Quantifier scope interpretation as a test for the argument structure of Polish ditransitives
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A substantial body of work has shown that scrambling languages use overt movement to establish scope dependencies between QPs while covert operations like QR are not available or limited (e.g. Hungarian, in E. Kiss 1991, Szablocs 1997). This study aims to experimentally investigate the correlation between the availability of scrambling in free word order languages, such as Polish, and the availability of scope changing mechanisms like QR and scope reconstruction. This correlation can be motivated by principles which favor isomorphism between the PF and LF representations (e.g. Reinhart’s (2005) Interface Economy, Bobaljik and Wurmbrand’s (2012) Scope Transparency) which would prevent the contexts that allow for word order permutations from admitting non-scope rigid interpretations. Ditransitive structures with quantified objects in Polish are well suited to test this assumption since they exhibit two object orders relatively freely, even in neutral intonation contexts, see IO-DO order vs DO-IO order in (c/d) in Table 1.

Table 1. Materials: object order x coordination x2 scope (disambiguation diagram)

| (a) | IO-DO order; no embedding | Nauczyciel pokazał jakiegoś uczniowi każdego naukowca. teacher showed some student every scientist |
| (b) | IO-DO order; embedding | Nauczyciel pokazał jakieś uczniowi pisarza i każdego naukowca. teacher showed some student writer every scientist |
| (c) | DO-IO order; no embedding | Nauczyciel pokazał jakiegoś naukowca każdemu uczniowi. teacher showed some scientist (to) every student |
| (d) | DO-IO order; embedding | Nauczyciel pokazał jakiegoś naukowca rodzicowi i każdemu uczniowi. teacher showed some scientist (to) parent and every student |

Offline data gathered in a psycholinguistic experiment measuring reaction times revealed that while one of the orders (IO-DO) is scope rigid (allows only for the surface scope interpretation (x∀)), as predicted by the isomorphism principles, the reverse order (DO-IO) is scope ambiguous (allows for both surface (x∀) and inverse (∀x) scope readings), which indicates that some LF mechanism is operative in this context. This result mirrors the observations on scope readings provided for ditransitives in other scrambling languages (e.g. German, Japanese in Bobaljik and Wurmbrand 2012 and Russian in Antonyuk 2015) and it cannot be explained assuming strict scope rigidity in free word order contexts. Since one of the orders allows for scope ambiguity while the other is scope rigid, this effect has been attributed to overt movement of a QP in one but not the other, under the assumption that the two orders are derivationally related. This has given rise to two contradictory proposals. Namely, one which takes scope ambiguity to be a result of scrambling followed by scope reconstruction (e.g. Sauerland 2000, Bobaljik and Wurmbrand 2012) and one which takes scrambling to result in scope freezing (Antonyuk 2015). These two accounts assume two different canonical orders for ditransitives, i.e. IO-DO order and DO-IO order respectively.

The second goal of this study was to test which of the scope changing mechanisms is responsible for scope ambiguity in DO-IO order by embedding the universal quantifier in coordination which should block QR of the universal QP, but not scope reconstruction of the existential QP (CSC, Ross 1967), compare (a/c) to (b/d). The prediction was that if scope ambiguity in DO-IO is due to QR, it should be blocked in the context with coordination, while if it is due to scope reconstruction, inverse reading should be available even with coordination. The constraint is represented in the diagrams below. While basic order in (1), regardless of which order it is, must remain scope rigid (i.e. the universal QP cannot move out and the existential QP takes scope over the universal QP), the derived order in (2), in which the existential QP is Across-the-Board (ATB) scrambled, allows for reconstruction of the existential QP below the universal in spec;VP. The diagrams in (1-2) illustrate that whichever object order is assigned the basic structure in (1), it should be scope rigid. Thus, if the scopally ambiguous DO-IO order becomes scope rigid in the contexts with coordination, it will suggest that this order has the structure in (1) which does not support reconstruction. However, if it remains scopally ambiguous, it will indicate that this order is derived as shown in (2). Since this study was not based on any underlying assumptions as to which object order is basic and which derived or which of the scope changing mechanisms is responsible...
for ambiguity, its results lead to unbiased conclusions about the argument structure of ditransitive constructions.

(1)

(2)

This experiment was based on a self-paced reading task. The participants (32 women and 1 man, Polish students of higher education, Mean\_age=19.68, SD=1.15, Mean\_accuracy=85%, not less than 70% per participant) were instructed to read a sentence, after which a diagram appeared illustrating either surface or inverse scope interpretation, as in (4) and (5). Their task was to decide whether the interpretation represented in the diagram was compatible with the interpretation of the sentence. The experiment consisted of 16 condition sentences (ambiguous) and 32 control sentences (unambiguous, 16 followed by matching diagrams and 16 by non-matching ones, as in (3)) and 24 unrelated fillers. Offline results (chi-square by items) showed that only the DO-IO order allowed for the inverse scope reading, also with coordination, although coordination negatively affected accessibility of this reading. This suggests that scope reconstruction is responsible for scope ambiguity in the DO-IO order and therefore, that this order must be derived. The results of reaction times to disambiguation diagrams evaluated in repeated measures ANOVA 2x2x2 (by subjects) collaborated this conclusion. They showed significant main effects of object order F(1,32)=4.531, p=.041, coordination F(1,32)=7.145, p=.012, and scope disambiguation F(1,32)=13.649, p=.001. This means that reaction times were faster in the IO-DO order than the DO-IO order, faster in the contexts without coordination than with coordination, and faster for the diagram presenting surface scope than the one showing inverse scope reading. Also, there was a close to significant 3-way interaction between the three variables, i.e. object order*coordination*scope disambiguation F(1,32)=4.060, p=.052. This result showed that the reaction to surface scope disambiguation diagram which followed the context without coordination was slower for the DO-IO order than the IO-DO order (F(1,32)=4.841, p=.035), the diagram following the structure without coordination with the IO-DO order obtained slower reaction times when it presented inverse scope reading than surface scope reading (F(1,32)=8.995, p=.005). Likewise, for the structures with coordination in the DO-IO order reactions were slower when the diagram presented the inverse scope reading (F(1,32)=7.052, p=.012) but for the context without coordination in the DO-IO order, the effect of scope disambiguation was insignificant (F(1,32)=.060, p=.809), which means that reaction times to inverse and surface scope readings were similar.

(3) **Control sentence** (unambiguous), e.g. for IO-DO order, no embedding

Nauczyciel pokazał kilku uczniom/jednemu uczniowi różnych naukowców.

teacher showed several studentsDAT /one student\_DAT different scientists\_ACC

(4) **Surface scope** reading diagrams:

a. IO-DO order

uczniowie naukowcy

b. DO-IO order

naukowcy uczniowie

(5) **Inverse scope** reading diagrams: