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1 Introduction and background: proforms and ellipsis at the syntax/semantics-interface

The question whether and to what extent proforms are transparent for extraction and whether binding into proforms is permitted has recently gained attention again in the syntactic literature (Haddican 2007, Houser, Mikkelsen and Toosarvandani 2007, 2011, Houser 2010, Baltin 2012 and Bentzen, Merchant and Svenovius 2013, for instance). The roots of this discussion go back to early generative treatments of anaphora, notably Hankamer and Sag (1976, 1984), who introduce the distinction between deep and surface anaphora, which boils down to a distinction in visibility of the internal structure of the anaphoric constituent to syntactic processes. In this more traditional terminology, VP-ellipsis in English – illustrated in (1a) – is a type of surface anaphora, whereas English do so in (1b) is a deep anaphora. While extraction from the ellipsis site is licensed, it is not from the proform. Compare (2a) and (2b).

(1) a. Alex visited Mary and Peter did visit Mary, too.
   b. Alex visited Mary and Peter did so, too.

   (2) a. I don’t know who(m) John visited but I know [who(m); Peter did – visit].
   b. *I don’t know who(m) John visited but I know [who(m); Peter did so].

From the perspective of the syntax/semantics-interface, this pattern is expected, of course.

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Ellipsis is a result of PF deletion and is interpreted on the basis of the unreduced LF structure. Proforms, however, are interpreted via the variable assignment function $g$. Let us briefly remind the reader of this differential structure and interpretation, in a framework based on Heim and Kratzer (1998): The structure underlying the interpretation of the verb phrase $\textit{visit Mary}$ in (1a) is (3a). The interpretation of the proform in (1b) yields the same result, in (3b). However, this interpretation is arrived at via a different compositional road, namely by assigning from the utterance context a value to a variable which we assume for now to be of type $<v,t>$. (Nothing hinges on this assumption, however.)

\[(3)\]

\[a. \quad \text{[[[VP visit [DP Mary]]]]} \|_g = \lambda e \in D_v. \text{visit}(\text{Mary})(e)\]
\[b. \quad \text{[[[VP so $7,<v,t>$]]]} \|_g = g(7,\langle v,t \rangle) = \lambda e \in D_v. \text{visit}(\text{Mary})(e)\]

Extracting a constituent from an ellipsis site is thus unproblematic, as is its interpretation, which we sketch in (4a) for the English example in (2a). If we assume that proforms are inserted from the lexicon, material semantically contained within the proform cannot be targeted by any movements. The structure sketched for (2b) in (4b) can thus be neither generated nor interpreted: Its interpretation would require that the assignment function generate a value which in turn contained an assignment function for lambda-abstraction to modify, (4c).

\[(4)\]

\[a. \quad \text{[[[1 [Peter did visit t1,e]]]]} \|_g = \lambda x \in D_e. \exists e \in D_v [\text{AGENT}(e) = \text{Peter} \& \text{visit}(g[x/1](1,e))(e)]\]
\[b. \quad *[[who(m) [1 [Peter did so $7,<v,t>$]]]]\]
\[c. \quad \mathcal{C} \mathcal{C} g(7,\langle v,t \rangle) = \lambda e \in D_v. \text{visit}(g[x/1](1,e))(e)\]

Just like English, German has a VP-proform, but by contrast, typically does not have VP-ellipsis (López and Winkler 2000, Winkler 2005 and Konietzko 2016, among others). Relevant examples are provided in (5) and (6). Extraction from the proform, as in (7), results in ungrammaticality. German $es$ thus appears to be opaque for extraction, that is, it is a deep anaphora in the sense of Hankamer and Sag (1976).

\[(5)\]

\[\text{Alex hatte Maria besucht und Peter hatte es auch.}\]
\[\text{Alex had Mary visited and Peter had pro(VP) also} \]
\[\text{‘Alex had visited Mary and Peter had done so, too.’}\]

\[(6)\]

\[\text{*Alex hatte Maria besucht und Peter hatte auch.}\]
\[\text{Alex had Mary visited and Peter had also} \]
\[\text{‘Alex had visited Mary and Peter had, too.’}\]

\[(7)\]

\[\text{*Ich weiß nicht, wen Alex besucht hat, aber ich weiß, [wen1 Peter es tat].}\]
\[\text{I know not who(m) Alex visited has but I know whom Peter pro(VP) did} \]
\[\text{‘I don’t know who(m) Alex visited but I know who(m) Peter did so.’}\]

If this characterization is correct, the acceptability of the German proform in comparative clauses comes as a surprise: The semantics of the comparative clause is characterized by abstraction over degrees, which is syntactically derived by $wh$-movement of a covert degree phrase. It is thus expected that VP-proforms are disallowed in comparative clauses, as movement out of or binding into a proform is not possible. This expectation is borne out for English, but not for
German: Below are two examples in which the VP-proform occurs either in the *als* (‘than’) -
 constituent of a clausal comparative or in the *wie* (‘how’) -constituent of a clausal equative. While the English examples are ungrammatical, the German examples are grammatical.

(8) a. Louise ist schneller geschwommen [als (wie) Johann *es* ist].
Louise is faster swum than how Johann pro(VP) is
‘Louise swam faster than Johann did.’

b. *Louise swam faster than Johann did so.

(9) a. Louise ist so schnell geschwommen [wie Johann *es* ist].
Louise is so fast swum how Johann pro(VP) is
‘Louise swam as fast as Johann did.’

b. *Louise swam as fast [as Johann did so].

In what follows, we will propose a syntactically transparent, compositional analysis which falls out directly from the analysis of the relevant comparison constructions, hence no additional stipulations are needed. In a nutshell, we suggest that (8a) and (9a) are cases of pseudo-
 extraction from a proform: Extraction in those cases is from an elided constituent which is 
adjoined to the proform. Before we look at the analysis in more detail, we remind the reader of 
the syntax and semantics of comparative clauses (and thus of the relevant extraction in the 
puzzling cases) in the next section. Section 3 presents the analysis and pursues some of its 
predictions. The last section offers some further discussion and concluding remarks.

2 The data and the puzzle: (apparent) extraction from German 
VP-proforms

In German comparative clauses, the use of the VP-proform *es* is productive and actually strongly 
preferred, as is also attested by the naturally occurring examples below.

(10) a. Die Latte liegt auf jeden Fall höher, [als sie *es* damals tat].
'Expectations are definitely higher than they were back then.'

b. Jetzt hat sie durch Zufall herausgefunden, 
dass ihr Nachmieter für die Miete viel weniger zahlen muss [als sie *es* musste].
'By chance she now found out that the next tenant is paying considerably less for 
the apartment than she had to.'

c. Dennoch müsse die Stadt weiter gehen, [als sie *es* bisher tat], sagt Wilke.
'The city still needs to go further than it has so far, Wilke says.'

d. Das ist schon komisch, wenn sich das Kettenblatt bei eingelegtem Gang 
schneller dreht [als die Kurbel *es* tut].


'It looks quite strange when the chain turns faster than the crank.'

Why are these data unexpected if German *es* is a deep anaphora and thus a proper proform? Comparative clauses are syntactically parallel to relative clauses in that they involve *wh*-movement. We will briefly illustrate this analysis for the subcomparative in (11), the syntactically most transparent case.

(11) Die Zugbrücke ist länger [als der Burggrabenweit ist].
    the drawbridge is longer than the moat wide

    ‘The drawbridge is longer than the moat is wide.’

Intuitively, (11) is true if the maximal degree to which the drawbridge is long exceeds the maximal degree to which the moat is wide. To this denotation, the comparative clause contributes a set of degrees, namely the set of degrees to which the moat is wide. This degree set then serves as the first argument of the comparative operator in (12) or of the equative operator.

(12) \[ [\text{longer}] = \lambda D' \in D_{<d,t'>}. \lambda D \in D_{<d,t>}. \text{MAX}(D) > \text{MAX}(D') \]

\[ [\text{MAX}] = \lambda D_{<d,t>}. \text{id} [D(d) \land \forall d' [D(d') \rightarrow d' \leq d]] \]

At LF, this degree set is derived by \textit{wh}-movement of the covert degree phrase (DegP) out of the specifier position of the AP. It triggers the insertion of a lambda-abstractor, which then binds the trace left behind by the movement, as indicated in (11).\(^5\) (See also Bresnan (1973), Chomsky (1977) and Lechner (2004) for a discussion on the syntax of the comparative clause.) In many dialects of German, the \textit{wh}-element is even overt, as in (13).

\begin{equation}
\text{(13) Die Zugbrücke ist länger [als wie der Burggrabenweit ist].} \\
\text{the drawbridge is longer than how the moat wide is} \\
\text{‘The drawbridge is longer than the moat is wide.’}
\end{equation}

If there is no commensurability involved (as is the case for the subcomparative), the degree predicate in the comparative clause is usually elided, as is illustrated in (14). Comparative deletion of the AdvP is licensed at LF because of Quantifier Raising (QR) of the DegP for type reasons.

\begin{equation}
\text{(14) Louise ist schneller geschwommen [als Johann schnell gelaufen ist].} \\
\text{Louise is faster swum than Johann fast run is} \\
\text{‘Louise swam faster than Johann ran.’}
\end{equation}

\begin{itemize}
  \item For convenience, we assume here that German has an inflectional category, just like English. (See e.g. Sternefeld 2006 for discussion.) Nothing in our analysis will hinge on that assumption.
\end{itemize}
In the proform case, repeated below, it appears however as if the indicated VP, along with the AdvP containing the trace, has been replaced by a proform, from which it should not have been possible to extract the wh-item and to thereby trigger the required lambda-abstraction over degrees.

(15) a. Louise ist schneller geschwommen [als (wie) Johann es ist].
Louise is faster swum than how Johann pro(VP) is
‘Louise swam faster than Johann did.’

b. *[CP wie [1 [Johann [[VP es7,<v,t> ist]]]]]
\[\subseteq g(7,<v,t>) = \lambda e \in D. \text{swum}(e) & \text{SPEED}(e) \geq g(1,d)\]

We suggest that this is indeed just a case of “apparently exceptional extraction” (Bentzen, Merchant and Svenovius 2013: 121) and that the AdvP, which hosts the degree trace, must be structurally available at LF, despite the presence of the proform.

3 Analysis: comparative deletion plus proform

An explanation of the acceptability of the German VP-proform in comparative clauses could go two ways: One could either pursue a derivational strategy under which the German proform is a spellout phenomenon and thus inserted only after the required movement has already taken place. Or one could pursue a structural strategy, where only some or none of the VP has been pronominalized. Bentzen, Merchant and Svenovius (2013) pursue such an approach for Norwegian but suggest an extension to German as well: They follow Déchaine and Wiltschko (2002) and Elbourne (2008) in a decompositional approach towards proforms and analyze German es as a definite determiner which takes a verbal projection as its complement. This complement then undergoes ellipsis. Applied to our example (repeated in (16) for the reader’s convenience), this analysis yields an LF along the lines of (17). Its interpretation would still need to be spelled out.

(16) Louise ist schneller geschwommen [als Johann es ist].
Louise is faster swum than Johann pro(VP) is
‘Louise swam faster than Johann did.’

(17) [CP wie [1 [Johann [vp [[es7<v,t> ist ]]]]]]]

Without further assumptions, however, all kinds of extraction should then be allowed out of the proform in German, contrary to fact. If the proform constituent is construed as a definite island, no extraction should be possible, again contrary to fact. (See Bentzen, Merchant and Svenovius (2013) for further discussion and some suggestions.) Note also that German does not allow VP-ellipsis in other environments. We repeat a relevant example below.

(18) *Alex hatte Maria besucht und Peter hatte auch.
Alex had Mary visited and Peter had also
‘Alex had visited Mary and Peter had too.’

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6 See Bentzen, Merchant and Svenovius (2013: 122) for a short discussion, too. Houser, Mikkelsen and Toosarvandani (2007, 2011) pursue such a derivational approach for Danish det, for instance.
We will therefore pursue a somewhat different structural approach here. We will continue to assume that German es is a VP-proform (and thus of the semantic type $\langle v, t \rangle$) and suggest that the seemingly exceptional extraction out of the proform in the comparative clause is a case of extraction out of elided material higher than the proform: In the case of our example, the AdvP has undergone comparative deletion, just as it has in the more transparent cases, such as (14) above. The proform then is interpreted as the lower VP and modified by the AdvP. As it is Spec,AdvP which hosts the trace, the extraction is in no way exceptional. The movement trace is hosted by elided material, which is syntactically present at LF. We spell out this analysis in (19). Out of this type of LF, extraction of a complement within the verbal projection (and thus the proform) is predicted to be impossible, and correctly so. The ungrammaticality of (20) – repeated from the introduction – is therefore expected.

\[ (19) \quad \llbracket [VP \ es_{7, \langle v, t \rangle}] \rrbracket^g = g(7, \langle v, t \rangle) = \lambda e \in D_v. \swum(e) \]

(20) *Ich weiß nicht, wen Alex besucht hat, aber ich weiß, [wen Peter es tat].
   I know not whom Alex visited has but I know whom Peter pro(VP) did
   ‘I don’t know who(m) Alex visited but I know who(m) Peter did so.’

Further evidence in favor of assuming comparative deletion even in the presence of the VP-proform comes from examples such as (21), where the adverbial is either overt or the proform ebenso (‘likewise’) is used in its place.

(21) a. Peter hat das Buch schnell gelesen und Maria hat es langsam getan.
   Peter has the book fast read and Mary has pro(VP) slowly did
   ‘Peter read the book fast and Mary read it slowly.’

b. Peter hatte den Vertrag leichtfertig unterschrieben
   Peter had the contract carelessly signed
   and seine Frau hatte es ebenso getan.
   and his wife had pro(VP) pro(AdvP) done
‘Thoughtlessly, Peter had signed the contract and his wife had done so, too.’

One would thus also expect to be able to construct examples which involve an overt AdvP for a subcomparison. We present two relevant examples below. As the comparisons expressed in (22) and (23) are of considerable semantic complexity, their syntactic acceptability is hard to judge, however. The equative in (22) involves a comparison of deviation. (See Bierwisch (1987, 1989) and Kennedy (1997) for further discussion.)

(22) Er hoffte, dass seine Enkel einmal genauso beschützt aufwachsen würden. He hoped that his grandchildren once as protected grow up would
    [wie er es leider angstvoll hatte tun müssen].
    ‘He hoped that his grandchildren would grow up as protected as he – unfortunately – had had to grow up fearful.’

(23) [It was Mary’s turn at this unusual ball game. Here is what she had to do in order to win:] Maria musste weiter werfen [als Peter es hoch getan hatte]. Mary must(past) further throw than Peter pro(VP) high done had
    ‘Mary had to throw the ball further than Peter had thrown the ball high.’

The AdvP can also undergo overt movement to construct a degree question, as in (24), where the extraction site is marked by an underscore. Degree questions based on VP complements are, however, expected to be ungrammatical, and they are. A relevant example is in (25).

(24) Wie häufig hat Laura die Klausur schon wiederholt und
    [wie häufig] hast du es jetzt __ getan?
    ‘How many times has Laura already taken this exam, and how many times have you now?’

(25) *Wie viele Bücher hat Laura gelesen und [wie viele (Bücher)] hast du es getan?
    ‘How many books has Laura read, and how many books have you done’

Not only does this analysis correctly predict that extraction of any of the complements of the verb is impossible, it also correctly predicts certain restrictions on extraction in the comparative clause: While adverbial comparatives are fine, attributive degree comparatives are degraded:

(26) ?? Anna wollte [eine längere Strecke laufen, [als Julia es hatte].
    ‘Anna wanted a longer course run than Julia pro(VP) had
    ‘Anna wanted to pick a longer course than Julia had done.’

(27) ?? Sabine hat [eine genauso geräumige Wohnung] besichtigt, [wie Anne es hat.]
    Sabine has a as spacious apartment viewed how Anne pro(VP) has
    ‘Sabine viewed an apartment which is as spacious as the apartment Anne had
The unacceptability of the attributive comparative in (26) and the attributive equative in (27) is expected, as the position from which movement would have to take place (Spec,AP) is again contained within one of the VP complements. It is thus syntactically not accessible.

Under our comparative deletion-plus-proform analysis, we additionally expect that other verbal adjuncts may be available for extraction in German, even when the proform is used. This expectation is borne out. An example is in (28).

(28) Ich weiß nicht, wo Alex nach Hans gesucht hat,
     aber ich weiß, wo er es hatte tun wollen.
     ‘I don’t know where Alex has actually looked for Hans
     but I know where he wanted to look for him.’

Note that this type of extraction is ungrammatical in English:

(29) *I don’t know where Alex went but I do know where his wife did so.

Before we explore the source of this variation further, let us provide a brief summary: The German VP-proform es is a pronominal element of type <v,t> and is interpreted as such. Cases of apparent extraction such as in the comparative clause are cases of extraction from a VP-adjoined, elided constituent. In the case of the comparative clause, the AdvP containing the gradable predicate has been subject to such a deletion operation. Its internal structure is therefore syntactically accessible.

Our analysis correctly predicts the differential acceptability of attributive versus adverbial comparatives with a VP-proform: The latter are available due to the fact that adverbs may adjoin above the pronominalized VP. The former are unavailable because binding into or extraction from the proform is not possible. German es may additionally occur in predicative comparatives, as what one might loosely label predicate anaphora (Merchant 2014). An example of such a predicative comparative is in (30). Note that in the case of predicative comparatives, there is no preference for the proform, but for the (at least superficially) phrasal constituent, as indicated by the bracketing.7

(30) Brigitte ist größer [als Louise (es ist)].
     ‘Brigitte is taller than Louise.’

At first sight, the acceptability of the attributive comparative in (30) is as surprising as the acceptability of its adverbial sibling, given the fact that it is not possible to bind into a proform. However, in the case of the attributive comparative, extraction, too, takes place from a position above the proform. Before we spell out this analysis, let us briefly remind the reader of the syntax of the construction. Consider the tree in (31b), which shows the structure of the unreduced comparative clause in the predicative case, (31a). (See also the analysis of the

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7 Tiemann, Hohaus and Beck (2012) as well as Hohaus, Tiemann and Beck (2014) conclude on the basis of data from first language acquisition that German has no genuinely phrasal comparative.
subcomparative in (11) above as well as von Stechow (1984a,b), Heim (1985), Kennedy (1997) and Beck (2011).)

(31) a. Brigitte ist größer [als Louise groß ist].
   Brigitte is taller than Louise tall is
   ‘Brigitte is taller than Louise.’

b. 

The phrase containing the gradable predicate (in our case an AP) contains a covert DegP in its specifier position, which then undergoes wh-movement. Under this analysis, the proform es in German may also be an A'-proform of type \(<d,<e,t>>\), as shown in (32) for the example in (30). Extraction out of Spec,AP is thus possible.  

(32) \[ \text{CP wie } \langle<d,t> \text{ 1 [c' C [w Peter [[VP t1,d [\lambda x' \text{ est},<d,<e,t>]] [v ist]] \ldots ]]]]} \]

\[ g(7,\langle<d,<e,t>>) = \lambda d \in D_d. \lambda x \in D_e. \text{HEIGHT}(x) \geq d \]

In sum, for adverbial comparatives we assume that German es is a VP-proform and thus targets a maximal projection. In the case of predicative comparatives, we propose that the proform targets an intermediate bar-level projection and acts as an A'-proform. The generalization behind the analysis is that the proform es is grammatical in comparative clauses in which binding takes

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8 Kennedy (1997, 2007), for instance, assumes that the AP is a complement of the degree head and thus contained within the DegP: \([\text{DegP [Deg [AP tall,<d,<e,t>]]]}\). As a consequence, binding takes place into DegP (and not into Spec,AP as assumed here). Under such an analysis, German es would be analyzed as an AP-proform. Under either syntactic analysis, however, the apparent extraction from a proform is extraction from a position above the proform, which is the generalization behind our analysis.

9 German es is an extremely versatile proform which can act for a number of other categories as well, among them NP and CP. See López and Winkler (2000) and Schwabe (2012), for examples and discussion.
place into material located above the proform. Binding into the proform itself should never be possible and in fact, it is never possible. In both cases, we witness pseudo-extraction from a proform.

4 Discussion and concluding remarks

What can the view from German thus contribute to the debate on whether proforms may be syntactically transparent? German *es* is not a good candidate for such a proform, as we show. It can plausibly be treated as a deep anaphora. From a methodological point, German *es* shows that pronominalization and deletion may co-occur in certain environments and create cases of pseudo-extraction, thereby masking the properties of deep anaphora.

Why is such a proform-plus-deletion analysis not available for English *do so*, which disallows the VP-proform in comparative clauses? And more generally, what governs whether such an analysis is available in a language? We will not answer these questions here, but provide some speculations and directions for further research. In the case of English, an explanation of the ungrammaticality of *do so* in comparative clauses will first have to address which structures to rule out, as a LF identical to the German case is unavailable due to the internally complex nature of the proform. Consider the two structures in (33).

(33) *Louise swam faster [than (how 1) Johann did so].

In the first tree, the AdvP attaches higher than in the German case, above the main verb. (This is a possibility, however.) In the second tree, *so* is analyzed as an AdvP complement to the verb, following a proposal in Houser (2010). It is then modified by the gradable predicate. The second structure might be unavailable for independent reasons, as *do so* might be in the process of being lexicalized as a single item. (On the diachronic development of the proform from a manner adverbial, see also Gast and König (2008).) Evidence for such a development might come from Houser (2010)’s observation that no material may intervene between the main verb *do* and the AdvP *so*: The example in (34) is ungrammatical. Yet, English *do so* must still exhibit a certain amount of internal structure: The verb is accessible for inflection, while the proform *so* may undergo topicalization. An example is in (35). (See López (1995) for further discussion.)

(34) *Paula happily submitted her assignment and James did reluctantly so.*
Rose badly wanted to buy this pair of high heels and so she did ___.

The exact syntactic category and internal structure of the proform as well as language change might thus influence the crosslinguistic availability of pseudo-extraction out of a proform.

References


