One of Those Constructions that Really Needs a Proper Analysis

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Example (1) seems impeccable to ~~many~~ almost all speakers. This should be surprising, since it involves an 'agreement mismatch', a failure of agreement between a plural nominal head (*those problems*) and a singular modifier (the relative clause *which really bothers you*), as made explicit in (2a). We think any remotely plausible grammatical theory will predict that (1) is ungrammatical and that speakers should reject it in favour of (2b), but they do not. On the contrary, the 'mismatch' construction in (1) is far more frequent, even in writing (searching google books for *one of the things that bother(s) me* gives about 5860 results for the mismatch form *bothers*, compared to 698 for *bother*).[1]

(1)   This is one of those problems which really bothers you.

(2)   a.   This is one of [**those problems**]$_{pl}$ [which$_{sg}$ really **bothers** you].
       b.   This is one of [**those problems**]$_{pl}$ [which$_{pl}$ really **bother** you].

This construction is not rare or exotic, and while it has been noted before (e.g. Huddleston and Pullum (2002), and in some prescriptive grammars), it has not received attention in the formal literature. While it appears at first sight to pose a fundamental problem for almost all accounts of agreement, including in particular the standard account of agreement in HPSG (e.g. Pollard and Sag (1994), Kathol (1999), Wechsler and Zlatić (2003)), we will show that a relatively straightforward account is possible, using existing HPSG apparatus.[2]

In the full paper, we will explore a number of properties of the mismatch construction, which we simply assert here for reasons of space. Externally, the NP *one of those problems which annoys you* is a normal singular indefinite — it differs from an indefinite like *a problem which annoys you* only in that it introduces a plural referent into the discourse, compare (3) and (4):

(3)   I've solved one of those problems that bothers you. *They* are quite interesting generally.
(4)   I've solved a problem that bothers you. *They are quite interesting generally.

Internally, the construction seems to be some kind of partitive, containing a relative clause (*which really bothers you*). Analyses of partitives in the HPSG literature include Kim and Sells (2008) and Flickinger (2008). Here we simply assume they involve an NP containing a quantity word (*one, two, ... several, many*) which combines with an *of*-PP, which transparently shows the definiteness and plurality of the NP it contains. For the sake of discussion we assume that the quantity word is the head.[3] A phrase like *one of those problems* will receive an analysis along the lines of (12). There seems to be no reason to think there is anything odd about the PP in the mismatch construction. The only important assumption we make is that it is semantically plural (denotes a plurality), and that it is therefore [INDEX|NUM *pl*]. This seems uncontroversial.

The internal properties of the relative clause also appear quite normal. Both *wh-* and *that* relatives are possible, as in (5), and as (6) shows, the relativized NP need not be a 'top-level' subject:

(5)   a.   She is one of **those women** who really **bothers** me.
       b.   It is one of **those issues** that really **bothers** me.

(6)   This is one of **those problems** which$_i$ [we think [Δ_i **deserves** urgent attention]].

What is crucial and distinctive about the mismatch construction is that the relative clause is singular: in particular, the relative pronoun is singular, so one would expect the nominal it modifies also to be singular. Evidence that the relative pronoun is singular comes from subject-verb agreement, as in (1), but the same conclusion can be reached by considering examples that do not involve relativized subjects. In (7) *which* is the object of *add*, and is co-indexed with the singular *itself*.

(7)   Seven is one of **those numbers** which$_i$ you can add Δ_i to **itself**$_i$ to get a non-zero result. Minus seven isn't.

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[1] We will assume here that (2a) and (2b) are equivalent, except that (2a) is more frequent. While this may be an over-simplification, we will have nothing more to say about examples like (2b), for which a proper treatment should be an automatic consequence of any adequate analysis of relative clauses and partitives.

[2] Our discussion here is restricted to English, see de Hoop et al. (n.d.) for discussion a similar construction in Dutch. This construction is not the only one in English to show apparent agreement mismatches (cf. examples like *That ten days in Berlin was really nice, A gang of kids were hanging around outside*). The full paper will show that the mismatch we are concerned with cannot be reduced to one of these other constructions.

[3] We assume this mainly to be consistent with Flickinger (2008), though implementing the idea raises some technical questions, as does the transparency of the PP for nominal properties. The full paper explores these issues.

Since subject-verb agreement, and pronoun antecedent agreement are generally assumed to involve INDEX values, this is clear evidence that the relative pronouns in the mismatch construction are INDEX|NUM *sg*.

Following Sag (1997), the standard analysis of relative clauses involves a constraint like (13a).[4] In words: relative clauses modify nominals whose index they share, and the restrictions of the index that come from the nominal are unioned with those that the relative itself imposes to produce the content of the relative clause itself. In the case of a normal singular relative modifying a singular nominal (e.g. a non-mismatch example like *a problem that bothers you*) this gives a content as in (13b). Since in head-adjunct structures the content of the mother comes from the adjunct daughter, this is the content of both the relative clause and the relative clause plus the modified nominal.

The crucial part of the analysis which is not shown in (13a) is that the index of the relative clause and the nominal is also the index of the relative pronoun. It is thus *impossible* to have a singular relative modifying a plural nominal. But in the mismatch construction we seem to have exactly this.

Perhaps the most obvious response to this situation is to suggest that in the mismatch construction, rather than modifying the plural *(of) those problems*, the relative clause is modifying *one* (which is singular). This is the correct analysis of examples involving a non-restrictive relative, such as (8).

(8) This is one of those problems, which really bothers you.

But it is not the right analysis for (1), which has a different interpretation from (8). The interpretation of (8) requires the context to contain an identifiable plurality of problems (NB *not* 'problems that bother you'). By contrast, the interpretation of (1) requires the context to contain an identifiable set of entities which are both problems and which also bother the addressee. That is, in the mismatch construction the relative clause must be interpreted inside the partitive, as a restrictive modifier of *(those) problems*.

This point can be re-enforced by considering examples involving a superlative like (9). Notice the negative polarity item *ever*, which is licensed by the superlative (cf. the ungrammaticality of (10) without the superlative). This is strong evidence that the relative clause is interpreted 'downstairs' in the semantic scope of the superlative, i.e. inside the partitive PP.

(9) This is one of **the most impressive goals** that **has** ever been scored at Wembley.
(10) This is one of the goals that has (*ever) been scored at Wembley.

In short, we have in the mismatch construction a singular relative clause which makes its semantic contribution 'downstairs' in a partitive PP, as a modifier of a plural nominal. There is a genuine agreement mismatch, and what appears to be a fundamental problem with the whole approach to agreement.

A natural reaction to agreement mismatches in general is to wonder whether it may be possible to exploit the distinction between INDEX and CONCORD agreement – INDEX agreement is 'semantic' and relates to how discourse entities are individuated, whereas CONCORD agreement is simply 'formal' or morphosyntactic. The issue is explored properly in the full paper, but we have already seen evidence that that makes this unlikely (cf. the downstairs NP denotes a plurality, and is INDEX|NUM *pl*, the relative pronoun and the relative clause are INDEX|NUM *sg*).[5]

Though we saw above that the problem of the mismatch construction cannot be solved by having the relative clause modify *one*, but it is clear *one* plays a crucial role in the construction. In particular, it seems that *one* is the *only* quantity word that allows the mismatch construction.

(11) *Two/*Many*None of the problems that bother**s** you have been solved.

We appear to have a paradox: the singular relative is in some sense selected by *one*, at the top of the partitive construction, but makes its semantic contribution at the bottom of the construction, inside the *of*-PP.

We suggest this paradox can be resolved if we assume some form of extraposition is involved. The HPSG literature contains two relatively recent proposals for dealing with this phenomenon: Kiss (2005), which exploits the scope underspecification available in MRS to allow an extraposed phrase to be interpreted

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[4]Here MOD is supposed to abbreviate CAT|HEAD|MOD, a more up-to-date implementation would use SELECT in place of MOD. Nothing hangs on this.

[5]One might conceivably try to argue that combining a relative clause with its head involves CONCORD, where the CONCORD and INDEX values can differ, but this would face the objection that, other than in this construction, singular relatives *never* modify plural heads.

at a position lower than its surface position, and Kay and Sag (2012), who use an EXTRAP feature which is percolated to achieve the same effect. We will assume the latter here.

Thinking from the top downwards, under this approach the top of an extraposition construction involves an XP daughter which is a member of the EXTRAP list of the head daughter. The EXTRAP list percolates downwards from mother to head daughter until it reaches a (non branching) node where the XP is removed from the EXTRAP list. At this point, the CONTENT of the mother is derived by combining the content of the XP with that of the daughter as though the XP were an adjunct of the daughter.[6]

Developing this idea, we can get a first approximation for the mismatch construction if we assume that, in addition to whatever lexical entry is involved in producing normal partitives as in (12), *one* has a lexical entry which allows it to combine with a partitive *of*-PP, and a singular relative clause, where the relative clause is interpreted as extraposed from the partitive PP. This will give structures like (14). The relative clause will percolate down into the *of*-PP and be interpreted as an adjunct of *those problems*.

Of course, this will not work as it stands, because though we have captured the idea that the relative is selected by *one* at the top, and makes its semantic contribution at the bottom inside the partitive, the extraposed relative $\boxed{2}$ is still singular, and must still be interpreted as modifying a plural *those problems*. This will still involve unifying the MOD value of the relative (NP_{sg}) with the NP_{pl} (*those problems*), which is impossible.

However, one might suppose that the following would be a simple solution. Suppose that instead of putting the actual relative clause on the the EXTRAP list, one could put a 'pluralized' version of it on the list. Adding a 'pluralisation' operator to the HPSG formalism would be a considerable innovation, but in any case, a moment's thought suggests that it would not be a solution. Exploiting existing notation, one might try to express the idea by requiring a structure like (15), where the notation [INDEX $\boxed{1}$![NUM *pl*]] indicates a value like $\boxed{1}$, except with *pl* as the value of INDEX | NUM (see, e.g. Sag (2012) for this notation in other contexts). The idea would be that the *sg* value of the INDEX | NUM value of $\boxed{1}$ has been 'restricted out' and replaced by *pl*, 'pluralising' the relative on the EXTRAP list. At first blush, this may seem plausible: it certainly overcomes the immediate problem of combining a singular relative clause with a plural – the relative clause that is passed downwards on the EXTRAP list will be looking for an INDEX | NUM *pl* nominal (which it will find in *those problems*). But on closer inspection it is incoherent: the only plausible interpretation of [INDEX $\boxed{1}$![NUM *pl*]] is a *copy* of $\boxed{1}$ that differs from $\boxed{1}$ at the indicated value. It does not indicate a token identity. But this means that the restrictions that come from the nominal (i.e. the restrictions in $\boxed{2}$) are not interpreted as restrictions on the index $\boxed{1}$, but on another index entirely. The interpretation will be wrong.[7]

So, rather than pursuing this idea, we will propose an alternative. We propose that, instead of the actual relative clause going onto the EXTRAP list of the partitive PP, what goes onto the EXTRAP list in the mismatch construction is something built from the relative clause, along the lines of (16), where for readability we have used an uppercase letter (X) for the plural index, and lower case (x, y) for singular indices.

This is a relative clause which is looking for a nominal that denotes a plurality, (X) with restrictions $\boxed{4}$. The content it produces will also have the plural index X, and the restrictions $\boxed{4}$, plus the restriction that every atomic part of the plurality (y) has the property of bothering the addressee. The effect is that the content of the singular relative clause is 'distributed' over the atomic elements of the plurality.

The interpretation of (1) is predicted to be that whatever *this* picks out is one of a plurality of problems X, where every individual problem in X bothers the speaker. This seems correct.

We appear to have successfully captured the key properties of the mismatch construction: it is conditioned by the presence of *one*, and involves a normal singular relative clause; the use of extraposition apparatus means that the relative clause is interpreted as a restrictive modifier inside the partitive PP, consistent with the facts about the interpretation, and the scope of superlatives. These facts have been captured without the use of additional theoretical machinery: the only cost is the addition of an additional lexical entry for *one*, which we omit here for reasons of space.

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[6]There is a technical problem here: Kay and Sag (2012) assume that the bottom of the extraposition path involves a *word*, but we are following Sag (1997) in assuming relative clauses modify NPs. We address this in the full paper.

[7]Thinking in terms of logical variables, the interpretation we would like for the NP is something like $\{ x : problem(x) \wedge bother(x, you) \}$, what this approach would give is something like $\{ x : problem(y) \wedge bother(x, you) \}$, where the variable y is unbound.

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(12)

$$
\begin{array}{c}
\text{NP}\\
\diagup\quad\diagdown\\
\begin{array}{c}\text{NP}\\ \langle \boxed{1}\rangle\\ |\\ \textit{one}\end{array}
\qquad
\begin{array}{c}\boxed{1}\,\text{PP}_{of}\\ \diagup\quad\diagdown\\ \begin{array}{c}\text{P}\\ |\\ \textit{of}\end{array}\quad \begin{array}{c}\text{NP}_{pl}\\ \textit{those problems}\end{array}\end{array}
\end{array}
$$

(13) a.
$$
\left[\begin{array}{l}
\text{MOD}\quad N\!:\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\\ \text{RESTR}&\boxed{2}\end{array}\right]\\[2ex]
\text{CONT}\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\\ \text{RESTR}&\boxed{3}\cup\boxed{2}\end{array}\right]
\end{array}\right]
$$

b.
$$
\left[\begin{array}{l}
\text{MOD}\quad N\!:\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\big[\text{NUM}\ sg\big]\\ \text{RESTR}&\boxed{2}\end{array}\right]\\[2ex]
\text{CONT}\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\\ \text{RESTR}&\boxed{2}\{\boxed{1}:\ bothers(\boxed{1},you),\ problem(\boxed{1})\}\end{array}\right]
\end{array}\right]
$$

(14)

$$
\begin{array}{c}
\text{NP}\\
\diagup\quad|\quad\diagdown
\end{array}
$$

- NP $\langle\boxed{1},\boxed{2}\rangle$ | *one*
- $\boxed{1}$ PP$_{of}$ EXTRAP$\langle\boxed{2}\rangle$
  - P | *of*
  - NP$_{\boxed{pl}}$ EXTRAP$\langle\boxed{2}\rangle$
    - NP$_{\boxed{pl}}$ EXTRAP$\langle\ \rangle$ — *those problems*
- $\boxed{2}$ S$_{rel}$ [MOD NP$_{\boxed{sg}}$] — *which bothers you*

(15)

$$
\begin{array}{c}\text{NP}\\ \diagup\quad|\quad\diagdown\end{array}
$$

NP | *one*

PP:
$$
\left[\text{EXTRAP}\ \Big\langle\ \left[\text{MOD}\ \left[\begin{array}{ll}\text{INDEX}&\boxed{1}\,!\,\big[\text{NUM}\ pl\big]\\ \text{RESTR}&\boxed{2}\end{array}\right]\right]\ \Big\rangle\right]
$$
of those problems

S$_{rel}$:
$$
\left[\begin{array}{l}
\text{MOD}\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\big[\text{NUM}\ sg\big]\\ \text{RESTR}&\boxed{2}\end{array}\right]\\[2ex]
\text{CONT}\left[\begin{array}{ll}\text{INDEX}&\boxed{1}\\ \text{RESTR}&\boxed{3}\{\boxed{1}:\ bothers(\boxed{1},you)\}\cup\boxed{2}\end{array}\right]
\end{array}\right]
$$
that bothers you

(16)
$$
\left[\begin{array}{l}
\text{CAT}\,|\,\text{HEAD}\ \left[\text{MOD}\ N\!:\left[\begin{array}{ll}\text{INDEX}&X\\ \text{RESTR}&\boxed{4}\end{array}\right]\right]\\[3ex]
\text{CONT}\ \left[\begin{array}{ll}
\text{INDEX}&X\\[1ex]
\text{RESTR}&\left\{\left[\begin{array}{l}\textit{foreach}\\ \text{INDEX}\ y\\ \text{RESTR}\ \{partof(y,X),\ atomic(y)\}\\ \text{SCOPE}\ \boxed{2}\{bothers(y,you)\}\cup\boxed{3}\end{array}\right]\right\}\cup\boxed{4}
\end{array}\right]
\end{array}\right]
$$