite result – with a temporary result”. These combine to show
573 how satisfactory the result of the decision process was considered to be. As the items
574 “interested – bored”, “aesthetic – not aesthetic” and “convenient – inconvenient” scored
575 highest on the third component, this factor appeared to address the evaluation of the process
576 in the narrower, aesthetic sense. Consequently the three factors were named “cognitive
577 effort”, “process appreciation” and “satisfactory result”. The polarity of the scales was
578 reversed in such a way that they corresponded to the factors' names. To achieve the final score
579 for each metaphor on the three scales, the means of the core items of each scale were
580 calculated. The internal consistency of the scales, computed according to Cronbach’s α , was
581 generally satisfactory: .84 for cognitive effort, .94 for satisfactory result and .70 for process
582 appreciation.

583 The reading times for the metaphors were then examined. In order to control for the differing
584 length of the sentence metaphors, mere reading times for each metaphor were calculated by
585 dividing the overall reading time by the number of syllables involved. The numbers of
586 syllables were counted using the linguistic tool Wortgenerator (WordCreator), a product of
587 Stefan Trost Media⁴.

588 The same calculation was applied to the processing times, except that here the number of
589 syllables in the paraphrases was counted. When the Enter key was pressed, the overall

⁴ <http://www.sttmedia.de/wortgenerator>

590 processing times not only included the time required to make a decision about the
591 paraphrases, but also the reading times of the metaphors in question. For this reason, the mean
592 reading time of the metaphor was subtracted from the overall processing time. The processing
593 times were again divided by the number of syllables to allow for the differing lengths of the
594 paraphrases.

595 To test hypothesis 1, correlations between self-ratings of cognitive effort and objective
596 measures, i.e. reading and processing time, were computed. We found substantial correlations
597 of high significance between the reading and the processing time ($r = .79, p < .01$), between
598 the processing time and the subjective cognitive effort ($r = .74, p < .01$), and between the
599 reading time and the subjective cognitive effort ($r = .73, p < .01$). These results indicated an
600 almost replaceable applicability of subjective and objective measures pointing to a
601 confirmation of hypothesis 1. Because the objective measures, as harder data, have a higher
602 degree of validity, they form the core of our subsequent empirical analyses (for a parallel
603 analysis based on subjective measures see appendix 3).

604

605 To test hypothesis 2, which proposes significant correlations between non-conventionality of
606 metaphors and objective and subjective measures of cognitive effort, the metaphors were
607 sorted by decreasing processing times as an objective measure of cognitive load, as can be
608 seen in table 1.

609

610

Insert table 1 about here

611

612 This progression gives striking evidence for the hypothesis that non-conventional metaphors
613 were associated with high cognitive effort: at position 14, there was only one conventional
614 metaphor ("*In Lehrjahren wird nicht alles auf einem Silbertablett serviert.*" "In education,
615 not everything is served up on a silver platter.") among the non-conventional ones. Apart

616 from this exception, all of the conventional metaphors featured shorter processing times
617 (mean = 227.03 ms) than non-conventional ones (mean = 361.46 ms). Further evidence
618 stemmed from a highly significant comparison of means ($t = 5.03, p < .01$).

619 The design of our experiment opened up another way to test the assumption that the
620 processing of non-conventional metaphors entails more cognitive costs than the processing of
621 conventional ones. If this hypothesis is true, the participants should have felt the need to re-
622 access a metaphor more often when processing a non-conventional metaphor compared to
623 processing a conventional one. This additional test of our hypothesis was confirmed by the
624 results of a t-test that checked how often the Enter key was pressed to re-access the metaphor:
625 Non-conventional metaphors were re-accessed significantly more often than conventional
626 metaphors ($\chi^2 = 20.16, df = 1, p = .000$).

627

628 The first step to test hypothesis 3 (the positive evaluation of cognitive effort in case of
629 satisfactory processing of non-conventional metaphors) consisted of computing the (partial)
630 correlations between the two self-rated measures satisfactory result and process appreciation
631 (controlling for processing time), between satisfactory result and the objective measure of
632 processing time (controlling for process appreciation) as well as between process
633 appreciation and processing time (controlling for satisfactory result). The results are
634 displayed in table 2.

635

636

Insert table 2 about here

637

638 Firstly, the negative correlation between cognitive effort (processing time) and satisfactory
639 result is plausibly a consequence the fact that cognitive effort increases with the growing non-
640 conventionality of metaphors (see hypothesis 2); this means that, in this case, it was more
641 difficult to achieve a satisfactory interpretation result.

642 Hypothesis 3, which refers to the aesthetic paradox, postulates a positive covariation between
643 cognitive effort and the positive evaluation of one's own interpretation process. This proposal
644 was indeed supported by the empirical data (positive correlation between processing time and
645 positive process appreciation). At the same time, however, we found a first indicator that
646 there may be an interaction effect: when checking for a satisfactory result, the correlation
647 between processing time and process appreciation was close to zero. The paradoxical effect
648 manifested itself in the (negative) covariation of satisfactory result and evaluation of one's
649 own interpretation process. How is this possible? The answer lies in the significant interaction
650 effect (satisfactory result X processing time) postulated in hypothesis 3, which is confirmed
651 by the regression analysis and which demonstrates exactly what is postulated by the aesthetic
652 paradox: Where there is high cognitive load (with above average processing times) the self-
653 analysis of the comprehension process is evaluated positively provided that a satisfactory
654 result of the metaphor interpretation is achieved.

655 For a more detailed analysis of this interaction, simple slope analyses (according to Aiken &
656 West, 1991) were conducted. This procedure allowed us to test whether the regression differs
657 significantly from zero in high, medium and low values of the moderator variable
658 "satisfactory result"

659  Insert figure 1 about here

660

661 The graph illustrates the effects of 1 standard deviation above or below the mean of
662 satisfactory result. It demonstrates that an unsatisfactory result (1 SD below the mean) was
663 (statistically) not relevant for the evaluation of one's own interpretation process while in
664 contrast, process appreciation increased significantly in cases where satisfactory result was
665 average ($b = 0.41$, $t = 2.26$, $p < .033$) or above average ($b = 0.94$, $t = 3.68$, $p < .001$). This
666 corresponds perfectly to the positive relationship (here regression) postulated by the aesthetic

667 paradox between cognitive effort and the positive evaluation of one's own comprehension
668 process provided that there is a satisfactory (and not an unsatisfactory) result.
669 Incidentally, the same data structure was found in simple-slope analyses with 2 and 3 SD
670 which we will not present here because they were not covered by our data. But from this it is
671 possible to derive the assumption that the aesthetic paradox is also (rsp. to a higher degree)
672 valid in processing objects that have more and higher aesthetic qualities than metaphors in
673 everyday communication.

674

675 **Study 2 (High Processing Demand)**

676

677 Study 2 replicated study 1 with one exception: the processing demand was higher than in
678 study 1. Instead of two paraphrases, the participants saw only one and were asked to assess
679 whether this paraphrase adequately reflected the meaning of the metaphor. We put forward
680 the same hypotheses as in study 1.

681

682 **Method**

683 **Participants.** In Study 2, the sample consisted of 40 participants (26 female and 14
684 male), 35 of whom were students (12 majoring in psychology, 23 in other subject areas), and
685 five were members of staff or didn't state their profession. Their ages ranged from 19 to 47
686 with a mean of 25.48 and a standard deviation of 5.69. Participants were randomly assigned to
687 one of four experimental groups of equal size. As in study 1, all participants were native
688 German speakers. The participants were offered a small financial incentive or course credits
689 for their participation. Reimbursement conditions were the same as in study 1.

690

691 **Material.** The same 15 conventional and non-conventional metaphors and the
692 corresponding 60 paraphrases were used as in study 1.

693

694 **Procedure.** As in study 1, the participants were given two tasks: Task one (decide
695 whether the metaphors presented were familiar or not) was aimed at recording reading times.
696 Task two consisted of two sub-tasks (a: decide on the appropriateness of the paraphrases; b:
697 assess the subjective comprehension process) and was aimed at collecting the processing
698 times as well as the subjective evaluation of this processing. The procedures for studies 1 and
699 2 were exactly the same except for the fact that in task 2a (judging paraphrase
700 appropriateness), the participants were given one paraphrase rather than two for each
701 metaphor. Consequently, the participants were not asked to decide between two alternative
702 paraphrases. Instead, the task involved judging whether the paraphrase given was appropriate
703 or not. Accordingly, task 2b addressed participants' process of deciding whether the given
704 paraphrase fitted the meaning of the related metaphor or not. The subjective evaluation of the
705 decision process was again collected using the set of seven-point bipolar scales.

706 As in study 1, metaphors applied in task one were not used in task two and vice versa. As the
707 participants were only given one paraphrase per metaphor but all of the 60 paraphrases of
708 study 1 were used, it was necessary to construct four sets of material: The two sets used in
709 study 1 were doubled for task 1. For task 2 (a and b), half of the metaphors were presented
710 together with the better fitting paraphrase, the other half together with the less adequate
711 paraphrase, i.e., there were two versions of task 2 applying the material of the original set one
712 (which was used in study 1). The same holds for the duplication of the second set.

713

714 **Results**

715 As subjective measures we used the scales of “cognitive effort”, “process appreciation” and
716 “satisfactory result” (described in the result section of study 1 and established by factor
717 analysis) based on the combined semantic differential data sets of study 1 and 2 (see appendix

718 2). The mean values over all participants (of study 2) on these scales for each metaphor were
719 again calculated as described above.

720 Hypothesis 1 again postulates covariance between subjective measures of cognitive effort,
721 reading times and processing times. Consequently, correlations between participants' self-
722 rating of cognitive effort and the objective measures for reading time and processing time
723 were comparable to study 1: we found substantial correlations of high significance between
724 reading time and processing time ($r = .58, p < .01$), processing time and subjective cognitive
725 effort ($r = .66, p < .01$), as well as reading time and subjective cognitive effort ($r = .73, p <$
726 $.01$). Thus, hypothesis 1 (covariance between subjective measures of cognitive effort, reading
727 times and processing times), was again corroborated. As in study 1, due to the higher degree
728 of validity of objective measures, the objective measures again form the core of our
729 subsequent analyses (for a parallel analysis based on subjective measures, see appendix 3)

730

731 Overall, the processing of metaphors sorted by decreasing processing time supported
732 hypothesis 2 (positive covariation of non-conventionality and objective/subjective measures
733 of cognitive load), as can be seen from the higher processing times for non-conventional
734 metaphors as opposed to conventional metaphors (see table 3).

735

736 Insert table 3 about here

737

738 There were, however, four metaphors, that didn't match the strict sequence: "In Lehrjahren
739 *wird nicht alles auf einem Silbertablett serviert.*" ("In education, not everything is served up
740 on a silver platter."), "*Der Kandidat ist mit seiner Vorgehensweise auf dem Holzweg.*" ("The
741 *candidate's approach to his PhD is barking up the wrong tree.*"), "*Wer gegen den Strom*
742 *schwimmt, muss sich für seine Meinung oft rechtfertigen.*" (If you go against the flow, you
743 often have to justify your opinion.) , and "Das Klavierspiel der Mädchen gräbt einen Tunnel

744 *durch die Jahre*” (“*The girls’ piano playing opens a channel through the years*”). However,
745 this does not affect the strong significance of a mean comparison between the processing
746 times of non-conventional (mean = 822.17 ms) and conventional (mean = 472.01 ms)
747 metaphors ($t = 3.20, p < .01$). Further evidence in support of hypothesis 2 came from the
748 number of times the metaphors were re-accessed. Non-conventional metaphors were re-
749 checked significantly more often than conventional ones ($\chi^2 = 20.17, df = 1, p = .000$).

750

751 To test hypothesis 3, which postulates a positive evaluation of cognitive effort when
752 satisfactorily processing non-conventional metaphors, (partial) correlations between process
753 appreciation, satisfactory result and processing time were computed, as well as the regressions
754 and the interaction between satisfactory result and processing time (see table 4).

755

756

Insert table 4 about here

757

758 As can be seen from table 4, the results showed the same pattern as in study 1: there is a
759 significant negative correlation between satisfactory result and processing time, a significant
760 negative correlation between satisfactory result and process appreciation, and a significant
761 positive relationship between processing time and process appreciation. The interaction effect
762 (satisfactory result X processing time) postulated in hypothesis 3 was again highly significant.
763 The detailed analysis of this interaction by simple slope analyses (Aiken & West, 1991) once
764 again demonstrated the effect described in study 1 (see figure 2).

765

766

Insert figure 2 about here

767

768 The graphs illustrate that an unsatisfactory result (1 SD below the mean) was not relevant for
769 the evaluation of one’s interpretation process, while process appreciation increased

770 significantly when satisfactory result was average ($b = 0.38$, $t = 2.26$, $p = .016$) or above
771 average ($b = 0.77$, $t = 3.13$, $p = .004$). As in study 1, this corresponds again to the
772 hypothesized aesthetic paradox: cognitive effort in metaphor processing is evaluated
773 positively, provided that it leads to a satisfactory result.

774

775 Thus, taken together, the results of study 2 confirm that the processing of non-conventional
776 metaphors requires more cognitive effort (processing times) than the processing of
777 conventional metaphors and – above all – they confirm the postulated paradoxical effect: In
778 high cognitive load (processing times above average), which occurs primarily in processing
779 non-conventional metaphors, participants evaluate their own comprehension process
780 positively provided that a satisfactory result of the metaphor interpretation is achieved.

781 This pattern of results remained constant, although the processing demands (reflected in the
782 processing times) in study 2 were – as expected – significantly higher ($F = 29.18$; $p = .000$)
783 than in study 1. Thus, it was more demanding to assess the appropriateness of one paraphrase
784 (study 2) than to decide which of two paraphrases best reflects the meaning of a metaphor
785 (study 1), but this higher demand (objectively measured by reaction times) did not affect the
786 structure and positive evaluation of the comprehension process.

787

788 **General discussion**

789

790 These studies concentrated on the relationship between cognitive effort and aesthetic-
791 emotional evaluation in conventional and non-conventional metaphors. As this relationship
792 has not been dealt with in previous studies, either theoretically or empirically, we have
793 modelled it heuristically by drawing on theories of working memory, polyvalence convention
794 in literary language, and on approaches dealing with the impact of an aesthetic reception
795 attitude and genre expectations on language processing. Theories of working memory propose

796 that working memory load increases with the complexity of the language material to be
797 processed. Thus, non-conventional metaphors should require more processing effort than
798 conventional ones. Additionally, based on polyvalence approaches for the processing of
799 literary language, we have assumed that the processing of metaphors automatically triggers an
800 implicit aesthetic reception attitude. In the prototypical case of processing literary texts, the
801 aesthetic reception attitude is triggered by the literariness of the text, i.e., by its inherent
802 fiction signals. We assume that in the field of everyday communication an ‘indirect speech
803 act’ (Berg, 1978) plays a parallel (although weaker) role. In our subject area, non-
804 conventionality might function as a signal to trigger an aesthetic reception attitude in non-
805 conventional metaphors, while idiomaticity might function as a signal in conventional
806 metaphors. Whether an aesthetic reception attitude was really triggered by these conditions
807 and whether there had possibly been differences in intensity, could, however, not be tested
808 explicitly in this pilot study and is a task for (our) further research

809

810 Based on this and on preliminary results of a previous study into aesthetic appreciation and
811 cognitive effort in processing conventional and non-conventional figurative language
812 (Wimmer et al., submitted), we have hypothesized that there is a contradictory suspense
813 between the cognitive effort required for processing and the positive emotional evaluation of
814 the process, a suspense that we have called the aesthetic paradox. We have labelled this
815 phenomenon “aesthetic paradox”, because people usually appreciate it when the cognitive
816 effort required for processing is minimized (cf. relevance theory and cognitive load theory).
817 The paradoxical character of the phenomenon stands in contrast to the state of flow (e.g.
818 Csikszentmihalyi, 1990) which – according to the theory – can only be experienced if there is
819 a good balance between the challenges of the task and one’s own perceived skills. If,
820 however, people take an aesthetic reception attitude and evaluate their own comprehension
821 process, even cognitive overload is (at least temporarily) appreciated. This is the major

822 contrast to processes of practicing on musical instruments, for example. Here, the satisfaction
823 lies in the end result, whilst the process of practicing is nevertheless evaluated as laborious
824 and aversive. In the aesthetic paradox, however, the effort and appreciation of this effort are
825 experienced simultaneously. Of course there are musicians who achieve a flow state when
826 playing the piano or the violin. But this state is described as a state of “effortless attention”
827 (De Manzano, Theorell, Harmat, & Ullén, 2010), that is, being in the flow state does not mean
828 that people experience their activity as “effort”.

829 In testing the aesthetic paradox, we expected that the longer cognitive process required for
830 understanding non-conventional metaphors would be positively evaluated by the participants.
831 At the same time, it is assumed that not only is the processing of non-conventional metaphors
832 objectively more time-consuming than the processing of conventional metaphors, but also that
833 participants are able to assess their processing effort adequately (i.e., compared with the
834 objectively measured processing time). We have addressed these questions in two studies
835 which only differ in the degree of processing demand. In Study 1 (Low Processing Demand),
836 the participants had to decide which of two metaphor paraphrases reflects the meaning of the
837 metaphor more adequately; in study 2 (High Processing Demand) the participants had to
838 decide if one metaphor paraphrase correctly describes the meaning of the metaphor.

839 The aim of this study was to confirm the positive evaluation of the comprehension process for
840 simple quasi-literary speech acts in everyday communication. For this reason, we only
841 concentrated on the aesthetically central distinction between conventional and non-
842 conventional metaphors. Within these two categories, we intentionally included purposive
843 metaphor samples with varying structures and qualities. For the same reason, the maximum
844 permitted processing time was set as generously as possible. The issue of the aesthetic
845 paradox is that recipients have an increased time tolerance (patience) that they use to generate
846 aesthetically satisfactory meaning variants. Of course, the length of the permitted potential
847 processing time implies that we do not primarily tap initial processing stages but also late

848 stages that involve the processing product. Indeed, there are initial ERP studies suggesting
849 that the late processing stages are crucial in the comprehension of non-conventional
850 metaphors (Resta, Bambini & Grimaldi, 2011). This inclusion of the processing product is a
851 constitutive feature of the theoretical construct (“aesthetic paradox”) which refers to a
852 satisfactory result of the comprehension process.

853 Taken together, the results of the two studies consistently demonstrate that non-conventional
854 metaphors require longer reading and processing times (increased decision times in
855 paraphrasing tasks and an increased number of times the metaphors were re-accessed) than
856 conventional metaphors. This result is consistent with other research showing that non-
857 conventional metaphors require more cognitive effort than conventional ones (e.g. Brisard et
858 al., 2001; Giora & Fein, 1999; Noveck et al., 2001) and impressively highlights the central
859 role of the relevance of the conventionality factor in metaphor processing.

860 Additionally, the studies show that the objectively measured and the subjectively assessed
861 cognitive effort correspond to a high degree, showing that participants are definitely able to
862 provide a valid estimate of their actual processing effort. The most important result, however,
863 is that the cognitively more strenuous (greater duration) processing of non-conventional
864 metaphors is positively evaluated, provided that participants are indeed satisfied with their
865 processing result, that is, if they have discovered a satisfactory meaning for themselves. This
866 result holds true for both low processing demands (study 1: selection of the correct meaning
867 from two given paraphrases) as well as for high processing demands (study 2: judging the
868 correctness of one paraphrase). Although the two studies differed significantly in the
869 processing demands, the higher demands did not affect the structure and positive evaluation
870 of the comprehension process. The pattern of results was the same in both studies. It should
871 be noted, however, that the difference in processing task did not imply qualitatively different
872 task demands but only different gradations in the level of processing difficulty.

873 Compared to the research that has so far been primarily concentrated on the cognitive
874 dimension of metaphor processing, this seems to be an innovative result that was made
875 possible by taking into account emotional and motivational aspects of the comprehension
876 process. In this way, it was possible to confirm that the normally stressful process of
877 understanding aesthetic objects (here: non-conventional metaphors) can nevertheless be
878 positively experienced and evaluated.⁵ This phenomenon of the aesthetic paradox strongly
879 illustrates that the dimension of the emotional-aesthetic evaluation of one's own process of
880 understanding plays an important role in the investigation of figurative and thus also of quasi-
881 literary language in everyday communication.

882 Not only do our two studies confirm previous studies of the positive evaluation of non-
883 conventional metaphors, they even appear to amplify them. The extension lies in the fact that
884 we used scales that were constructed on the basis of a factor analysis and that the inner
885 consistency of the scales (Cronbach's α) proved to be satisfactory overall (Wimmer, et al., in
886 press). However, this cross-validation with regard to the appreciation of the language items is
887 only the starting point for further modelling and testing the reflexive evaluation of the
888 comprehension process. This positive aesthetic evaluation of the comprehension process (but
889 not of the language items) is the decisive characteristic of the aesthetic paradox.

890

891 With these studies, the phenomenon of an aesthetic paradox as a positively evaluated
892 cognitive effort (under the condition of an aesthetic reception attitude) has been theoretically
893 modelled and empirically made probable to some extent. The theoretical model does,
894 however, comprise many assumptions which could not (yet) be tested in this first validation

⁵We do not differentiate between aesthetic interest and pleasure/enjoyment as it is proposed by Whitfield (2009). Whitfield postulates in his categorical-motivation model that objects which are instances of closed categories provide in particular enjoyment and pleasure, whilst objects which are instances of open categories evoke interest. This approach refers primarily to reactions to aesthetic objects. The aesthetic paradox, however, refers to the reflexive evaluation of one's own comprehension process – and here the paradox among other aspects also includes the coincidence of interest and pleasure. This has of course to be tested in further research.

895 step. However, before a valid proof of the postulated paradox can indeed be assumed, further
896 specific empirical tests are needed. These mainly include the following:

- 897 • The aesthetic paradox implies that the dimension of the aesthetic reception competence of
898 the recipients is no less important than the aesthetic quality of the language items. The
899 theoretical assumption that the satisfactory result of the comprehension process also
900 includes the satisfaction with one's own reception competence, could not, however, be
901 tested in this preliminary study. This testing will be an important next step in order to
902 speak really comprehensively of an aesthetic paradox.
- 903 • The structure of the postulated paradox has been derived from everyday experience with
904 aesthetic objects (see for example the sad film paradox), as well as from empirical studies
905 of literary reception processes. In these studies (e.g. Meutsch, 1987; Zwaan, 1993), the
906 existence of an aesthetic reception attitude has been confirmed and at the same time the
907 cognitive processes involved have (rudimentarily) been investigated (within the
908 framework of studies on polyvalence convention and the processing of aesthetic objects).
909 What is missing is the explicit emotional and motivational evaluation of the process of
910 understanding as it is was carried out in this study.
- 911 • In parallel, in studies of quasi-literary everyday communication (operating with figurative
912 language) the aesthetic reception attitude which, for economical reasons, has only been
913 assumed for the domain of non-conventional metaphors in our studies, must be validated
914 explicitly. Here it would also be interesting to discover if and to what extent the aesthetic
915 reception attitude depends on prior knowledge/experience, the degree of expertise (experts
916 of the literary scene vs. novices), the genre preference, the verbal sensibility or verbal
917 fluency, and if these variables affect the experience of the comprehension process. Thus, it
918 would be conceivable, for example, that, in participants with low prior knowledge in
919 literary art reception, the reception attitude is less pronounced than in experts and

920 consequently, that novices evaluate the effort required for processing non-conventional
921 metaphors less positively than experts.

922 • In addition, the category of figurative language should be differentiated by investigating
923 the aesthetic reception attitude and the aesthetic paradox in other language forms such as
924 irony, idioms, hyperbolas, understatement etc. In doing so, the cognitive and emotional
925 processes that account for the additional cognitive effort should be examined in greater
926 detail. This affects questions and issues such as the following: Is it the meaning
927 representation that is more time consuming? Is the additional processing time required for
928 the understanding of weak implicatures, to assess alternative meanings, or to decide on
929 one particular alternative? Are emotional processes activated that lead to a reverberation
930 of the meaning? Studies that concentrate on these processes should, where appropriate,
931 use eye-tracking procedures combined with think aloud protocols (e.g. Kaakinen &
932 Hyönä, 2005). They should also include individual working memory capacity as an
933 important determining factor. The relevance of working memory capacity for the
934 comprehension and production of metaphors has already been empirically confirmed (see
935 Chiappe & Chiappe, 2007); additionally the question of whether participants with high
936 memory capacity are better able to deal with the cognitive load involved in understanding
937 non-conventional metaphors than participants with low memory capacity should also be
938 raised. Are they able to enjoy this load more and do they evaluate it more positively than
939 participants with low memory capacity?

940 • The dependent variables can also be further examined - additional differentiations
941 allowing for an estimation of convergent and discriminant validity are possible and
942 appropriate. These include processing attitudes such as processing patience, frustration
943 tolerance, and openness for interpretations in dealing with aesthetic objects (e.g. in
944 literature, art or music lessons). These aspects correspond largely to what is generally
945 considered to be relevant for creative problem solving (see Kaufman, 2009; Runco, 2007;

946 Weisberg, 2006). Thus, in future research it has to be clarified whether the results and
947 presumed processes regarding the aesthetic paradox are not only relevant for the
948 processing of aesthetic objects but can also be applied constructively in the field of
949 creative problem solving.
950

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- 1162

1163 **Appendix captions**

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1166

1167 Appendix 1. Overview over metaphors and related paraphrases

1168

1169 Appendix 2. Factor structure of the semantic differential items for the overall sample of study
1170 1 and 2

1171

1172 Appendix 3. Additional analyses based on subjective measures of cognitive effort instead of
1173 processing time.

1174 Study 2: Correlations/regressions between the scales process appreciation, satisfactory result
1175 and (subjective) cognitive effort including simple slope analysis for 2 SD

1176

1177

Conventionality	Metaphor	Correct paraphrase	Rather incorrect paraphrase
conventional	Der Doktorand ist mit seiner Vorgehensweise auf dem Holzweg. (The candidate's approach to his PhD is barking up the wrong tree.)	Der Doktorand irrt sich mit seiner Vorgehensweise. (The candidate is at fault in his approach.)	Der Doktorand ist mit seiner Vorgehensweise schon lange beschäftigt. (The candidate has been working on his approach for a long time.)
conventional	Es trat eine peinliche Pause ein, weil der Redner den Faden verloren hatte. (An embarrassing break occurred, because the speaker had lost the thread.)	Es trat eine peinliche Pause ein, weil der Redner die Reihenfolge seiner Argumente vergessen hatte. (An embarrassing break occurred, because the speaker had forgotten the order of his arguments.)	Es trat eine peinliche Pause ein, weil der Redner lautstark und emotional wurde. (An embarrassing break occurred, because the speaker got stressed and emotional.)
conventional	Die Wörter von Politikern werden gern auf die Goldwaage gelegt. (Politicians' words are often weighed in the balance.)	Die Wörter von Politikern werden gern übergenu genommen. (Politicians' words are willingly treated very pedantically.)	Die Wörter von Politikern haben kein großes Gewicht. (Politicians' words are not treated with great importance.)
conventional	Die deutschen Beachvolleyballerinnen reiten auf einer Erfolgswelle. (The German beach volleyball players are riding on the crest of a wave.)	Die deutschen Beachvolleyballerinnen eilen von Sieg zu Sieg. (The German beach volleyball players are going from success to success.)	Die deutschen Beachvolleyballerinnen spielen mal überragend, mal grotenschlecht. (The German beach volleyball players sometimes play brilliantly, sometimes terribly.)
conventional	Wer gegen den Strom schwimmt, muss sich für seine Meinung oft rechtfertigen. (If you go against the flow, you often have to justify your opinion.)	Wer sich gegen die Mehrheitsmeinung stellt, muss sich für seine Meinung oft rechtfertigen. (If you do not behave like the majority, you often have to justify your opinion.)	Wer unverständliche Aussagen macht, muss sich für seine Meinung oft rechtfertigen. (If you make incomprehensible assumptions, you often have to justify your opinion.)
conventional	Die Schüler haben die Theateraufführung selbst auf die Beine gestellt. (The pupils alone brought the performance to life.)	Die Schüler haben die Theateraufführung selbst zu Stande gebracht. (The pupils produced and directed the performance on their own.)	Die Schüler haben für die Theateraufführung die Bühne selbst aufgebaut. (The pupils built the stage for the performance on their own.)
conventional	Als er das Tagebuch seiner Großmutter las, ging ihm ein Licht auf. (While reading his grandmother's diary, he suddenly	Als er das Tagebuch seiner Großmutter las, verstand er plötzlich alles. (When he was reading his grandmother's diary, he	Als er das Tagebuch seiner Großmutter las, fühlte er eine große innere Wärme. (When he was reading his grandmother's diary, he felt

	saw the light.)	suddenly understood everything.)	an inner warmth.)
conventional	Die Junge Union fordert den Verteidigungsminister auf, den Soldaten endlich reinen Wein einzuschenken. (The "Junge Union" calls on the minister of defence to come clean with the soldiers.)	Die Junge Union fordert den Verteidigungsminister auf, den Soldaten endlich die unangenehme Wahrheit zu sagen. (The Junge Union calls on the Minister of Defence to finally tell the soldiers the unpleasant truth.)	Die Junge Union fordert den Verteidigungsminister auf, den Soldaten endlich besseres Trinkwasser zu garantieren. (The Junge Union calls on the Minister of Defence to finally ensure better drinking water for the soldiers.)
conventional	Der Service der Deutschen Telekom ist zum Haare Raufen. (Deutsche Telekom's customer service is enough to make you tear your hair out.)	Der Service der Deutschen Telekom macht einen richtig wütend. (Deutsche Telekom's customer service makes you feel very angry.)	Der Service der Deutschen Telekom sorgt für Streitigkeiten. (Deutsche Telekom's customer service causes conflicts.)
conventional	In Talkshows können die Zuschauer ihren Senf dazu geben. (In talk shows, the audience can add their two pennies worth.)	In Talkshows können die Zuschauer ihre Meinung zu allem und jedem sagen. (In talk shows, the audience can speak their mind openly and freely.)	In Talkshows können die Zuschauer gewürzte Chips austauschen. (In talk shows, the audience can exchange spicy snacks.)
conventional	Zu Beginn eines Verkaufsgesprächs soll man nicht mit der Tür ins Haus fallen. (You should not approach a sales conversation like a bull in a china shop.)	Zu Beginn eines Verkaufsgesprächs soll man nicht gleich all seine Wünsche vorbringen. (At the beginning of a sales conversation, you should not present all your wishes at once.)	Zu Beginn eines Verkaufsgesprächs soll man den Kunden nicht beleidigen. (At the beginning of a sales conversation, you should not insult the customer.)
conventional	Die Prognose der Analysten hat ins Schwarze getroffen. (The analysts' forecast hit the bull's eye.)	Die Prognose der Analysten war völlig richtig. (The analysts' prognosis was correct.)	Die Prognose der Analysten ging am Ziel vorbei. (The analysts' prognosis missed the target.)
conventional	Der Artikel des Wochenmagazins ist Schnee von gestern. (The article in the magazine is water under the bridge.)	Der Artikel des Wochenmagazins ist ziemlich veraltet. (The article in the magazine is quite outdated.)	Der Artikel des Wochenmagazins muss noch entsorgt werden. (The article in the magazine still needs to be disposed of.)
conventional	Blogger nutzen das Internet, um richtig Dampf abzulassen. (Bloggers use the internet to let off steam.)	Blogger nutzen das Internet, um ihren Ärger emotional mitzuteilen. (Bloggers use the internet to express their deepest emotions.)	Blogger nutzen das Internet, um Ihre Hardware richtig zu nutzen. (Bloggers use the internet to properly test their hardware.)
conventional	In Lehrjahren wird nicht alles auf einem Silbertablett	In Lehrjahren wird einem nicht alles leicht gemacht.	In Lehrjahren muss man sehr sparsam leben.

	serviert. (In education, not everything is served up on a silver platter.)	(In education, life is not always easy.)	(In education, a certain amount of financial caution is required.)
non-conventional	Und stirbt er einst, nimm ihn, zerteil in kleine Sterne ihn. * (When he dies, take him and split him into little stars.)	Und stirbt er einst, so halte sein Andenken für viele ganz lebendig. (When he dies, ensure that he is not forgotten.)	Und stirbt er einst, Sorge für die Aufteilung des Erbes an alle Nachkommen. (When he dies, make sure his inheritance is distributed to all his offspring.)
non-conventional	Das Nest meiner Träume ist leer. * (The nest of my dreams is empty.)	Ich mache mir keine falschen Hoffnungen mehr. (I no longer hope for unrealistic things.)	Meine Familie hat mich im Stich gelassen. (My family has let me down.)
non-conventional	Das Klavierspiel der Mädchen gräbt einen Tunnel durch die Jahre. * (The girls' piano playing opens a channel through the years.)	Das Klavierspiel der Mädchen versetzt uns in die Vergangenheit. (The girls' piano playing brings the past to life.)	Das Klavierspiel der Mädchen lässt sie viel älter wirken. (The girls' piano playing makes them appear much older.)
non-conventional	Leben ist Brückenschlagen über Ströme, die vergehn. * (Life is building bridges over fading rivers.)	Leben heißt, Kontinuität in einer sich ständig wandelnden Welt aufrecht zu erhalten. (Life is about retaining continuity in a constantly changing world.)	Leben bedeutet, sich permanent selbst zu verlieren. (Life means permanently getting lost in yourself.)
non-conventional	Helle Länder sind deine Augen. * (Your eyes are light countries.)	Deine Augen schenken mir ganz neue Lebenserfahrungen. (Your eyes give me a completely new view of life.)	Deine Augen sind weit gereist. (Your eyes have travelled extensively.)
non-conventional	Wir haben den Regen gebogen und uns Vertrauen geliehen. (We have seen the sunshine through the rain.)	Wir haben aus Trauer und Verzweiflung Zuversicht und Hoffnung gezogen und uns Vertrauen geliehen. (In grief and despair, we have found hope and confidence.)	Wir haben die richtige Kleidung ausgewählt und uns Vertrauen geliehen. (We chose the right clothes and gained confidence.)
non-conventional	Ein Licht ruft Schatten in den Zimmern wach. (Light brings the shadows to life.)	Glück führt im Leben immer auch zu Leid. (In life, luck is always paired with sorrow.)	Bei Tag sieht man einfach besser. (You can see better during the daytime.)
non-conventional	Trinkt, o Augen, was die Wimper hält, von dem goldenen Überfluss der Welt! * (Drink, mine eyes, for all you're worth, of the world's golden treasures!)	Genießt, so viel Ihr könnt, die Schönheiten dieser Welt! (Enjoy as much as you can of what the world has to offer!)	Stärkt Euch, solange die Vorratskammern gefüllt sind! (Strengthen yourselves while you can!)
non-	Dein Ärger ist ein auswegloses Schattenspiel.	Weil du deinen Ärger nicht richtig auslebst, kommst du nie	Wenn du dich ärgerst, wirst du immer unkontrolliert

conventional	* (Your anger is a desperate shadow play.)	aus ihm heraus. (As you don't emote your anger properly, you are stuck with it.)	aggressiv. (When you get angry, you always get uncontrollably aggressive.)
non-conventional	Ein Sonnenaufgang für die Ohren. * (A sunrise for the ears.)	Ein überwältigender Hörgenuss. (A powerful aural pleasure.)	Die Ohren werden sanft geweckt. (The ears are gently awakened.)
non-conventional	Youtube hängt das Netz voller Geigen. (Youtube makes you see the world through rose-coloured spectacles.)	Youtube schafft im Internet eine fantastische Auswahl an Musik. (Youtube brings together a fantastic selection of music on the internet.)	Youtube erhöht die Konkurrenz im Internet erheblich. (Youtube considerably increases the competition on the internet.)
non-conventional	Der Schmerz ist dünn geschliffen. (The pain is like someone twisting a knife.)	Ich habe stechende, schneidende Schmerzen. (I have acute, stabbing pains.)	Der Schmerz ist nur oberflächlich. (The pain is only superficial.)
non-conventional	Das Wort ist das Licht des Menschen. * (Words are the light of man.)	Die Sprache ist Ausdruck und Bedingung des menschlichen Geistes. (Language is both the expression of and the prerequisite for the human mind.)	Ohne das Wort hätte der Mensch keine Elektrizität. (Without language, man wouldn't have electricity.)
non-conventional	Den Himmel süßt der kleine Mondbonbon. * (The moon makes heaven sweeter.)	Man kann sich auch mit kleinen Freuden wie im Himmel fühlen. (Even small pleasures can contribute to a bigger experience.)	Runde Formen sind ein wesentliches Merkmal himmlischer Objekte. (Round shapes are a vital feature of beautiful objects.)
non-conventional	Am Todesstreifen hört man heute nur das Schweigen der Grenzhunde. * (The only thing you can hear in No-Man's Land, is the silence of the border dogs.)	Am Todesstreifen ist die Lebensgefahr der Vergangenheit nur mehr Erinnerung. (In No-Man's Land, the threat of death is no longer present.)	Am Todesstreifen werden nur noch Hunde mit Maulkorb eingesetzt. (In No-Man's Land, the watchdogs are muzzled.)

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*For some non-conventional German metaphors there seems to be no equivalent in English and they might not be understood as metaphors.

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Items	Factor		
	1	2	3
interested – bored	.426	.715	-.068
resolved quickly – took time to resolve	-.542	.216	.658
challenging – not challenging	.865	.130	-.535
certain – uncertain	-.486	.052	.939
resolved successfully – not resolved successfully	-.438	.103	.933
expensive – inexpensive	.824	.089	-.479
with a definite result – with a temporary result	-.461	.004	.943
aesthetic – unaesthetic	.177	.872	-.015
rather overchallenging – rather underchallenging	.830	.016	-.536
convenient – inconvenient	-.071	.773	.157
required effort – did not require effort	.894	-.062	-.534
complex – simple	.812	.229	-.300
required consideration – did not require consideration	.824	.142	-.310

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In addition, we have also conducted parallel analyses based on subjective measures of cognitive effort. We only report the results with regard to the crucial interaction effect. In study 1 (low processing demand) we did not achieve the same pattern of results when we took subjective instead of objective measures of cognitive effort. This is because the subjective cognitive effort is so low that the comprehension process is not evaluated negatively even in the case when it does not lead to a satisfactory result. Instead, subjective cognitive effort and satisfactory result add up to a more positive evaluation of one's own comprehension process. There is, however, no doubt that the results based on objective measures of cognitive effort are more valid and sensitive with regard to the underlying cognitive process than the results based on subjective measures. In study 2, however, (high processing demand) the same pattern of results was achieved when we took subjective measures of cognitive effort instead of the objective measures (processing times) (see below).

Pearson Correlations (partial-)	Process appreciation	Satisfactory result	Cognitive effort	Satisfactory result* Cognitive effort
Satisfactory result		-.812**(.432*)		
Cognitive effort	.884**(.691**)		-.972**(-.932**)	
Regression analysis				
Corrected R ²	.855			
Standardized β	-(AV)	-.180	.768	.342
T	-(AV)	-.369	1.701	2.918
p	-(AV)	.716	.104	.008

* p < .05; ** p < .01 (two-tailed)

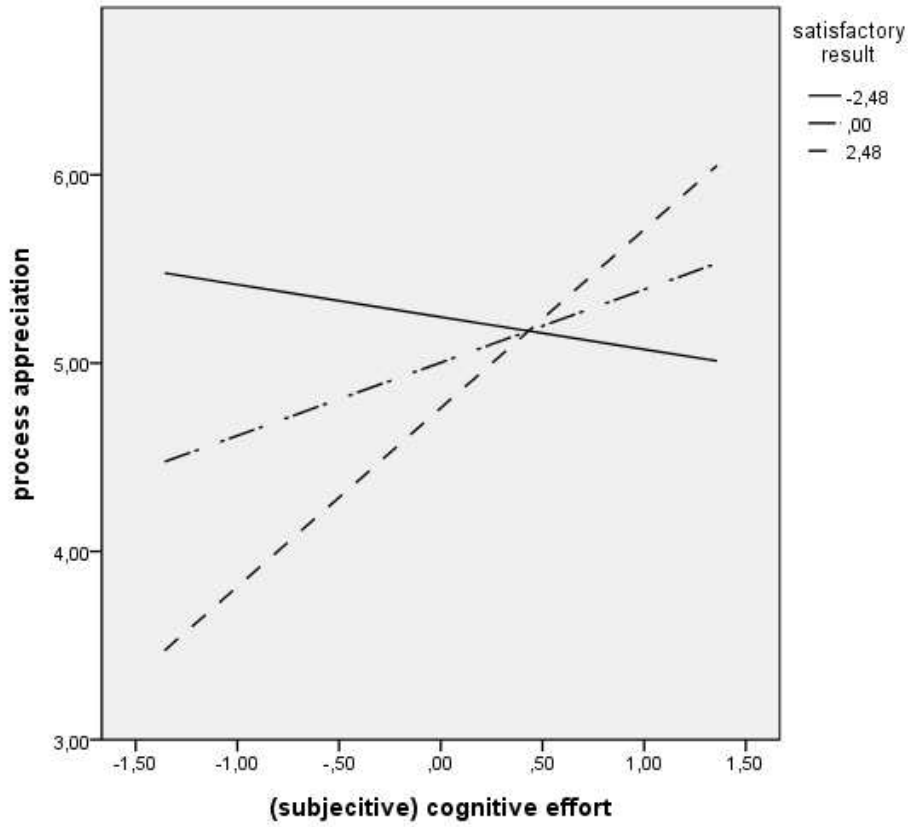
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Conditional Effect of Focal Predictor at Values of the Moderator Variable

Satisfactory result	b	se	t	p	LLCI(b)	ULCI(b)
-2.48	-.348	.781	-.445	.661	-1.977	1.282
.00	.786	.461	1.706	.103	-.175	1.747
2.48	1.919	.338	5.682	.000	1.215	2.624

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