

Are discourse expectations modulated by being linguistically creative? A production and perception study on Implicit Causality

Oliver Bott (oliver.bott@uni-bielefeld.de)

Matthias Schrumpf (matthias.schrumpf@uni-bielefeld.de)

Jens Michaelis (jens.michaelis@uni-bielefeld.de)

Torgrim Solstad (torgrim.solstad@uni-bielefeld.de)

Abstract

The present study investigates the production and perception of creative language with a particular focus on the discourse level. In particular, it addresses the question whether discourse biases associated with Implicit Causality are altered when we make a contribution that is intended to be original. This issue was addressed in two text production and two offline rating experiments. Our results show that creative contributions to ongoing discourse leave biases such as Implicit Causality largely unchanged but affect other linguistic markers.

Keywords: Linguistic creativity; Implicit Causality; coreference; discourse coherence; language production; perception

Introduction



Linguistic creativity has traditionally been considered to be a hallmark of human language (von Humboldt, 1836; Chomsky, 1965; Bergs, 2019). In order to be linguistically creative, speakers are required to make utterances that are perceived as original, that is, as deviating in some respect from norms or conventions established in the language system. At the same time, the produced speech should be effective in reaching the speaker's goals in the ongoing discourse (Runco & Jaeger, 2012).

Psycholinguistic studies have investigated a number of phenomena generally assumed to involve linguistic creativity. Examples include word- and sentence-level phenomena like compounds (Libben, 2013), novel metaphors (Beaty, Silvia, & Benedek, 2017), metonymic extensions (Frisson & Pickering, 1999; Schumacher, 2013), implicature (Noveck & Reboul, 2008; Breheny, 2018), conceptual pacts and lexical choice in reference (Brennan & Clark, 1996) and indirect speech acts (Boux, Margiotoudi, Dreyer, Tomasello, & Pulvermüller, 2023). However, less is known about linguistic creativity at the discourse level, involving more than a single sentence.

The present study aims to fill this gap by investigating whether and how discourse-pragmatic biases are influenced in a production task explicitly forcing participants to be creative. The biases under investigation are associated with Implicit Causality (henceforth, IC) verbs such as *fascinate* and *adore*, which denote interpersonal relations. IC is well-known from psycholinguistic research on discourse production (Au, 1986; Brown & Fish, 1983; Ferstl, Garnham, & Manouilidou, 2011; Garvey & Caramazza, 1974; Hartshorne & Snedeker, 2013; Kehler, Kertz, Rohde, & Elman, 2008; Rudolph & Försterling, 1997; Solstad & Bott,



2022) and comprehension (Featherstone & Sturt, 2010; Garnham, Traxler, Oakhill, & Gernsbacher, 1996; Garnham, Child, & Hutton, 2020; Koornneef & van Berkum, 2006; Pyykkönen & Järviö, 2010; Stevenson, Knott, Oberlander, & McDonald, 2000; van den Hoven & Ferstl, 2018) and commonly assumed to be associated with three different biases.

First, as shown in production studies (Kehler et al., 2008; Bott & Solstad, 2014; Solstad & Bott, 2022) IC verbs come with a **coherence bias**: When asked to continue prompts after the pencil symbol in (1)-(2) there is a preference for providing an explanation as to *why* someone was felt to be fascinating or adorable:

- (1) Liz fascinated Ian.  **She** was a great dancer.
- (2) Liz adored Ian.  **He** was always so patient.

IC verbs can thus be seen as triggers of a Question under Discussion (Roberts, 1996/2012), which may most broadly be construed as a *why* question (Kehler & Rohde, 2017). In the case of *fascinate* and *adore* the question is why the emotion these verbs describe came about in the first place (Bott & Solstad, 2014, 2021; Solstad & Bott, 2022). For instance, *Why was Ian fascinated (by Liz)?*.

Next, there is a likewise strong **coreference bias** for those explanations to be associated with one of the participants, or referents, in the relation (Garvey & Caramazza, 1974; Brown & Fish, 1983; Au, 1986; Rudolph & Försterling, 1997; Ferstl et al., 2011; Hartshorne, Sudo, & Uruwashii, 2013; Solstad & Bott, 2022). This bias is a function of the particular verb class in question. For the psychological verbs *fascinate* and *adore*, the explanation typically pertains to the individual evoking the psychological state (also known as the stimulus argument), which would be the subject of *fascinate* (3) and the object of *adore* (4):

- (3) Liz fascinated Ian because  **she** was very clever.
- (4) Liz adored Ian because  **he** was always so patient.

Third, there is a **form bias** as to the particular expression we use to refer to the arguments of the verb. Recent studies (Bott & Solstad, to appear; Weatherford & Arnold, 2021) have shown that reference to the biased referent is usually established by means of a personal pronoun (*she*), whereas explanations that make reference to the non-biased argument

(e.g., *Ian* in (3) and *Liz* in (4)) display a greater proportion of other referential expressions such as proper names.

All three biases are remarkably strong with typically $\geq 60\%$ EXPLANATIONS, coreference biases of $\approx 90\%$ and pronominalization rates $\geq 90\%$. However, the biases are pragmatic in nature and can thus be overridden. It is, for instance, fully felicitous to continue (1) with *Therefore, Ian decided to ask her out*, that is, a CONSEQUENCE about the object argument, referred to by repeating the proper name.

These biases have been extensively studied in “non-creative” settings, asking participants to provide the first continuation that comes to mind. In the present study, we modified this task by also asking participants explicitly to provide creative continuations in a separate block of the experiment. On the one hand, we were interested in whether the coreference, coherence and form biases would be overridden, or weakened, this way. At the same time, we wanted to assess whether such a simple manipulation would be perceived by interpreters as triggering creativity in the first place. This particular production task seemed very well suited in this regard, since so much is known about the default, non-creative biases associated with IC.

Of relevance to the purposes of the current study, the online comprehension of the IC coreference bias has been shown to be influenced by comprehenders’ background mood (Van Berkum, Goede, Alphen, Mulder, & Kerstholt, 2013). However, no effect of mood was found in a parallel offline production task. Since mood and affect are directly related to creativity, with positive moods promoting cognitive flexibility (Isen, 1999; Davis, 2009), it is an open question whether linguistic creativity interacts with the IC coreference bias. Regarding the discourse level, Skalicky, Crossley, McNamara, and Muldner (2017) recently investigated linguistic markers of creativity analyzing linguistic features of conversations between participants elaborating creative ideas in joint divergent-thinking tasks. Their results show that the degree of elaboration of creative ideas is correlated with causal cohesion and exemplification of ideas. The present study adds to the insights of Skalicky et al. (2017) by investigating the likelihood of causal elaboration in a language production task manipulating linguistic creativity directly.

Experimental Study

We present the findings of **two discourse continuation experiments** on creative discourse in German, the first investigating coreference biases in creative vs. “default” explanations after *weil* ‘because’ and the second addressing discourse coherence more generally in continuations realized as independent sentences after a full stop. Importantly, these production tasks were complemented by **two perception experiments** employing rating tasks querying the originality and felicity of the continuations elicited in the production experiments.

All discourse continuations were annotated with respect to the above biases involving coreference, coherence as well as

(co)-referential form. Further variables of interest were the length and syntactic complexity of continuations as a proxy for their degree of overall content elaboration. Last but not least, we also investigated the influence of personal traits on creative discourse production, which may be an important factor because creativity is known to vary greatly between individuals, with clear correspondences to their personal traits (Runco, 2014). In particular, we assessed the influence of the factor *Openness to New Experience* from McCrae and Costa (1987)’s Big Five Model, a personality trait known to be linked to general creativity and the personal inclination to engage in creative writing (Prabhu, Sutton, & Sauser, 2008; Greengross & Miller, 2009, a.o.).

Methods, Production Experiments (Exps. 1 & 2)

Materials and Procedure Two web-based discourse continuation experiments were conducted using PCIBex (Zehr & Schwarz, 2018), testing German IC prompts with 20 subject-biased stimuli with stimulus-experiencer (henceforth, SE) verbs like *fascinate* and 20 object-biased stimuli with experiencer-stimulus (henceforth, ES) verbs like *adore* (factor VERB TYPE) adopted from Solstad and Bott (2022). Both experiments employed $2 \times 2 \times 2$ within participants/items designs with the following factors: (PRODUCTION) BLOCK: default vs. explicitly creative continuations, VERB TYPE: SE vs. ES verbs, and GENDER ORDER: masc.>fem. vs. fem.>masc. order of NPs (e.g., *Ian fascinated Liz* vs. *Liz fascinated Ian*). The latter factor was included as a counterbalancing factor. Semantically similar verbs such as *faszinieren* ‘fascinate’ and *bewundern* ‘adore’ were paired in a lexical item by combining them with the same names. In the first block, participants were asked to produce 20 continuations under standard IC instructions (“write the first continuation that comes to your mind”). In the second block, they received another set of instructions asking them for 20 maximally creative continuations, operationalized as original (German ‘originell’) and felicitous (German ‘gelungen’), see Runco and Jaeger (2012) for defining features of creativity. Between participants, it was further manipulated whether continuations were provided after *weil* ‘because’ (Exp. 1) or after a full stop (Exp. 2) like in examples (3)/(4) vs. (1)/(2). For each experiment, four lists were constructed according to a Latin Square design in such a way that each item was presented twice in each list, once with the SE verb and once with the ES verb in different gender orders (masc.>fem. vs. fem.>masc.). One of these verbs occurred in the creative block and the other in the baseline, non-creative block. The presentation order of experimental items was individually randomized within the non-creative and creative blocks, respectively. The experiments did not include any fillers except that each block started with three practice items which were not revealed as such to participants.¹

¹All experimental materials, the data and the statistical analyses in the form of an R markdown file are publicly available in the following OSF archive https://osf.io/n8gx2/?view_only=2836a1b552824c30a59cf726bdc439d3.

Participants 40 native German speakers were recruited via Prolific for Exp. 1 (mean age 23.1 y. [range 18-35 y.]; 22 female, 17 male, 1 diverse; self-reported college students) and another 40 participated in Exp. 2 (mean age 21.9 y. [18-32 y.]; 31 female, 9 male; self-reported college students). At the end of the experimental session, participants received the freely admissible German version of the IPIP openness scale consisting of 20 questions (Goldberg et al., 2006). Openness scores were assigned following standard IPIP guidelines (<https://ipip.ori.org/>). IPIP scores did not differ significantly between participants in Exps. 1 and 2 ($t(78) = .17$, $p = .86$; Exp. 1: $\bar{x} = 73.4$, $sd = 7.8$, range = [58, 88]; Exp. 2: $\bar{x} = 73.8$, $sd = 10.1$, range = [48, 91]).

Annotation The resulting 3200 continuations were annotated for coreference (subject vs. object coreference) and the form of anaphoric expressions (personal pronouns, demonstrative pronouns, repeated names, full DPs) applying comparable annotation guidelines as in Solstad and Bott (2022). The 1600 continuations from Exp. 2 with the full stop prompts were also annotated with respect to coherence relations (EXPLANATION, RESULT, ELABORATION, CONTRAST, OCCASION, OTHER, INDETERMINATE). Coherence relations were annotated and operationalized by means of insertion tests using *weil* ‘because’ (for EXPLANATION), *sodass* ‘and so’ (RESULT), *und zwar* ‘namely’ (ELABORATION), *aber* ‘but’ (CONTRAST), and *nachher* ‘afterwards’ (OCCASION) (Jasinskaja & Karagjosova, 2021). In addition, the syntactic complexity of all continuations in Exps. 1 and 2 was assessed by annotating whether the continuation involved (further) clausal embeddings or sentence coordination. The reliability of the annotation task was checked with a second annotator for a random sample of 200 productions from each of the two experiments. The coreference coding turned out to be highly reliable (Exp. 1: Cohen’s $\kappa = 0.89$; Exp. 2: Cohen’s $\kappa = 0.82$) and the coherence coding (Exp. 2) also proved to be substantially reliable (Cohen’s $\kappa = 0.61$).

124 out of the 3,200 productions consisted of incomplete or ungrammatical sentences or were obviously nonsensical (3.8% of the data). These were excluded from the analysis leaving a total of 3,076 productions (1,573 in Exp. 1 and 1,503 in Exp. 2).

Methods, Perception Experiments (Exps. 3 & 4)

In a second set of crowd-sourcing experiments, productions elicited in Exps. 1 and 2 were rated by native German speakers by means of two sliders (range 0-99), one for originality and one for felicity, testing 80 productions per rater. Exp. 3 evaluated productions after *weil* ‘because’ (Exp. 1, $N = 60$), whereas Exp. 4 evaluated productions after a full stop (Exp. 2, $N = 60$). Raters were again recruited from Prolific, applying the same filters as in the production experiments. None of the raters had participated in the production experiments. They were blind with respect to the creativity manipulation, not knowing from which block (non-creative vs. creative) a given continuation was sampled. However, they were ex-

PLICITLY informed about the continuation task and were shown some sample trials during instruction. Their task was to explicitly rate each continuation relative to its prompt: “(i) How original/creative, and (ii) how felicitous is it to continue this prompt in this particular way?”.

Counterbalancing methods were applied to make sure that each rater received the same number of productions from each participant of Exps. 1 and 2, and furthermore from each experimental item/verb, resulting in two continuations per participant and verb, one from each block. This way, a total of three felicity and originality judgments were collected for every single production from the production task, respectively. The ratings served as a check of the creativity manipulations in Exps. 1 and 2 and were furthermore used for analyses of particularly creative vs. non-creative language.

Results and Discussion

We start with the results from the rating task (Exps. 3/4) since it first has to be established that the explicit request to provide a creative continuation in a blocked design is suited for manipulating creativity in the first place. Following this, the findings with respect to the three IC biases from the production task in Exps. 1/2 will be presented.

Results of the Rating Task in Exps. 3/4

We computed mean felicity and originality scores for each of the productions from Exps. 1 and 2 and investigated whether the creativity manipulation worked as intended. The distributions of the felicity and originality scores are shown in Figure 1. The perceived originality varied greatly between the non-creative baseline block (median 39.0) and the creative block (median 63.7). The felicity scores furthermore showed that creative discourse continuations were perceived as being at least as felicitous as the continuations from the baseline block (median 74.0 vs. 72.0).

Two linear mixed-effects regression analyses were conducted in R using the *lme4* package (Bates et al., 2015), fitting the perceived originality and felicity of discourse relations as a function of the centered predictors EXPERIMENT (Exp. 1 vs. Exp. 2), (PRODUCTION) BLOCK (non-creative baseline vs. creative) and VERB TYPE (SE vs. ES verbs) and their interactions. The models included random intercepts for participants and items as well as random slopes of BLOCK. This was the maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2013) to converge. The first analysis on originality ratings revealed only a main effect of BLOCK (here and always below, model comparison via a likelihood ratio test with a model without the fixed effect in question: $\chi^2(1) = 78.28$, $p < .0001$) in the absence of any interactions or other significant main effects. Thus, the only factor modulating perceived originality was the block the continuation was sampled from.

The second analysis on perceived felicity gave rise to a significant two-way interaction between EXPERIMENT and BLOCK ($\chi^2(1) = 11.13$, $p = .0008$). A follow-up analysis showed that after full stop prompts in Exp. 2, continu-

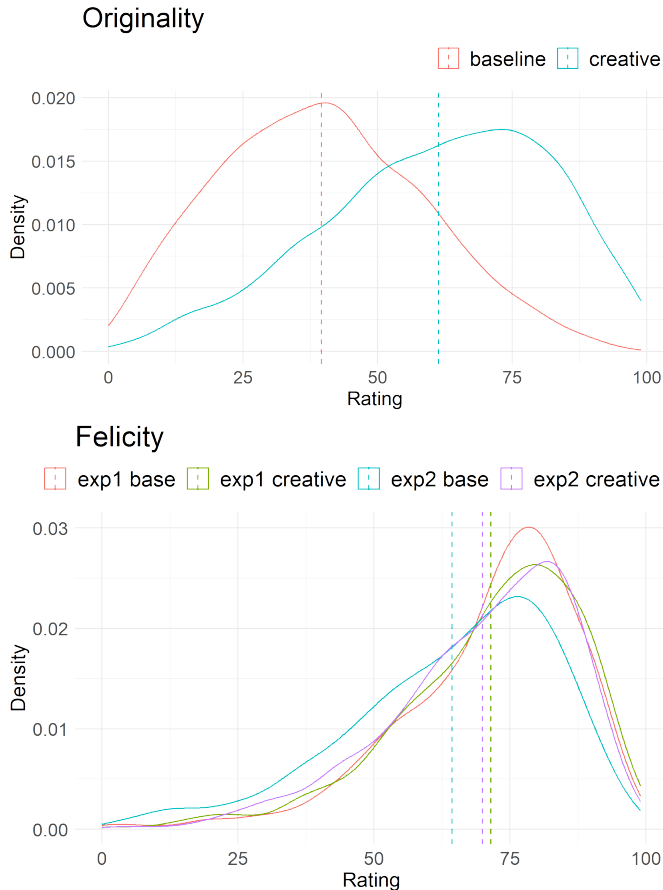


Figure 1: Density distributions and means of originality (top) and felicity scores (bottom) from perception Exps. 3 and 4 as a function of BLOCK (base(line) vs. creative) and PRODUCTION EXPERIMENT (Exp. 1 vs. Exp. 2). Since perceived originality did not vary between the two production experiments, their data were collapsed for plotting originality scores.

ations from the non-creative, baseline block were rated as somewhat less felicitous than continuations from the creative block (mean scores 64.3 vs. 69.8; main effect of BLOCK $\chi^2(1) = 15.26, p < .0001$). However, after *because* prompts in Exp. 1, felicity ratings did not differ between the two blocks ($\chi^2(2) = 0.16, p = .95$).

To summarize, the discourse continuations were in fact perceived to be linguistically creative, that is, original and felicitous, thus meeting the defining features of creativity (Runco & Jaeger, 2012). Having established that the manipulation of creativity via explicit instruction – what we may call *creativity on demand* – did indeed show an effect, we next analyzed the annotations of discourse properties of the continuations.

Analysis of IC Production Biases in Exps. 1/2

For the analysis of the effects on the three biases, we will first look into the **coreference properties** of creative relative to baseline continuations. The second analysis will then

extend the scope of the analysis to **discourse coherence** relations, while a third analysis will deal with the **referential forms** chosen for reference in (non-)creative discourse. For inferential statistics, we will report logit mixed-effects regression analyses on the respective categorical dependent variables (Jäger, 2008).

Coreference Bias For the analysis of coreference biases, only continuations with at least one anaphoric expression and with an subject-verb-object reading of the prompt (Solstad & Bott, 2022) were included in the analysis ($N_{\text{Exp. 1}} = 1,504$ continuations, $N_{\text{Exp. 2}} = 1,388$ continuations). Table 1 presents the descriptive statistics on the observed biases to refer back to the subject or the object, respectively.

Following Kehler et al. (2008), the coreference in continuations after a full stop were conditioned on the coherence relation between the prompt and the continuation sentence. Here, we restrict our attention to EXPLANATION relations, which for the psychological verbs in the present study should lead to a bias towards the stimulus argument, that is, the Implicit Causality bias mentioned above (Ferstl et al., 2011).

The verb type manipulation in Exp. 1 gave rise to strong Implicit Causality Biases in the range of 90% coreference bias to the stimulus argument, replicating the effects in (Solstad & Bott, 2022). Strikingly, the coreference biases were virtually indistinguishable in the creative and in the baseline blocks. This was confirmed in the GLMER analysis modeling reference to the subject after *because* prompts in Exp. 1, which revealed a highly reliable main effect of VERB TYPE ($\chi^2(1) = 1187.5, p < .0001$) in the absence of any effects involving BLOCK ($\chi^2(2) = 0.83, p = .66$).

Table 1: Coreference biases in the creative and baseline (base) continuations with at least one anaphoric expression of Exp. 1 and Exp. 2 as a function of VERB TYPE (stimulus-experiencer vs. experiencer-stimulus). For Exp. 2, coreference biases are only reported for continuations realizing EXPLANATION (EXPL) relations with orthogonal biases.

	Condition	Subject	Object
<i>Exp. 1</i>	(<i>weil</i> ‘because’)		
	SE creative	327 (88.9%)	41 (11.1%)
	ES creative	37 (9.6%)	347 (90.4%)
	SE baseline	341 (90.5%)	36 (9.5%)
	ES baseline	31 (8.3%)	344 (91.7%)
<i>Exp. 2</i>	(EXPLANATIONS)		
	SE creative	158 (62.5%)	95 (37.5%)
	ES creative	28 (10.4%)	242 (89.6%)
	SE baseline	141 (70.1%)	60 (29.9%)
	ES baseline	23 (10.1%)	205 (89.9%)

Explanations after full stop prompts in Exp. 2 led to a qualitatively similar, albeit less extreme IC coreference biases with a subject bias for SE verbs and an object bias for

ES verbs. The GLMER analysis on coreference in explanations again revealed only an effect of VERB TYPE ($\chi^2(1) = 339.48, p < .0001$) but no effects involving BLOCK ($\chi^2(2) = 2.94, p = .23$).

To summarize, the coreference analysis revealed coreference biases of the same direction and strength in creative discourse continuations as was the case in the non-creative baseline conditions. Thus, the highly original discourse continuations made reference to the same characters as did the non-creative controls. This could be consistently shown for explanations and IC bias, both explicitly marked (Exp. 1) as well as in discourse without explicit marking (Exp. 2).

Coherence Bias The distributions of discourse relations in discourse continuations following prompts with a full stop as a function of BLOCK and VERB TYPE are presented in Figure 2. Across the board, participants predominantly produced explanations, well in line with results from previous research on the coherence bias of IC verbs (Kehler et al., 2008; Bott & Solstad, 2014; Solstad & Bott, 2022). Moreover, verb types differed with respect to the coherence relations they gave rise to: While SE verbs gave rise to more RESULT relations than did ES verbs, the opposite pattern was observed regarding CONTRAST relations. These observations fit well with those reported in Solstad and Bott (2022), who hypothesized that contiguous events are more likely for SE verbs, which are causative with a temporally bounded resultant state (Moen & Steedman, 1988).

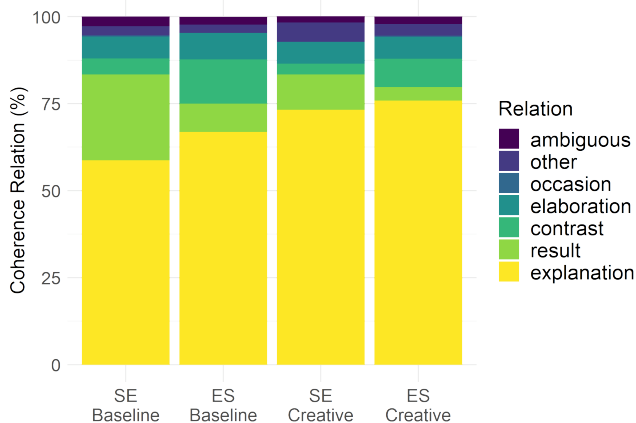


Figure 2: Distribution of coherence relations produced after a full stop in Exp. 2. Note: continuations were coded as ambiguous if they passed multiple insertion tests.

Contrary to our initial assumptions, the explanation coherence bias turned out not to be weakened, and instead even stronger in the creative productions (with a mean coherence bias of 74.5% EXPLANATION relations) than in the non-creative baseline controls (62.8% EXPLANATION relations). This was supported by a logit mixed-effects regression analysis modeling the likelihood to produce an EXPLANATION

relation vs. some other relation including the centered fixed effects of BLOCK, VERB TYPE and their interaction as well as random intercepts for PARTICIPANT and ITEM and the by-participants random slope of BLOCK. The GLMER analysis revealed two significant main effects and no interaction. Participants were in fact more likely to produce an explanation in the creative block than in the baseline block (main effect of BLOCK: $\chi^2(1) = 7.05, p = .0079$). They also produced reliably more explanations after ES than after SE prompts (main effect of VERB TYPE: $\chi^2(1) = 6.10, p = .0135$). Regarding the creativity manipulation, the present data show that creative discourse continuations even more strongly address the QuD raised by IC verbs than is the case in default continuations. Taken together with the findings of the coreference analysis above, the data suggest that in the production of creative discourse, language producers maximize discourse coherence by sticking to the implicit QuDs raised in discourse and provide original answers to these. We will return to this issue in the general discussion.

Notably, the VERB TYPE effect surprisingly contrasts with the findings of Solstad and Bott (2022), using the same materials. We have to leave this question for future research.

Anaphoric Form Bias We now turn to the third type of bias, involving referential forms. In typical explanations with two referents of different gender, speakers of German tend to refer back to previously mentioned characters by producing a personal pronoun (Bott & Solstad, to appear), and almost uniformly so in subordinate *because* clause continuations. Since previous work has shown great differences between anaphoric forms referring back to the subject as opposed to the object, respectively, the data were split by coreference to subjects vs. objects. The only forms that appeared regularly were personal pronouns and repeated names. All other forms were therefore collapsed into the category OTHER. Table 2 presents the anaphoric forms produced in Exp. 1.

Table 2: Anaphoric forms produced in Exp. 1 referring back to the subject (Subj.) or the object (Obj.) in the creative (creat.) and baseline (base) blocks. Note: PERS = personal pronouns, NAME = repeated name, OTHER = other forms.

referent	block	PERS	NAME	OTHER
Subj.	creat.	358 (98.4%)	5 (1.4%)	1 (0.3%)
	base	371 (99.7%)	1 (0.3%)	0 (0.0%)
Obj.	creat.	337 (86.9%)	24 (6.2%)	27 (7.0%)
	base	352 (92.6%)	11 (2.9%)	17 (4.5%)

A logit mixed-effects model analysis was performed on the coreference data from Exp. 1, modeling the likelihood to refer back by means of a personal pronoun vs. names and all other forms. This time, BLOCK and COREFERENCE served as predictors in a model including the random intercepts of participants and items. The analysis revealed significant main effects of COREFERENCE ($\chi^2(1) = 90.34, p < .0001$)

and of BLOCK ($\chi^2(1) = 12.91, p = .0003$), but no interaction ($\chi^2(1) = 1.02, p = .313$). The first main effect was due to the fact that other forms than pronouns appeared more frequently in reference back to the object than to the subject, much in line with research on reference production (Fukumura & van Gompel, 2010, a.o.). The creativity-related effect resulted from more forms other than personal pronouns being used in creative continuations than in non-creative baseline continuations. Albeit being small, this effect fits well with our observation below that creative continuations often included more complex sentence structures than did baseline continuations and included reference to more referents enhancing the need for unambiguous reference by using a name.

Other Linguistic Markers of Creative Discourse To gain a better understanding of other linguistic markers indicative of linguistic creativity, we conducted an exploratory analysis investigating further features of the continuations. Here, we only report selected global measures of textual elaboration like continuation length as measured in number of characters and words as well as syntactic complexity, that is, whether continuations exhibited syntactic sub- or coordination. The results of the analyses are summarized in Table 3.

Creative continuations were about twice as long as baseline continuations. They also involved a multitude of syntactic embeddings and coordination structures relative to baseline continuations. Inferential statistical analyses showed strong (main) effects of BLOCK for all three measures (see the RMD report on OSF). Thus, textual elaboration proved to be an important strategy for being linguistically creative.

Table 3: Linguistic measures of textual (number of characters (ch.) and words (w.)) and syntactic elaboration (sub- and/or co-ordination) of the productions in Exp. 1 and 2. Standard deviations in parentheses.

Exp	block	mean N ch.	mean N w.	sub/co
Exp. 1	creat.	60.2 (29.1)	9.9 (4.7)	26.4%
	base	30.7 (11.6)	5.3 (1.8)	3.2%
Exp. 2	creat.	75.9 (38.9)	12.4 (6.5)	53.7%
	base	41.5 (20.1)	6.8 (3.2)	18.2%

Openness to experience and linguistic creativity

Our final analysis examined the interrelations between personality traits such as openness to experience and participants’ linguistic creative potential to produce creative text continuations. This was done in correlational analyses relating participants’ openness scores as measured by the IPIP openness scale to the perceived originality of their discourse continuations. Two originality measures of genuine linguistic creativity were considered: 1) the general originality of all continuations of a given participant (corresponding to the mean originality score), and 2) the specific ability to be creative on demand (measured by the difference score between the mean originality score in the second as compared to the

first block). Scatterplots and regression lines are shown for both measures in Figure 3.

There was neither a correlation between IPIP scores and perceived overall originality ($r = .13, t(78) = 1.18, p = 0.24$) nor between IPIP scores and the difference scores of perceived originality between blocks ($r = .02, t(78) = 0.15, p = 0.88$). Thus, being able to be linguistically creative in a task like the present one does not seem to be directly related to personality traits for general creativity. This wasn’t, however, the main focus of this paper and future studies should address these issues more systematically, also taking into account the mediating role of motivation as well as measures of general creativity beyond personality traits (Prabhu et al., 2008, a.o.).

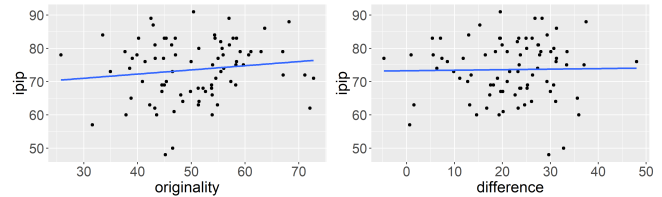


Figure 3: Scatterplots and regression lines relating participants (Exp.1/2)’s IPIP scores and 1) the global perceived originality of their continuations (upper panel), and 2) the difference score between blocks (lower panel).

Conclusions

The present study shows that explicitly creative language does in fact interact in interesting ways with the QuDs raised in prior discourse. Creative language addresses the current QuD even more strongly than non-creative, or default, language. Participants produced more explanations and these explanations were of the same basic type as indicated by the stable coreference biases (Solstad & Bott, 2022). This suggests that speakers were not creative by choosing a different discourse structure, deviating from the default explanation strategy. Rather, they provided highly original explanations content-wise, while still serving the IC discourse biases. This nicely fits with the observation that creative content was established with more complex anaphoric forms: Since creative continuations are longer and more complex, the participants’ roles in the causal relation must be marked more clearly.

Methodologically, our study demonstrates that *linguistic creativity on demand* opens an interesting way to study creativity in text production, but also more generally in communication. The ratings elicited in the perception task show that participants are generally able to shift into a creative mode when asked to do so. Comments on the experiment in a debriefing questionnaire indicated that participants enjoyed coming up with creative continuations. Instead of asking for original and felicitous discourse in general, we may use the present combination of production and perception tasks to study more specific aspects of linguistic creativity such as innovative compounds, metaphors, and indirect answers.

References

- Au, T. K.-f. (1986). A verb is worth a thousand words: The causes and consequences of interpersonal events implicit in language. *Journal of Memory and Language*, 25(1), 104–122.
- Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, 68(3), 255–278.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48.
- Beaty, R. E., Silvia, P., & Benedek, J. M. (2017). Brain networks underlying novel metaphor production. *Brain and Cognition*, 111, 163–170.
- Bergs, A. (2019). What, if anything, is linguistic creativity? *Gestalt Theory*, 41(2), 173–184.
- Bott, O., & Solstad, T. (2014). From verbs to discourse – a novel account of implicit causality. In B. Hemforth, B. Mertins, & C. Fabricius-Hansen (Eds.), *Psycholinguistic approaches to meaning and understanding across languages* (pp. 213–251). New York: Springer.
- Bott, O., & Solstad, T. (2021). Discourse expectations: explaining the implicit causality biases of verbs. *Linguistics*, 59(2), 361–416.
- Bott, O., & Solstad, T. (to appear). The production of referring expressions is influenced by the likelihood of next mention. *Quarterly Journal of Experimental Psychology*.
- Boux, I. P., Margiotoudi, K., Dreyer, F. R., Tomasello, R., & Pulvermüller, F. (2023). Cognitive features of indirect speech acts. *Language, Cognition and Neuroscience*, 38(1), 40–64.
- Breheny, R. (2018). Scalar implicature. In C. Cummins & N. Katsos (Eds.), *The Oxford handbook of experimental semantics and pragmatics* (pp. 39–61). Oxford: Oxford University Press.
- Brennan, S., & Clark, H. (1996). Conceptual pacts and lexical choice in conversation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(6), 1482–1493.
- Brown, R., & Fish, D. (1983). The psychological causality implicit in language. *Cognition*, 14(3), 237–273.
- Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, Mass.: MIT Press.
- Davis, M. A. (2009). Understanding the relationship between mood and creativity: A meta-analysis. *Organizational Behavior and Human Decision Processes*, 108(1), 25–38.
- Featherstone, C. R., & Sturt, P. (2010). Because there was a cause for concern: An investigation into a word-specific prediction account of the implicit-causality effect. *The Quarterly Journal of Experimental Psychology*, 63(1), 3–15.
- Ferstl, E. C., Garnham, A., & Manouilidou, C. (2011). Implicit causality bias in English: a corpus of 300 verbs. *Behavior Research Methods*, 43(1), 124–135. doi: 10.3758/s13428-010-0023-2
- Frisson, S., & Pickering, M. (1999). The processing of metonymy: Evidence from eye movements. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25(6), 1366–1383.
- Fukumura, K., & van Gompel, R. P. (2010). Choosing anaphoric expressions: Do people take into account likelihood of reference? *Journal of Memory and Language*, 62(1), 52–66. doi: 10.1016/j.jml.2009.09.001
- Garnham, A., Child, S., & Hutton, S. (2020). Anticipating causes and consequences. *Journal of Memory and Language*, 114, Article 104130. doi: <https://doi.org/10.1016/j.jml.2020.104130>
- Garnham, A., Traxler, M., Oakhill, J., & Gernsbacher, M. A. (1996). The locus of implicit causality effects in comprehension. *Journal of Memory and Language*, 35(4), 517–543.
- Garvey, C., & Caramazza, A. (1974). Implicit causality in verbs. *Linguistic Inquiry*, 5(3), 459–464.
- Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. G. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality*, 40, 84–96.
- Greengross, G., & Miller, G. F. (2009). The big five personality traits of professional comedians compared to amateur comedians, comedy writers, and college students. *Personality and Individual Differences*, 47, 79–83.
- Hartshorne, J. K., & Snedeker, J. (2013). Verb argument structure predicts implicit causality: The advantages of finer-grained semantics. *Language and Cognitive Processes*, 28(10), 1474–1508. doi: 10.1080/01690965.2012.689305
- Hartshorne, J. K., Sudo, Y., & Uruwashii, M. (2013). Are implicit causality pronoun resolution biases consistent across languages and cultures? *Experimental Psychology*, 60(3), 179–196.
- Isen, A. (1999). Positive affect. In T. Dalgleish & M. Power (Eds.), *The handbook of cognition and emotion* (pp. 521–539). Sussex, England: Wiley.
- Jasinskaja, K., & Karajosova, E. (2021). Rhetorical relations. In D. Gutzmann, L. Matthewson, C. Maier, H. Rullmann, & T. E. Zimmermann (Eds.), *The Wiley Blackwell companion to semantics* (p. 1-29). Hoboken: Wiley.
- Jäger, T. (2008). Categorical data analysis: away from anovas (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, 59, 434-446.
- Kehler, A., Kertz, L., Rohde, H., & Elman, J. L. (2008). Coherence and coreference revisited. *Journal of Semantics*, 25(1), 1–44. doi: 10.1093/jos/ffm018
- Kehler, A., & Rohde, H. (2017). Evaluating an expectation-driven question-under-discussion model of discourse interpretation. *Discourse Processes*, 54(3), 219-238.
- Koornneef, A. W., & van Berkum, J. J. A. (2006). On the

- use of verb-based implicit causality in sentence comprehension: Evidence from self-paced reading and eye tracking. *Journal of Memory and Language*, 54(4), 445–465.
- Libben, G. (2013). The nature of compounds: A psychocentric perspective. *Cognitive Neuropsychology*, 31(1-2), 8–25.
- McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, 52(1), 81–90.
- Moens, M., & Steedman, M. (1988). Temporal ontology and temporal reference. *Computational Linguistics*, 14(2), 15–28.
- Noveck, I. A., & Reboul, A. (2008). Experimental pragmatics: A Gricean turn in the study of language. *Trends in Cognitive Sciences*, 12(11), 425–431.
- Prabhu, V., Sutton, C., & Sauser, W. (2008). Creativity and certain personality traits: Understanding the mediating effect of intrinsic motivation. *Creativity Research Journal*, 20(1), 53–56.
- Pyykkönen, P., & Järvikivi, J. (2010). Activation and persistence of implicit causality information in spoken language comprehension. *Experimental Psychology*, 57(1), 5–16.
- Roberts, C. (1996/2012). Information structure in discourse: Towards an integrated formal theory of pragmatics. *Semantics & Pragmatics*, 5(article 6), 1-69.
- Rudolph, U., & Försterling, F. (1997). The psychological causality implicit in verbs: A review. *Psychological Bulletin*, 121, 192–218.
- Runco, M. A. (2014). Chapter 9 - personality and motivation. In M. A. Runco (Ed.), *Creativity (second edition)* (pp. 265–302). Oxford University Press. doi: 10.1016/B978-0-12-410512-6.00009-6
- Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, 24(1), 92–96.
- Schumacher, P. B. (2013). When combinatorial processing results in reconceptualization: toward a new approach of compositionality. *Frontiers in Psychology*, 4(article 677), 1–13.
- Skalicky, S., Crossley, S. A., McNamara, D. S., & Muldner, K. (2017). Identifying creativity during problem solving using linguistic features. *Creativity Research Journal*, 29(4), 343–353.
- Solstad, T., & Bott, O. (2022). On the Nature of Implicit Causality and Consequentiality: The Case of Psychological Verbs. *Language, Cognition and Neuroscience*, 37(10), 1311–1340. doi: 10.1080/23273798.2022.2069277
- Stevenson, R. J., Knott, A., Oberlander, J., & McDonald, S. (2000). Interpreting pronouns and connectives: Interactions among focusing, thematic roles and coherence relations. *Language and Cognitive Processes*, 15(3), 225–262.
- van den Hoven, E., & Ferstl, E. C. (2018). The roles of implicit causality and discourse context in pronoun resolution. *Frontiers in Communication*, 3.
- Van Berkum, J. J. A., Goede, D. D., Alphen, P. M. V., Mulder, E. R., & Kerstholt, J. H. (2013). How robust is the language architecture? The case of mood. *Frontiers in Psychology*, 4. doi: 10.3389/fpsyg.2013.00505
- von Humboldt, W. (1836). Über die Verschiedenheit des menschlichen Sprachbaues und ihren Einfluss auf die geistige Entwicklung des Menschengeschlechts. In J. C. E. Buschmann (Ed.), *Wilhelm von Humboldt Gesammelte Werke* (pp. 39–61). Berlin: Dümmler.
- Weatherford, K. C., & Arnold, J. E. (2021). Semantic predictability of implicit causality can affect referential form choice. *Cognition*, 214, 104759. doi: <https://doi.org/10.1016/j.cognition.2021.104759>
- Zehr, J., & Schwarz, F. (2018). *PennController for Internet Based Experiments (IBEX)*. doi: 10.17605/OSF.IO/MD832