Datives, extra arguments and semantic binding
Extra-argumental datives, in contradistinction to lexical datives, obligatorily bind a variable in their local domain. We show that the phenomenon of obligatory binding is quite common for extra arguments in argument alternations in general. A unified compositional analysis of obligatory binding is possible if we assume that binder indices are introduced not by "antecedent" DPs but rather by argument-introducing functional heads.

Empirical realm and main claims: Datives can be introduced by verbal roots (lexical datives) or be integrated into the structure as additional or extra arguments in an applicative-like construction. It can be observed that, in German, extra-argumental datives obligatorily bind a possessor variable in a local domain. The possessive-marked DPs alternate freely with bound bridging definites, as shown in (1). A similar binding requirement of extra-argumental datives is found in other languages, cf. (2-4).

(1) Der Udo$_i$ trat   dem Ede$_j$ gegen   sein/das $_{j/*i/*k}$ Schienbein.   <German>
    the Udo kicked the Ede$_{DAT}$ against   his/the   shin
(2) Udo$_i$ kicked Ede$_j$ in the$_{j/*i/*k}$ shin.   <English>
(3) Udo$_i$ pnul Ėde$_j$ v nogu $_{j/*i/*k}$.   <Russian>
(4) Le médicin leur a radiographié l'   estomac.   <French>
    the doctor to them X-rayed   Sg. Def stomach   (Vergnaud / Zubizaretta 1992:597)

Crucially, this obligatory binding of a co-argument is required only by extra-argumental datives. With lexical datives as in (5), the choice of the binder is not grammatically restricted:

(5)   Der Udo$_i$ zeigte dem Peter$_j$ sein/das $_{j/i/k}$ Schienbein.
      the Udo showed the Peter$_{DAT}$ his/the   shin

Interestingly, the phenomenon of obligatory binding by extra arguments can be observed in other constructions, too. Many productive argument alternations also collected in Levin (1993) display the same binding pattern. This can be illustrated with a few argument alternations with variants in a. and b.

(6) Possessor-Attribute Factoring Alternation
    a. I admired his courage.
    b. I admired him$_i$ **for his$_i$ courage**.
(7) Locative *have* Alternation
    a. There is a nest in the tree.
    b. The tree$_i$ has a nest **in it$_i$**.
(8) Locative *spray/load* Alternation
    a. Jack sprayed paint on the wall.
    b. Jack sprayed the wall$_i$ with paint {**in its$_i$ entirety**}.
(9) Location Subject Alternation
    a. We sleep five people in each room.
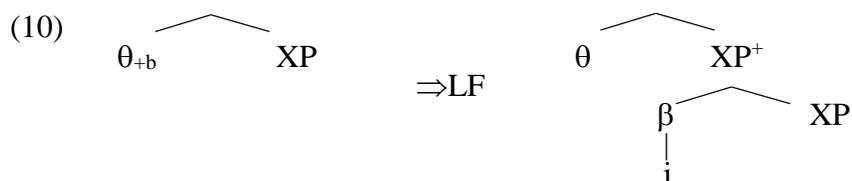   b. Each room$_i$ sleeps five people {**inside it$_i$**}.

Other than in the a-constructions in (6a)-(9a), the b-constructions display obligatory variable binding. The bound variable in the b-variant is expressed explicitly as a pronoun in constructions (6b) and (7b) and remains implicit in (8b) and (9b). However, even if it is implicit it can *salva veritate* be made explicit as shown in curly brackets. The material in the brackets is, we assume, PF-optional but semantically active, irrespective of whether it is pronounced. It is part of the interpreted structure. What all these binding configurations have in common is that, similar to extra-argumental datives, the binder DP does not belong to the argument structure of the root of the base verb, but rather is integrated as an extra argument.

Challenge: Now, the question is how to model the obligatory semantic binding requirement that comes with the extra arguments compositionally. One possibility would be to enrich the lexical entries of the base verbs so as to lead to a kind of reflexivization for the b-variant.

Another one would be to assume that the binding requirement is introduced by the prepositions *for*, *in,* etc. With either option, we would arrive at individual analyses for each particular verb or for each particular preposition. Our aim is, however, a unified compositional analysis. Such an analysis is possible if we assume that the binding requirement is triggered by a type of applicative or voice head that introduces the extra argument (the direct objects of (6b/8b), the subjects of (7b/9b)). This head is combined with a binder feature that requires the argument in its specifier to bind a variable in its local domain.

Previous analyses: In his analysis, Author 2 (2012, 2014) suggests that extra-argumental datives as in (1), unlike the lexical dative in (5), are introduced by a functional theta head, a type of an argument-introducing head in the sense of Wood & Marantz (2015). Given a proposal made by Kratzer (2009), this verbal functional head ties in well with the fact that extra-argumental datives have only two thematic contributions across constructions and always co-occur with a bound variable further down in the co-phasal structure. According to Kratzer, "semantic binders (λ-operators represented as binder indices) are introduced by verbal functional heads, rather than by "antecedent" DPs, as assumed in Heim and Kratzer (1998), for example. Verbal functional heads, rather than DPs, are then the true syntactic antecedents for bound pronouns" (Kratzer 2009:193). Instead of verbal functional heads, we will speak of theta heads, in order to refer to heads that introduce a theta role and host DPs in their specifiers. These theta heads differ from Pylkkänen-style applicative heads in some crucial respects. First, low and high applicative heads of Pylkkänen in Author 2's analysis are unified as one type of functional head. This unification takes into account the fact that the heads Pylkkännen calls "low" and "high" applicatives are cross-linguistically marked by the same morphology and pattern alike (Marantz 1993:121), a fact ignored by Pylkkänen (2002). Second, the obligatory binding requirement of extra arguments is beyond the reach of Pylkkänen's (2002) analysis, but lies at the core of Author 2's analysis, which ties the binding property to theta heads.

Extension of the previous analysis: We develop a binding analysis of (6)-(9)'s b-constructions on the basis of the analysis of extra-argumental datives by Author 2 (2012, 2014). The core of this analysis elaborates on Kratzer's (2009) proposal to implement reflexive binding in an agent-severed system with theta heads. The theta head enters the derivation with a binder feature [+b] that leads to structure expansion along the lines of Author 2's (2014) Generalized Binder Rule in the tradition of Büring's (2005) Binder Rule; cf. (10). Spelling out Kratzer's (2009) program, it is tied to a verbal functional head/a theta head.

(10)

θ_{+b} XP $\Rightarrow$LF θ XP$^+$

                                                      β XP

                                                      |
                                                      i

The ensuing structure can be interpreted with standard machinery (FA, predicate abstraction, (Davidsonian) predicate modification; derivation not shown here). We assume that b-constructions in (6)-(9) involve the configuration in (10). They differ only in the thematic entailment introduced by the theta head.

The extension of the proposal beyond extra argument datives to constructions in (6) - (9) forms part of a larger endeavor to demonstrate the necessity of describing many well-known argument alternations as being dependent on the presence of binder theta heads.

Conclusion: In sum, the paper shows that the restructuring of argument structure frequently involves obligatory semantic binding. A unified compositional analysis of the obligatory variable binding that we observe with extra-argumental datives and with other extra arguments is possible if we assume binder theta heads.