(Ir)regularity of verbs revisited: Evidence for a lexical entry complexity based account

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Abstract

To explore the representation and encoding of regularity as well as the inflectional processes involved in the production of regular and non-regular verbs, we investigated three groups of German verbs: regular, irregular and hybrid verbs. In a picture naming experiment and a picture word interference experiment, articulation latencies were measured while participants named pictures of actions, producing the 3rd person singular of German verbs in present and past tense. The differences in naming latencies in the three groups of verbs in the two tenses suggest that the complexity of lexical entries of verbs is a decisive factor in the production of verbs. We propose a lexical entry complexity account which can explain the pattern of the presented data while the blocking mechanism (e.g. Pinker, 1991; Clahsen, 1999) cannot.

1 Introduction

One of the prominent accounts of processing irregular vs. regular verbs, the Dual Mechanism Model (DMM: Pinker, 1991, 1998; Jaeger, 1996; Clahsen, 1999), assumes different routes for processing regular and irregular inflection. Whereas regular forms are generated by concatenating verb stems and corresponding suffixes in a rule-governed process, irregular forms are stored as ready-made entries in the lexicon and must be looked up individually. The standard finding that the production of irregular verbs takes longer than that of regular verbs is explained in the following way. The regular route is a default mechanism that starts to process each verb irrespective of its (ir)regularity status. In the case of the irregular forms, this regular default mechanism must be blocked and the irregular form is retrieved from the lexicon. Suppressing the rule is costly and time-consuming (Pinker, 1991; Jaeger, 1996; Clahsen, 1999), which explains why the production of irregular forms takes longer.

An interesting psycholinguistic contribution on the core issue about the structure of lexical entries of verbs is made by Clahsen (1999) and Clahsen et al. (2002) adopting the approach of Minimalist Morphology (Wunderlich, 1996). Minimalist Morphology teases apart regular inflection and lexically driven inflection and assumes two qualitatively distinct linguistic mechanisms for them. While regular inflection is pursued by a combinatorial affixation process, it is claimed (Wunderlich & Fabri, 1995), that irregular past tense forms, e.g. *ran*, are represented as subnodes of lexical entries. Based on these concepts, Clahsen and colleagues argue that irregular participles such as (*ge*)*trunken* [drunk] are mentally represented as structured, underspecified lexical entries. Stem alternants are represented as subnodes of a hierarchically higher mothernode. Subnodes are underspecified feature pairs formed upon the pattern <phonological string, morphological feature value> which get features from the mother node by inheritance. The subnodes are shared by verbs of the same class.

Previous studies did not consider the representation of (ir)regularity itself: whether is represented as a property of individual forms

(implicit assumption of DMM) or of whole inflectional paradigms. The following experiments investigated hybrid German verbs to test these two hypotheses.

2 Study

As already suggested, there are some aspects of the DMM that are in need of further inspection. The role of (ir)regularity has been explored so far only in the past tense, so that it is not clear whether the (ir)regularity of a verb (paradigm) per se plays the decisive role, or whether the concept of (ir)regularity is bound to the individual irregular forms. In our research we explored the production of three types of German verbs in past and present tense to differentiate between the two options and to clarify further issues concerning the production of regular and irregular verbs.

The German verb system is organised in a greater diversity than shown so far and greater than for example the English one. It is set up by *three* basic paradigms: the *regular* paradigm and the non-regular paradigm which is comprised of *hybrid* and *irregular* verbs. The second and third type of verbs is traditionally labelled as *irregular* verbs disregarding possible dissociations. Regular verbs (e.g. *spielen* [play]: *er spielt, er spielte, er hat gespielt*) have only one stem and take regular affixes in both past (–te) and present tense (-t). Irregular verbs have several stems and take on irregular forms both in present and past tense (e.g. *brechen* [break]: *er bricht, er brach, er hat gebrochen*). Hybrid verbs also have more than one stem but their present conjugation is completely regular, while their past forms are irregular (e.g. *singen* [sing]: *er singt, er sang, er hat gesungen*).

2.1 Material

Nine intransitive German verbs were chosen for each type of verb. The three groups were equated in terms of word form and lemma frequency, length, initial phoneme, ablaut patterns and transitivity. Verbs containing allomorphy (ə-epenthesis *bluten, ich blute, ich blutete* versus none in *lachen, ich lache, ich lachte*) were excluded to avoid ə-epenthesis to affect reaction times. Actions were depicted in black and white line drawings. Some were taken from Masterson & Druks (1998), but several were designed for this purpose in the same style and comparable complexity (see Figure 1).

2.2 Picture naming experiment

In Experiment 1, participants named pictures of actions in the 3rd person singular present or past tense within a sentential context in a picture naming paradigm - a task that involves conceptualisation and avoids possible priming between the presented and elicited forms. Tense was blocked and counterbalanced across subjects. Measurement of articulation latencies started when the picture appeared on the screen. A voice key was triggered by the first phoneme of the participants' utterances. Wrong namings, hesitations or technical errors during measurement were excluded from the analyses.

A two-way repeated measures ANOVA yielded significant main effects of Regularity, [$F1(2,70) = 116.61$, $MSE = 3579.28$, $p < .001$; $F2(2,16) = 21.61$, $MSE = 5312.15$, $p < .001$] and Tense [$F1(1,35) = 41.41$, $MSE = 4058.29$, $p < .001$; $F2(1,8) = 168.14$, $MSE = 254.98$, $p < .001$]. The interaction between Regularity and Tense reached significance by subjects and very scantily by items [$F1(2,70) = 6.92$, $MSE = 1153.38$, $p < .01$; $F2(2,16) = 3.64$, $MSE = 485.99$, $p = .05$]. A post hoc Scheffé-Test ($diff_{crit;\ p<.05} = 20.2$) revealed that reaction times do not differ between irregular and hybrid verbs and that their articulation latencies depend on the factor Tense (production is faster in present tense) whereas that particular Tense effect is not significant for regular verbs.

Regular verbs in the present and past tense were produced significantly faster than all other verbs (see Table 1). Crucially, the naming latencies of hybrid and irregular verbs did not differ from each other in both tenses suggesting that (ir)regularity is not a property of individual verb forms, but generalizes to all forms within a paradigm.

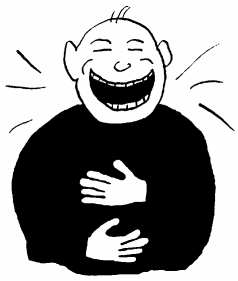

Figure 1. Example for stimuli in Experiment 1. Pictures were named with inflected verbs (e.g. *lacht* [is laughing]) in present and past tense in a sentential context provided by the pronoun *jemand* [somebody].

Table 1. Mean Response Latencies (RT, in Milliseconds, standard deviations in parentheses), (Experiment 1).

	Regularity			
Tense	**irr**	**hyb**	**reg**	**M**
past	638 (185)	619 (171)	480 (106)	577 (171)
present	577 (170)	547 (158)	447 (93)	520 (153)
M	606 (180)	583 (169)	462 (101)	549 (165)

2.3 Picture-word-interference experiment

In Experiment 2, we tested whether (ir)regularity, once not bound to individual verb forms, is represented in form of abstract (ir)regularity nodes, as assumed for gender or conjugational class (Levelt et al., 1999; Bordag & Pechmann, 2009). In a picture-distractor paradigm, participants named pictures of actions with verbs in the 3rd person singular present and past tense (same material as in Experiment 1). Additionally, a written distractor verb appeared over or above the picture which should be ignored by the participants. In the congruent condition, the picture and the distractor were either both regular or non-regular, in the incongruent condition they differed in regularity. An identical condition where the name of the picture served as distractor was applied as control condition. Materials were counterbalanced so that each item appeared in each condition. We expected an (ir)regularity congruency effect (slower RTs in the incongruent condition), reflecting competition between abstract grammatical features for (ir)regularity. The experiment proceeded as Experiment 1.

The statistical analysis revealed effects that corresponded to those of Experiment 1 with differences that were expected due to the changes of the paradigm (see Table 2). The 3x3x2 ANOVA showed main effects for Distractor [$F1(2,34) = 67.62$, $MSE = 4085.17$, $p < .001$; $F2(2,16) = 110.20$, $MSE = 1275.68$, $p < .001$], Regularity [$F1(2,34) = 162.39$, $MSE = 3037.14$, $p < .001$; $F2(2,16) = 13.87$, $MSE = 18869.99$, $p < .001$] and Tense [$F1(1,17) = 5.03$, $MSE = 5603.75$, $p < .05$; $F2(1,8) = 18.37$, $MSE = 991.41$, $p < .01$].

The regular present forms of the hybrid verbs were again produced more slowly than the regular present forms of the regular verbs. Moreover, there was no statistical difference between naming latencies of regular present tense forms of hybrid verbs and the irregular present tense forms of the irregular verbs. All main effects were significant and replicated the results of Experiment 1. However, the critical conditions did not exhibit the expected congruency effect. Consequently, we assume that rather than through abstract node representation, the paradigmatic effects could be explained as a result of complexity of lexical entries and (ir)regularity might be coded by the lexical entries' complexity.

Table 2. Mean Response Latencies (RT, in Milliseconds, standard deviations in parentheses), (Experiment 2).

Past Tense	Regularity		
Distractor	**irr**	**hyb**	**reg**
identical	676 (111)	658 (104)	610 (91)
incongruent	735 (107)	727 (107)	656 (92)
congruent	730 (106)	722 (104)	652 (84)
M	714 (111)	703 (109)	639 (91)
Present tense			
identical	665 (110)	660 (112)	703 (109)
incongruent	709 (119)	703 (115)	643 (94)
congruent	714 (112)	710 (105)	644 (87)
M	699 (113)	691 (113)	630 (93)

3 Conclusion

We argue that postulating two different mechanisms for the processing of regular and irregular inflection (DMM) and a blocking mechanism cannot account for all data, in particular not for the fact that even regular forms of hybrid verbs are produced more slowly than regular forms of the regular verbs. The results are most likely not due to general form effects, for which the material was carefully controlled.

We propose that the crucial explanatory factor for the observed results is the complexity of the lexical entry: If a verb has alternating stems (irregular and hybrid verbs), the retrieval of the appropriate one takes longer than the retrieval of a single stem entry (regular verbs). The generation of the correct word form is more costly for hybrid and irregular verbs because more stems are related to their lemmas, e.g. *brechen* [to break]: *brech-e*, *brich-st*, *brach-∅*, *ge-broch-en*, *bräch-e*. Hence, compared to regular verbs, *selection* is necessary to access non-regular verbs as opposed to the mere lexical *retrieval* of a single stem from a single lemma.

This proposal is consistent with Clahsen (1999) and Clahsen et al. (2002) and can be extended with the new empirical data to the

present tense. It assumes internally structured lexical entries in form of feature pairs of phonological and morphological information.

Blocking was a promising attempt by Pinker & Prince (1994) and Pinker (1999) to explain empirical data. However, the blocking mechanism of the DMM cannot account for the fact that even regular forms of hybrid verbs are produced more slowly than regular forms of regular verbs. According to the DMM, blocking is kind of waiting of a non-regular form for spell out: a quite counterintuitive and uneconomic mechanism. Therefore, once we can explain longer reaction times for non-regular verbs with lexical entry complexity we can abandon the idea of a blocking mechanism (cf. Ockham's razor: the simple explanation with fewer assumptions is the better one).

Whether the inflection for person and number for all three types of verbs proceeds similarly or not is in need of further investigation.

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