Transitivity Alternations in English and Norwegian: Final Report

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1 Project Proposal and Background

The inspiration for the project came from the observation that English and Norwegian, although similar in some respects, differ considerably in how they express transitive-intransitive verb pairs. In English, the most common situation is for the very same verb root to be used for both transitive and intransitive statements (1).

(1)   a.   The door opened.
          b.   John opened the door.

In Norwegian, the most common situation is for the transitive verb to be augmented with a reflexive clitic *seg*-'self' to create the intransitive 'translation' of (1-a), as shown in (2).

(2)   a.   Døra åpnet seg.
          b.   Jan åpnet døra.

Our leading research question was to investigate the phenomenon with psycholinguistic methods to see (i) whether the two strategies corresponded to a common underlying semantic form or not, and (ii) whether there were any processing differences between the two strategies. The general theoretical background questions included questions of event complexity from a purely cognitive viewpoint on the one hand, and questions of coding complexity on the other. With respect to the latter point, the idea was that even if the types of events being described in the two languages were the same, the fact that overt morphology is used in Norwegian, while the English forms are morphologically *ambiguous* was hypothesized to be a point of variation when it came to the processing of sentences containing such verbs. We had important methodological questions also. Most importantly, we wanted to know whether psycholinguistic techniques such as timed judgements and behaviours below the level of conscious reasoning could be used to investigate fine grained distinctions between verbal categories that are usually the purview of purely theoretical research.

Finally, we had training and expertise enhancing goals for UiT and the department of linguistics which were also important motivations for the project. There were no designated experts in psycholinguistic methods or the use and analysis of statistics in place at the Institutt for Språkvitenskap at UiT when the project was proposed, although the Language Acquisition group had begun to be interested in this area. Thus, the project proposed a collaboration with the University of Edinburgh as consulting partner to develop the skills and expertise in these areas among the employees at the humanities faculty at UiT.

2 The Experiments

We planned a single pilot study for both languages, and then a main experiment directly comparing Norwegian and English with respect to the transitivity alternation.

The pilot study was intended to demonstrate the semantic comparability of the two languages, and the main experiment was intended to investigate the role of morphological marking on the processing of the alternation. Since Norwegian was under-investigated with respect to verbal processing, we had to factor in a lot of time for corpus work on the frequency of different verbs and the rate at which the intransitive and transitive variants were used.

As it turned out, the pilot study designed to confirm the semantic commensurability of the two constructions gave us a very clear early indication that the two languages were quite different in their cognitive underpinnings (subsection 2.1). This was a surprising and exciting result from the point of view of the theoretical literature, but it meant that the planned main experiment comparison could not take place in exactly the way we had anticipated. Thus, the 'main experiment' as originally envisaged, was conducted only in English, with a smaller Norwegian version run as a check on the interpretation of our results there (subsection 2.2).

The final set of experiments were run in order to follow up on the results discussed in subsection 2.1 to explore whether the *seg* marked forms were in fact processed as if they were transitive, or intransitive. In other words, is the *seg* processed as any ordinary direct object in the language, or does it have a detransitivizing function. Consistent with project aims, we ran parallel tests for English as a comparison and control because in the case of English the transitivity or intransitivity of a particular construction is not in doubt. These experiments are reported in subsections 2.3 and 2.4 respectively.

In what follows, we describe and report on the experiments that were conducted in roughly chronological order. This is because the outcomes of one experiment in this field nearly always affect the hypothesis space and steer the course for the planning of subsequent experiments. Presenting our results in this order will allow the logic of that progression to emerge. However, in section 3, we will pull together the results from the whole group of experiments to give a more holistic perspectives on the most important discoveries and the potentials for future work.

In each of the following subsections, we provide citations and links to the academic presentations and papers connected to that particular experiment, that present the results in fuller detail.

2.1 Experiment Group I: The Norwegian vs. English view of the world

The video experiment was designed to test whether the English and Norwegian versions of the 'intransitive' utterance, as shown in (2) above were actually semantically comparable, or whether they were expressing subtly different things. Given the theories in the literature, the two main rival explanations of the alternation were causative vs. reflexive. In the causative explanation, the transitive verb is just expressed the 'caused' event version of what is expressed by the intransitive verb. In the reflexive analysis, the intransitive version actually involves the single argument somehow being responsible for its own fate (in the case of the door in (2), it 'causes its own opening').

To create a completely comparable test, we elicited judgements on identical video-clips, instead of asking for judgements in the speakers' own languages. The participants saw a 'caused' event, but then had to answer a Yes-No question containing the 'intransitive' verbal form, as exemplified in (3):

(3)   VIDEO: Person in kitchen melting butter in a pan. The butter becomes liquid and
        bubbly.
        QUESTION: Did the butter melt? (ENG): Smeltet smøret? (NOR)
        TASK: Press Y(es) or N(o).

Thus, the judgements on entailments were grounded in independent properties of the visual
representation of the world. Both sets of language users were therefore reacting to identical
real world scenarios, but had a different linguistic form for the question. Since we assume that
purely pragmatic factors related to a visual scene should affect English and Norwegian speakers
equally, any significant *difference* in behaviour between the two groups can be interpreted as a
difference in the semantics of the anticausative question in English vs. Norwegian, and not be
attributed to e.g. differences in use of metalinguistic negation.

   We set up two hypotheses to test with this methodology. Hypothesis 1 corresponds to the
idea that there is a simple entailment relation between a causative verb and its inchoative
counterpart. Since the depicted caused events are all judged to be true in the causative verb
version, we have a prediction for how the inchoative version must therefore be judged.

Hypothesis 1: The truth of anticausative verb is strictly entailed by the caused event.
Prediction: Participants will answer *Yes* to all test questions.

Failure of this prediction would undermine Hypothesis 1, but would not give us any handle
on the reasons for the failure. We therefore manipulated the saliency of the theme properties
vs. agent properties in facilitating the event to directly test Hypothesis 1 against the reflexive
analysis.

Hypothesis 2: The truth of the anticausative verb is dependent on the possibility of in-
terpreting the Theme subject as an EFFECTOR.
Prediction: Participants will not answer *Yes* across the board, but will be more likely to
answer *Yes* to the test items where the theme is highly salient compared to the agent.

2.1.1   The Experiment

We conducted the experiment with Norwegian speaking participants (with material in Norwe-
gian), and English informants (with material in English) at the University of Edinburgh. We
used 14 verbs in the experiment, of which 7 were reflexive marked anticausatives in Norwegian,
and 7 were labile in Norwegian. This was because we wanted to test our two hypotheses on
the two different languages, but we also wanted to test whether morphology made a difference
in the Norwegian case. In other words, would the 'marked' nature of the alternation in the
Norwegian case be a factor in whether the participants behaved according to Hypothesis 1 or
Hypothesis 2. The corresponding translational equivalents in English were all labile. We coded
the English translation equivalents of the Norwegian marked *seg* anticausatives as 'marked'
as well, in case there was something pragmatically special about these kinds of eventualities,
but we did not expect this factor to have any effect on the results. The verbs used in the
experiment are given in table 2.

   To manipulate the salience of the Theme and Agent, two different video clips for each verb
were included, one with a so-called Theme-focus, and one with co-called Agent-focus, defined
as the following:

Table 1: Verbs used in experiment

Labile alternation	Marked anticausative
roll/rulle	open/åpne (seg)
overturn/velte	split/dele (seg)
melt/smelte	spread/spre (seg)
spin/snurre	move/flytte (seg)
detach/løsne	bend/bøye (seg)
splash/skvette	lock/låse (seg)
balance/balansere	turn/snu (seg)

- Theme focus: a successful unfolding of the event is largely determined by the properties of the theme. The agent on the other hand, is not necessarily active throughout the event. (Here it is easier to interpret the Theme as an EFFECTOR.)

- Agent focus: a successful unfolding of the event is mainly dependent on the force of the agent. The agent acts volitionally, and is active throughout the event. (Here it is hard to interpret the Theme as an EFFECTOR.)

The experiment was run on 42 native speakers of Norwegian at the University of Tromsø and 46 native speakers of English at the University of Edinburgh.[1] Each informant saw only one version of each verb, i.e., either Theme focus or Agent focus (that is 7 videos with Theme focus and seven videos with Agent focus).

In total, each informant saw 3 (practice phase) + 19 (fillers) + 14 (test) = 36 videos. The videos were presented in random order. The question was answered by pressing Y(es) or N(o). We used OpenSesame (Mathôt et al. 2012) to run the experiment and collect the responses.

2.1.2 Analysis, results and discussion

In analysing the data, we fitted two mixed-effects logistic regression models (using the lme4 package in R, Bates et al. 2015), one for English and one for Norwegian. Response (Yes or No) was the dependent variable. Each included the predictors Context (Theme focus or Agent focus) and Marking (unmarked or marked), and the interaction between them. The models additionally included random intercepts for subject and item, and by-subject slopes for context and marking and the interaction between context and marking, as well as a by-item slope for context. Predictors were dummy coded, and the intercept was the unmarked/labile verbs in the Theme focus. The full summaries of the models can be found in appendix 1. We further compared the overall frequencies of Yes-responses in English and Norwegian using a simple χ^2 test.

We found a significant difference in the responses from the Norwegian and the English informants, with the Norwegian speaking informants giving yes-responses in 64.4% of the trials, and the English speaking informants giving *Yes*-responses in 92.2% of the trials ($\chi^2 = 141.2$, $p < 0.001$). In both languages, the Theme focus context yielded more Yes-responses than the

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[1]For both groups, we used mainly undergraduate students, but both groups contained 10-12 post-graduate students and staff from the universities. We saw no difference in responses between undergraduate and post-graduate/staff groups.

Table 2: Results, % *Yes*-responses.

	English		Norwegian	
	Theme Focus	Agent Focus	Theme Focus.	Agent Focus
Unmarked /labile	92.6	89.9	90.5	63.2
Relfexive marked	96.2	90.2	59.2	44.9

Agent focus context, but the effect was significant only in Norwegian. The value for 'Marking' did not have a significant effect in English, but it did in Norwegian. The results are shown in table 3 and figure 1. The full summary of the results, verb by verb, can be found in appendix 2. We will go through the results carefully below, first the English results and thereafter the Norwegian results.

Figure 1: Percentage yes-responses for "unmarked" and "marked" anticausative verbs, by focus on theme or agent in the videos, for English and Norwegian respondents. Error bars represent two standard errors.
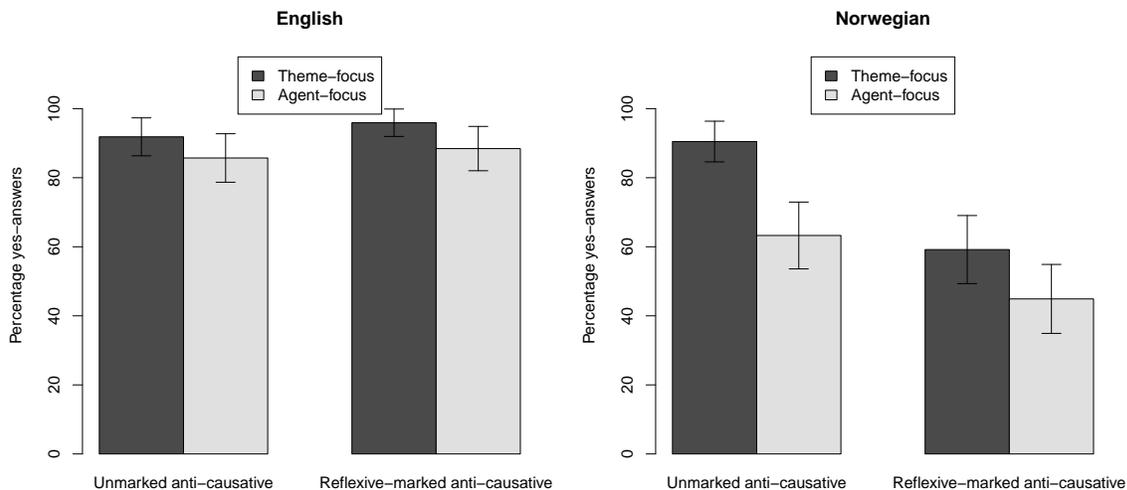
The results for the English experiment are shown in figure 1. Both the so-called "marked" and "unmarked" anticausatives look the same in English. We did not expect these groups to be different unless there were a genuine pragmatic or functional difference in their distribution (corresponding to the Norwegian marking setting) that was affecting the judgements. We did not find any effect of "marking" (or "spontaneity") in English. If anything, the verbs that are marked in Norwegian get a slightly higher rate of *Yes*-answers in the corresponding English, both in the Theme context (96.2%) and Agent context (90.2%) for marked verbs, vs. 92.6% in Theme focus and 89.9% in Agent focus for the verbs that are unmarked in Norwegian. But this difference is not significant.

There was no significant effect of context, but there was slight increase in *Yes*-responses for the Theme focus compared to the Agent focus (94.4% for Theme focus compared to 90%

Agent focus).

The results from the Norwegian experiment were, as can be seen in figure 2 below, significantly different from the English results. As reported above, Norwegians gave significantly fewer *Yes*-answers than English speakers, showing that there is a significant effect of language ($\chi^2 = 141.2$, $p < 0.001$).

When we consider the effect of context, both the reflexive marked verbs and the unmarked verbs in Norwegian had a higher percentage of *Yes*-responses for the Theme focus compared to the Agent focus. Unmarked verbs in Norwegian in Theme focus were almost unanimously accepted (90.5%), just like in English. However, in the Agent-Focus condition for these verbs, there was a significant drop in *Yes*-responses (27.5%, $\beta = $ -2.0122, $SE(\beta) = 0.9556$, $p < 0.05$). The effect of context was numerically smaller for the reflexive marked verbs, but the interaction between context and marking was not significant ($\beta = 1.1260$, $SE(\beta) = 1.1767$, ns.). The effect of context in Norwegian contrasts sharply with the results for English, and the anticausative analysis is thus not supported for Norwegian. Rather, the reflexive analysis seems to be correct for Norwegian, both for unmarked and reflexive marked verbs.

There was also a strong effect of marking in Norwegian: unmarked verbs yielded a more *Yes*-responses than the reflexive marked verbs. The effect was most clearly seen in the Theme Focus context (31.3%, $\beta = $ -2.4730, $SE(\beta) = 0.7873$, $p > 0.001$), but as stated above, there was no interaction between context and marking.

The reflexive analysis predicts that contextual modulation will affect the judgements of speakers, but it does not predict that all verbs are equally frequent or easy to construe in each kind of construction. There was a difference in the Norwegian results concerning the difference between 'marked' and 'unmarked' anticausatives is that even though both types of anticausative in Norwegian must be given a reflexive analysis, the 'marking' corresponds to a division within the verbs according to how likely they are to express spontaneously occurring (uncaused) events. Unmarked alternations in Norwegian are restricted and nonproductive, but have arisen precisely in the case of verbs that are high in the spontaneity scale. We might therefore expect them to have higher baseline acceptance rates in the Theme-Focus modulation.

Based on our results, we proposed a decausative analysis for English anticausatives. Under this analysis, the causative contains either a causer or a full cause component that is radically absent in anticausative, while the anticausative contains no element that is not present in the causative. The anticausative is thus always entailed by the causative, and it is thus logically impossible to deny the anticausative while claiming the causative. This of course does not mean that an anticausative always provides a pragmatically felicitous description of a caused event: describing a scene where two people move a sofa towards a wall as *the sofa moved towards the wall* is not felicitous in most contexts, and the description can be challenged with a meta-linguistic negation: 'No, the right way to describe the event is to say that the two people moved the sofa towards the wall'. Still, it is logically undeniable that the sofa moved towards the wall. Even though there may be some very weak effects of meta-linguistic negation in our results, as shown in the lower number of *Yes*-responses in the Agent focus, the participants were overall not willing to deny the truth of the anticausative description after having seen a caused event. Given that we expect some noise in any kind of psycholinguistic experiment of this sort, the English participants were remarkably categorical in their judgements.

The interesting thing for us about this particular experiment is that the test materials were identical for the Norwegian and English speakers, meaning that all effects of context, pragmatics, and task construal should balance out and be the same for the two populations.

Therefore any statistically significant differences between the two groups of speakers must be interpreted as differences in the semantics of the language used to frame the test question. As we saw, the results were unambiguous in this regard. Overall, the Norwegians produced statistically fewer *Yes*-answers than their English speaking counterparts. Most Norwegians showed strong effects of context, while most English respondents showed none.

We have argued, specifically, that the reflexive analysis (Chierchia 2004; Koontz-Garboden 2009), is crucially different when it comes to the entailment relations between the causative and the anticausative (or, reflexive). Under the reflexive analysis, the anticausative always includes one piece of meaning that is not present in the causative, namely that the theme argument is responsible for the initiation and unfolding of the event. The causative thus *never* entails an anticausative/reflexive. When a speaker is asked whether a reflexive/anticausative description of a caused event is true, s/he thus has to evaluate whether the involvement of the theme (relative to the involvement of the agent/external cause) in the initiation is salient enough for it to qualify as an EFFECTOR in the current context. There's certainly some subjectivity involved in this evaluation, and it is therefore not surprising that we see a lot of variation between the participants in the Norwegian experiment. For the English informants the task is much simpler: they simply have to evaluate whether the targeted referent underwent a certain change of state or location, without having to take into account the causing event.

Our experiment showed therefore that there is a real semantic difference between the way in which (4-a) and (4-b) are related to each other in English, and the way in which (5-a) and (5-b) are related to each other in Norwegian.

(4) a. The door opened.
     b. John opened the door.

(5) a. Døra åpnet seg.
     b. Jon-Erik åpnet døra.

The former are in some kind of inclusion relation semantically, presumably related to the presence vs. absence of causative substructure. The latter are related via an abstract identity of the *nature* of the change undergone, but one does not logically entail the other: in some contexts the two alternants can be used to describe the same situation in the world, but not in others. We have assumed that the best account on the market that would correspond to this behaviour is the reflexive analysis of Koontz-Garboden (Koontz-Garboden 2009), since it also seems to make sense of the way in which our different 'conditions' affected the judgements.

As carefully investigated by Haspelmath (1993), some languages overwhelmingly have derived causatives (e.g. Indonesian, Turkish and Mongolian), while other languages mainly have derived anticausatives (e.g. Russian and German). We think it is important to extend experimental work of the type described above to get a fuller picture of how the nature of morphological marking matches up with the semantics of the alternation.

We think the opportunities for further cross linguistic work in this area are potentially very exciting and important, since far reaching analytical decisions depend on the core semantics of the alternation which are often difficult to establish by individual testing. Moreover, the experiment itself is simple to implement and, at least in this case, gave clearer results than the individual linguistic judgements could.

This paper was presented at AMLaP, at the ESPP in Noto, and at CUNY Processing conference. This study has been written up as a full paper, and is now accepted for publication

2.2 Experiment Group II: English Alternating Verbs are 'Intransitive'

With the video experiment, we established that in English the transitive alternant entails the intransitive one in (1). But this fact does not tell us, which direction, if any, the derivation proceeds, or how the pair is represented in the mental lexicon. So far, traditional grammaticality judgements do not seem to give us much purchase on the latter type of question.

In English there is also another group of alternating verbs, where the transitive sentence entails its intransitive counterpart as well, but where the internal argument rather than the external argument has been in omitted in the intransitive version , as in (6):

(6)   a.   John knitted.
        b.   John knitted a sweater.

In both (6-a) and (6-b), the agent is present, but in (6-a), the internal argument is dropped. the difference between the causative and object drop alternation is sketched in (7):

(7)   a.   Causative alternation: NP1 V NP2 → NP2 V
        b.   Object drop: NP1 V NP2 → NP1 V

In principle, English could have two argument dropping rules: one that targets external arguments as in (7-a) and one that targets internal arguments, as in (7-b). Alternatively, English could have two argument augmenting rules: one that adds a causer to an unaccusative structure, and one that adds an internal argument to an unergative structure. In this experiment we compare these two types of alternating verbs with pure transitive and pure intransitive verbs respectively in a controlled processing task which involved the integration of a verb into a surrounding sentence. Our aim was to see how the two 'ambiguous' verb types in English patterned in processing terms compared with unambiguous transitives and intransitives.

More and more results on processing and production of English and other languages supports the idea that verbs are transitive "by default", or that a transitive frame is category general property of verbs, see e.g. Omaki et al. on strategies for gap-filling, and van Gompel et al. on priming of (in)transitive structures. When it comes to the effects of transitivity on verb processing, there is a strong documented tendency for the parser to interpret a Noun Phrase following a verb as a direct object (frazier). However, Staub (2007) reports that unambiguously intransitive verbs did not provoke this response, arguing that intransitivity information was guiding the initial parse. However, in tests with verbs with optional transitivity of various degrees, even verbs with low frequency transitive alternants behaved as if they were 'expecting' a following NP object, arguing that general mechanisms were overriding lexical information (van Gompel and Pickering 2001).

There has been some work suggesting that event structure 'complexity' can be specifically tapped into in certain tasks. Gennari and Poeppel (2003) reported reduced reading times on stative as a opposed to eventive verbs, a result replicated for German with stative vs eventive versions of identical lexical items. Brennan and Pylkkänen (2010) also found that states were 'easier' to process than events. Within the group of eventive verbs themselves, McKoon and Macfarland (2002) reported that 'externally caused' verbs like *break, melt* produced longer reading times than internally caused intransitives like *bloom, glow* on a lexical decision task, as

well as timed grammaticality judgement tasks, arguing for a representational difference between the two types of verb, possibly in terms of event complexity. Thompson (2003) similarly found that unaccusatives are more difficult to access in verbal naming tasks than unergatives for agrammatic aphasics, and unaccusatives are rarely spontaneously produced. While we think that the notion of 'complexity' in the representation of verbal meaning is probably highly task specific, we were encouraged by these earlier results to think that the methodologies of self paced reading could uncover differences at the fine grained level corresponding to different types of caused events.

Results from filler-gap experiments, transitivity priming experiments, and reading experiments all suggest that being transitive is somehow the unmarked property of verbs, while being intransitive is marked. From this we can hypothesise that intransitive verbs should take longer time to initially process than transitive verbs. On the other hand, if the intransitive verbs have lexically specific argument frames associated with them, as suggested by van Gompel and Pickering (2001), which presumably are activated when they are encountered, it should be easier to detect when they occur in a deviant argument structure frame. We wanted to test whether this was true, by a using a go-no-go paradigm, where both transitive and intransitive verbs occurred in identical deviant frames. Further, we wanted to test whether our two groups of alternating verbs behaved like the transitive or intransitive verbs.

Our experiment was a direct comparison between four different types of verb:

- T: strictly transitive verbs

- I: strictly intransitive verbs

- Caus: verbs of unstable valency due to causative-inchoative alternation (*break/melt* type verbs)

- OD: verbs of unstable valency due to Object Drop

We had 9 verbs in each class, which were matched for frequency (log frequency from Baayen et al.) and word length. The Caus and OD groups were also matched for transitivity percentage by hand, using the first 200 hundred relevant hits from the British National Corpus. The exact verbs used in the experiment together with their frequencies are shown in Figure 2.[2]

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[2]The OD group contains three verbs that may not traditionally be viewed as object drop verbs, namely *recover*, *bathe* and *relax*. These may be better described as inherently reflexive verbs. Following Schaeffer et al, we assume that these verbs contain a null or a dropped reflexive argument, making them structurally similar to regular object drop verbs.

Figure 2: **Our Verb Classes**

	T (LogFreq)	I (LogFreq)	A (LogFreq)	A2 (LogFreq)
1.	destroy (9.77)	compete (9.5)	expand (9.45)	survive (9.51)
2.	punish (8.11)	vanish (7.24)	heal (8.37)	recover (8.8)
3.	seduce (6.3)	grovel (6.31)	topple (5.57)	shoplift (3.0)
4.	betray (6.65)	hover (6.59)	unfold (6.37)	inhale (6.75)
5.	strangle (6.15)	linger (6.37)	widen (6.44)	bathe (6.51)
6.	seize (7.56)	shudder (7.48)	shatter (7.78)	sew (7.18)
7.	hinder (6.81)	stumble (7.03)	ferment (6.21)	knit (7.01)
8.	injure (7.11)	thrive (7.25)	weaken (7.11)	navigate (7.5)
9.	harass (7.88)	wander (7.83)	melt (7.93)	relax (8.68)

The main challenge lay in setting up a test that would allow a direct comparison of the four different types of verb, even though they have (by definition) different subcat frames. We wanted to compare the verb types in a test that involved syntactic integration, and not just a lexical decision task. The novelty of the experimental paradigm, and the reason we were able to compare verbs with different transitivity preferences against each other directly as exact minimal pairs was that the crucial test items consisted of the clausal complement frame. The verbs were chosen so that *all* the test verbs would be ungrammatical in this particular frame. An example of the test sentence type is shown in Figure 3.

Figure 3: **The Core Test Sentence Type**

(8)   a.   The group bragged that Molly was the tallest. (CP-taking verb)
       b. *The team weakened that Martin was a student. (Caus-class)
       c. *The group sewed that Robert was a musician. (OD-class)
       d. *The committee thrived that Susan wrote the article. (I-class)
       e. *The company punished that Fiona was a teacher. (T-class)

The experiment we ran was a Go/No-Go or 'Stop Making Sense' paradigm, for testing integrating verbs of different types into different syntactic frames (G. Mauner and Carlson 1995). Subjects were instructed that they would be reading a list of sentences, and told that some of them were possible sentences of English and some not. They then read the sentences, self paced, word by word, having been instructed to press an 'abort' button when they decided that a sentence was bad/not possible.

Thus, the only difference between the ungrammatical sentences in question was the verb class of the verb. Specifically, we wanted to check (i) whether the reading time of the verb itself differed between the verb classes, (ii) whether the time to abort (judgement of ungrammaticality) was significantly correlated with verb class and (iii) whether the alternating verbs patterned with transitives, intransitives, or neither, in their behaviour.

65 English speaking undergraduates from Edinburgh University were tested, 3 were discarded afterwards on the basis of their results (median response time for verbs over 1 second).

2.2.1 Results and Discussion

For our dependent variables, we measured reading time on the verb as well as the average time to abort and average word to abort for the ungrammatical test sentences. Our hypothesis was that differences in representational complexity among the different verb classes would create differences in reading times in the verb itself: lexically unmarked verbs should be faster to read than verbs with a specified argument structure frame associated with them. However, once a more specified frame has been activated, it should be easier to easier to detect a deviant complement, thus giving rise to shorter time to reject the ungrammatical sentence.

The verb always appeared after a subject consisting of a definite article and a noun (e.g. *the crowd*, *the group*), and was followed by either a complementizer plus a subordinate clause (in the test condition) or a matching on non-matching complement (transitive or intransitive depending on word class). For investigating the verb reading time, we were able to include the filler material as well, as it was identical to the test material up to and including the verb. We thus had a large amount of data to work with for this measure (9 verbs in 4 classes for 62 informants). In total 69 observations (3%) were removed (2.5 standard deviations/subject). The results are shown in figure 4 (standard errors in brackets). As can be seen, the average reading time for the transitive verbs is considerably shorter compared to the intransitive verb.

Figure 4: Verb Reading Times, by verb class

T	I	Caus.	OD
569 (10)	600 (11)	596 (12)	584 (11)

A mixed effect model was carried out with verb class as the fixed effect, and random incepts for subject and item and a and by-subject random slope for the effect of verb class. The factors of verb class were coded so that the group of I and Caus. contrasted with the group of T and OD, and the factors of the two groups were contrasted with each other (i.e., I vs. Caus, and T vs. OD). Coefficients are given in figure 4. The results thus clearly show that intransitive verbs take longer time to read in this type of task compared to transitive verbs. Further, the causative verbs behave like the intransitive verbs, while the object drop verbs have reading times somewhere in between the transitive and intransitive verbs.

We also did not find correlation between verb reading time and verb frequency, percentage transitivity, or length of the verb. We conclude that differences in mean were due to difference in processing speed of different verb classes.

The test material consisted of a verb from one of the four classes preceded by a noun phrase and followed by the complementizer "that" and a subordinate clause. Every participant saw 3 verbs from each verb class in the test condition. We measured both the time it took from after the verb to when the sentence was rejected, and how many verbs the participants read before rejecting the ungrammatical sentences. The verb was always presented as the third word, and the complementizer was the fourth word. The values for word at reject and time to reject are given in figure 5.

11

	T	I	Caus.	OD
Word at reject:	5.22 (0.08)	4.84(0.09)	5 (0.09)	5.08 (0.08)
Time from comp. to reject:	1633 (76)	1403 (78)	1501 (77)	1664 (89)

For word to reject, we see the opposite trend compared to verb reading time: Transitive verbs require more context before they are ruled out compared to intransitive verbs. The two alternating groups are located in between T and I, and just like for the verb reading time. A similar trend is seen for time to reject, but here the OD class takes is further off than T. Mixed effect linear models were run for both word at reject and time to reject, using the same fixed and random effects/slopes as in the previous model, and the same contrast treatment (I/Caus vs. T/OD, I vs. Caus, and T vs OD), and again, the difference between the I/Caus and the T/OD group was significant ($t > 2$ for both measures), and the differences within the groups were not. The graph in figure 6 shows at which word the sentences were rejected. As can be seen, the big differences between the two classes is that the sentence most often were rejected already at the complementizer for the intransitive and the causative verbs, while the rejection took place at the subordinate subject in most trials in the transitive and object drop condition.
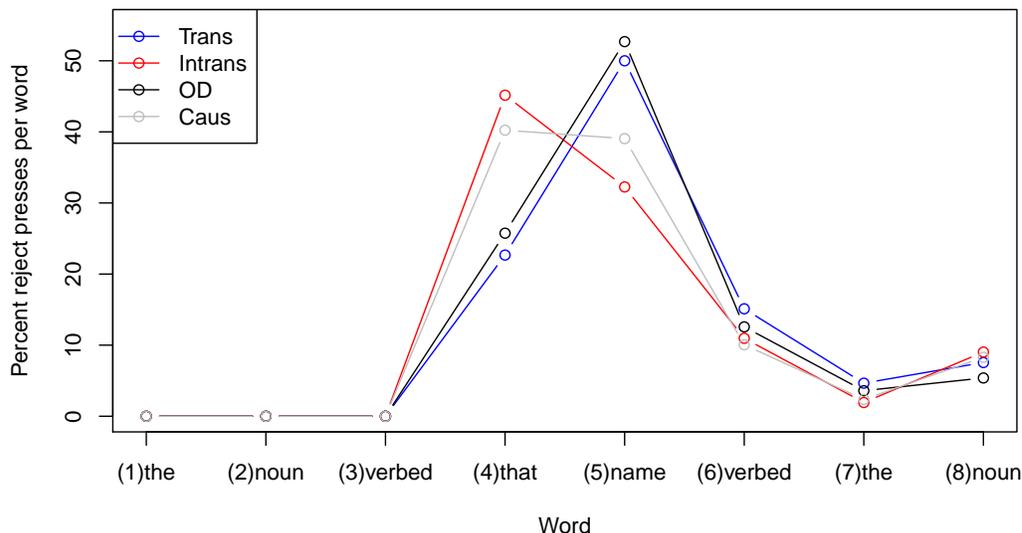
The difference between T and I in reading time of the verb is predicted by a theory in which the intransitive verbs are "marked", and the transitive verbs "default". A specific subcategorisation frame is activated as the intransitive verb is processed, while a more category general frame ("the transitive frame") is activated when the transitive verb is processed. Our hypothesis is that the activation of the specific frame leads to a quicker rejection of the sentence in the ungrammatical CP-frame.

The ambiguous verbs in the causative-alternation did not differ significantly from the intransitive verbs in any of the three measures we looked at. This could be interpreted in several

ways. One possibility is that the causative verbs are underlyingly "intransitive", and thus should behave like the intransitive verbs. Another possibility is that these verbs, just like intransitive verbs, have a specified frame associated with them (or actually two), and the only thing that triggers the slowdown at the verb, and the speed-up afterwards, is the fact that a specific verb frame has been activated. We cannot be sure which one of the mentioned analyses is the correct one, but we can at least conclude that our alternating verbs are not underlyingly transitive. The object drop verbs on the other hand did not differ significantly from the *transitive* verbs, suggesting that they are "default" verbs, just like transitive verbs. Our results for the object drop verbs are compatible with results from other studies on sentence processing and object drop verbs (e.g.....), where it has been shown that optionally verbs with even very low transitivity percentage behave like transitive verbs.

The difference found between the intransitive and transitive verbs in the post-verb region could in principle be attributed to the ambiguity of the complementiser "that". "That" can also be interpreted as a demonstrative (*I read that book*). It could be hypothesised that the participants in some cases parse "that" as a demonstrative, and thus the as the start of an object DP, and wait until the next word before rejecting the sentence. However, a demonstrative "that" could also be the start of a temporal adverbial, e.g. *he bathed that day until his skin was all wrinkly*. In fact, none of the sentences could be fully ruled out as ungrammatical until word 5 was shown, but still, the participants could presumably quite early on in the experiment figure out that the "that" was used as a complementiser (and note further that a neither demonstrative "that", nor any other deictic elements were used in the experiment).

Since the Norwegian complementizer *at* is not ambiguous between being a complementizer and being a demonstrative determiner, we conducted a parallel test in Norwegian using just transitive and intransitive verbs as shown in (9).

(9)   a.   Transitive: John invaderte at Knut sjelden spiste ostepop til frokost.
       b.   Intransitive: Ingrid svømte at Lars ofte gjemte godteri under sofaen.

The results showed a similar effect, arguing that the slow down from the processing of transitives was not due solely to the demonstrative interpretation.

	T	I
Word at reject:	3.9 (0.09)	3.88 (0.1)
Time from comp. to reject:	**1447** (64)	**1298** (61)
Verb reading time:	676 (17)	656 (20)

Even if some of the difference in the post-verb reaction times could be attributed to the status of "that", it still doesn't explain the difference between causative and the object drop verbs. The causative verbs all had subjects that could be interpreted as agents, i.e., a transitive frame was easily evoked. This should have made the interpretation of "that" as a demonstrative equally plausible for causative verbs as for transitive and object drop verbs. At the moment, we chose to analyse the difference between I/Caus and A/OD in the post-verb region as an effect of "verb frame markedness", rather than as an effect of the ambiguity of "that", though clearly, follow-up experiments will have to be run to settle this issue.

2.2.2   A Production Task

As a pre-task for the main experiment, we ran an offline production task to assess the correctness of our verbal classifications, in particular with respect to the alternating verbs which we

were hoping to elicit both transitive and intransitive continuations for in some proportion. For (most of) the verbs tested in the real experiment, we asked informants to 'produce a simple well formed sentence of English using the verb *V-ed*.' We did not give the respondents sentences with already provided 'subjects' since we did not want the choice of subject as animate or inanimate to guide the continuation. This led to a few productions that used the past tense verbal form given as an adjectival participle. This was coded as such, but did not affect the overall results. Each informant produced 60 sentences in all, in a pseudo randomized order. In addition to a, aa, t, and i verb classes above, the test also included 10 stative transitive verbs and 10 CP complement taking verbs.

For this experiment we had 27 respondents, who each produced sentences for the same sixty verbs.

We coded the responses as 'transitive frame', 'intransitive frame', 'verbal passive' and 'adjectival passive'. In some cases, the response was unclassifiable, which we left out of the coding, but this amounted to only 2 sentences out of a total of 1620. There were a smattering of 'perfect' forms, but we coded these as transitive or intransitive according to the construction they were in.

Recall that the crucial a vs. aa verb classes were balanced for percentage of transitive and intransitive variants found in the British National Corpus. However, the production task elicited an asymmetry in the tendency to produce intransitive forms in a spontaneous context—one that actually confirms the surprising result of our processing task. The numbers for the two flexible verb classes are shown in Figure 6.

Figure 6: **A Production Asymmetry**

	Intrans	Active Trans	Passive Trans	AdjPass
A	168	70	30	11
AA	118	142	6	12

Since the number of adjectival passive forms was the same, we did not retain those numbers when running the chi-squared test on this table.

The skew in numbers here is highly significant by the chi-square test: X-squared = 49.1873, df = 2, p-value = 2.085e-11

Our experiment is significant because the theoretical literature is divided as to whether the labile causative-inchoative alternation in English derives the transitive alternant from the intransitive or the other way around. The psycholinguistic literature one the other hand assumes that processing behaviour in sentences is driven by external distribution patterns and based on expectations. Our study was unique in comparing verb classes directly in an integration task because of the choice of an ungrammatical CP frame that was common to all. We might have expected that the ambiguous verbs would pattern differently, or in an intermediate way with respect to the two rigid verb classes. What we found however was that even when controlled for frequency, and frequency of transitive alternant in a corpus (BNC), object drop verbs and causative-inchoative alternating verbs behaved statistically reliably differently, showing that probabilities in external distribution are not a stand-in for lexical representations.

Specifically, when it comes to the lexical representation of the ambiguous verbs in the alternating causative-inchoative class in English the results of our reading study back up the results of an offline production study in suggesting that they are underlyingly represented as *intransitive*.

2.3 Experiment Group III: Transitive Verbs *not* the Default in Norwegian

Because of the first experiment, we knew that Norwegian intransitivized verbs marked with *seg* were not simply equivalent to an intransitive uncaused verb as in English. However, we still needed to test exactly what their status was in the linguistic system of a Norwegian user. We posed the problem in terms of trying to decide whether the *seg*-marked verb forms were processed in a way more similar to transitive verbs, more similar to intransitives, or different from the two.

In order to test this properly, we needed to find a psycholinguistic test where transitives and intransitives behaved reliably differently. One such test is the so called filler-gap paradigm. In this experiment, we construct sentences using a word like *who* or *what* which anticipate a 'gap' further along in the sentence. The results from the literature suggest that when the parser encounters a verb, it immediately expects a 'gap' in the object position of that verb. It turns out that in English, this expectation of a gap is stronger for transitive verbs than for intransitive verbs, so that it seems that processors of English sentences treat transitive and intransitive variants differently when processing for gaps. In other words, lexical knowledge of the selectional properties of these verbs is guiding the processing of the sentence at an early stage. If this is so for Norwegian as well, then it can be used to probe whether *seg*-marked verbs are treated as transitive or intransitive when first encountered.

We set up the experiment in two modes, one using self-paced reading and the other using eye-tracking. This is an important technical improvement to the initial scope of the project. Because of the acquisition of an eye tracker at UiT, and the initiative of Lundquist in our project to develop expertise in this methodology, we were able to add this type of experiment to our roster and test the filler gap paradigm in both modalities.

In the setting up of our experiment, we assumed that the filler-gap paradigm functions as a kind of "transitivity test": we expect a slowdown after the transitive verb when a potential gap-position is filled with an overt NP, but we expect no slowdown at e.g. an adverb directly following an intransitive verb, since there's no gap-position here that can be filled. In recent work, Omaki et al. also observes a slowdown at the intransitive verb in gap conditions compared to transitive verbs.

The aim of our experiment is to test if the filler-gap paradigm can tell us whether different types of reflexive marked predicates pattern with intransitive verbs or transitive verbs. First we test strict transitive and strict intransitive verbs in gap and non-gap conditions:

(10) a. TR. NO-GAP: Elevene lurte på om ekspertene kunne gjenvinne *plasten* til leker påfabrikken.
          'The students wondered if the experts could recycle the plastic as/to toys at the factory.'
      b. TR.GAP: Elevene lurte på hva ekspertene kunne gjenvinne *plasten* til påfabrikken.
          'The students wondered what the expert could recycle the plastic to/as at the factory.'

15

(11)   a.   INTR, NO-GAP: Vakten lurte på om fangene hadde krøpet *ut* av vinduet under rømningsforsøket.
'The guard wondered if the prisoners had crawled out of the window during the attempt to escape.'

        b.   INTR, GAP: Vakten lurte på om fangene hadde krøpet *ut* av under rømningsforsøket..
'The guard wondered what the prisoners had crawled out of during the attempt to escape.'

We expected a longer reading time at the direct object position in (10-b) (gap) compared to (10-b) (no gap), but no difference for the intransitives. At least, we will find some sort of "intransitive" and "transitive" profile, from the reading data. We thus want to compare the "intransitive" and "transitive" profiles to different types of reflexive predicates. In this first experiment, we test only inherently reflexive predicates (i.e., predicates that have to be followed by a reflexive marker).

(12)   a.   REFL, NO-GAP: Legen ville vite om mannen skammet *seg* over fortiden sin under utredningen. The doctor wanted to know if the man felt ashamed of his past during the investigation.

        b.   REFL, GAP: Legen ville vite hva mannen hadde skammet *seg* over under utredningen.
The doctor wanted to know what the man felt ashamed over during the investigation.

2.3.1   Results

What we are looking for is *gap penalty*, that is, if there is an increase in looks in the gap condition compared to the non-gap condition. The most relevant areas will be the post-verb area and the verb itself. Before comparing the three verb-classes with each other, we show the overall reading times for the three classes separately, focusing on three different standard eye-tracking measures: first fixation duration, total dwell time, and number of glances.

Transitive:
Graphs for the measures for the transitive verbs are given in figure 7. We see no gap-penalty for the verb in any of the measures, but we see a gap-penalty for the post-verb area (direct object) and the preposition.
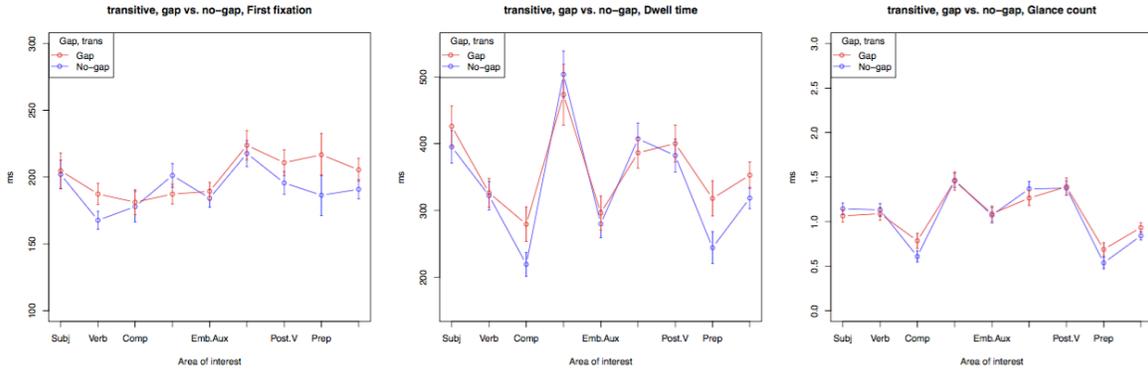
Figure 7: Transitive, First fixation, Dwell time and glance count

Intransitive:

Graphs for the intransitive verbs are shown in figure 8. Here we see very little gap-effect in the first fixation measure, only a slight increase at the verb (not significant). Looking at dwell time and glance counts, there seem to be a gap penalty starting already at the complementizer. As will be returned to, it is hard to get anything before the post-verb area to come out as significant.
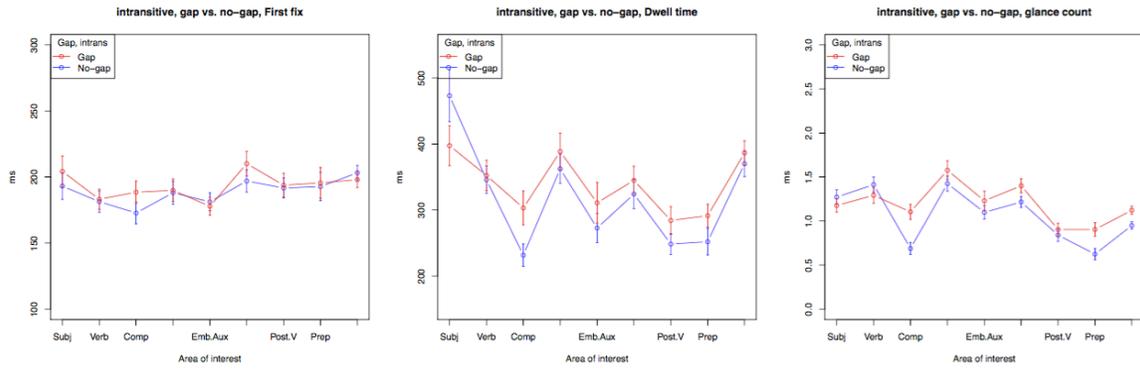
Figure 8: Intransitive, First fixation, Dwell time and glance count

Reflexives

For the reflexive, there is a slight gap-penalty at the preposition, and looking at Glance count, there is a gap penalty at the post verb element as well (i.e., the relfexive "seg"). The fixation probability for *seg* is fairly low though (0.37 in no-gap, and 0.52 in gap).
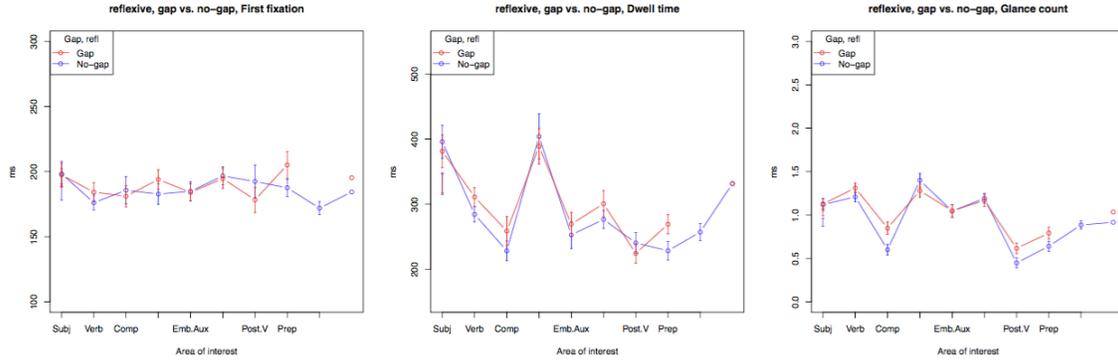
Figure 9: Reflexive, First fixation, Dwell time and glance count

As stated above, we are looking for gap-penalties, and more specifically, we are looking for different effects of the gap for the three different verb classes. However, first, it is worth pointing out that the overall reading times for the transitive verbs are much longer than the reading times for the intransitive and reflexive verbs, both in gap and no-gap condition. Moreover, we only find a significant effect of the gap on the preposition - there are significantly more and longer fixations on the preposition in the gap condition. The effect is most clear for the transitive verbs. We don't see any effect directly on the post-verbal element (a direct object for the transitive verbs, a particle for the intransitive verbs and the reflexive pronoun for the reflexive verbs. This is surprising, especially for the transitive verbs (compare Stowe 1986). No significant gap effect is found on the verb either.

The most interesting result here for Norwegian is the absence of a gap-penalty for the transitive verbs.

2.3.2 Filler-Gap English (Reading Time)

As a comparison, we ran the same experiment on English, and in this case we did find a gap penalty and an effect at the immediate post verb position for transitive verbs.
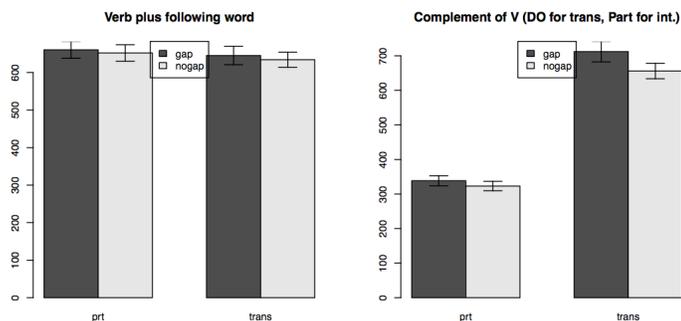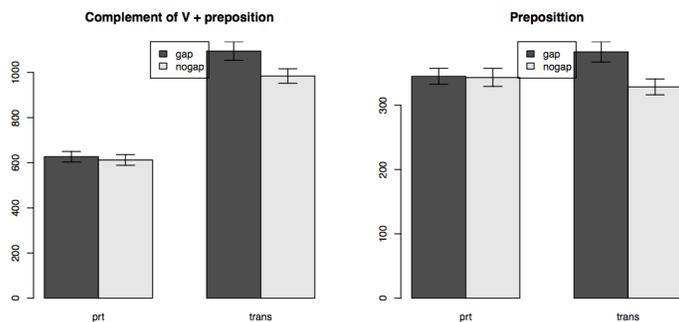
Figure 10: English results 1

Figure 11: English results 2

So once again, our attempts to directly compare English and Norwegian expose surprising differences between the two languages in linguistic processing that could not have been anticipated from the literature. In this case, we found that even in the case of unambiguously transitive verbs, Norwegian processing of the filler-gap paradigm showed no effect of 'expecting a gap' in the direct object position of the transitive verb, although one was found in English (replicating the results from the literature). The Norwegian subjects seem to be expecting a gap after the preposition, rather than after the verb.

Since we were intrigued by this result, we wanted to check whether there were any strong differences to be found in the corpora for English and Norwegian in terms of the proportion of transitiive verbs used. In other words, we wanted to know whether there were any differences in frequency that might affect the predictability of having a transitive verb. In English the transitive verb is the most common, default, option for a verb, so the parser is justified in predicting that verbs will be transitive and in expecting that words like *who* or *what* come from direct object position. However, maybe the reality in Norwegian is a bit different.

2.3.3 Corpus Comparison

We did an extensive corpus investigation of translated texts (both where the original language was English, and where the original language was Norwegian) to compare the counts.

What we discovered was:

Norwegian is a V2 language. When the main verb has moved, several elements can intervene between the verb and the direct object:

(13)   a.   Igår köpte <u>Kalle</u> ett paraply.
              Yesterday John bought an umbrella.
        b.   Kalle köpte <u>nyligen</u> ett paraply.
              John recently bought an umbrella.
        c.   Kalle köpte <u>inte</u> ett paraply.
              John did not buy an umbrella.

Higher preference for direct objects over PP-objects in English.

Percent direct objects and V-DO order.

	Eng, +DO	Nor, +DO	Eng, +V-DO	Nor, V-DO
Gaarder	41	38	40	36
Rowling	44	35	41	32
Rankin	50	42	42	34
Kinsella	44	37	42	34
All novels	47	39	42	34
Blogs	49	39	39	31

(14)   a.   as he left the house (V+DO)
        b.   Så gikk han ut (PP)

(15)   a.   ...then he jerked his head around to look again (V+DO)
        b.   ...men s bråsnudde han på hodet for å se etter en gang til (PP)

(16)   a.   He drummed his fingers on the steering wheel (V+DO)
        b.   Han trommet med fingrene mot rattet (PP)

(17)   a.   ...until he passed a group of them (V+DO)
        b.   ...helt til han kom forbi en ny klynge (Adv)

(18)   a.   He eyed them angrily as he passed (V+DO)
        b.   I forbifarten glante han sint på dem (PP)

(19)   a.   ...clutching a large doughnut in a bag (V+DO)
        b.   ...med en stor smultring i en pose i hnden (PP)

This material was given as a presentation in a workshop on processing in the scandinavian languages in Lund, and we are working on a paper that integrates both experimental studies with the corpus work that was done.

2.4   Experiment Group IV: Garden Paths and a New Methodology for Testing Transitivity

Most syntactic priming studies have used the dative alternation as the subject of study, and most studies have targetted priming in production rather than comprehension. It has even been suggested that priming in comprehension is purely lexically driven, and thus only shows up prime and target verbs are identical, see e.g. Branigan, Pickering McLean, 2005, Arai,

Van Gompel Scheepers 2007, but see Thothathiri Snedeker, 2008 for evidence for abstract, syntactic priming in comprehension.

Our final study was devised in an attempt to establish a paradigm for priming of (in)transitivity in comprehension. Our project goal is to test different classes of intransitive verbs against each other, e.g. Unaccusative vs. unergative verbs, morphologically marked vs. morphologically simple verbs, verbs with PP-arguments vs. verbs followed by PP-adjuncts. But to do this, we need a paradigm that is not dependent on semantic identity or similarity between two alternants (as in e.g. the dative alternation or the active-passive alternation), as optionally intransitive verbs are not semantically identical to their transitive altnernants (c.f. 'John ate' 'John ate an apple', 'John broke the cup' 'The cup broke'). Unfortunately no such paradigm was available in the literature and we had to create our own. The experiment we describe here tested the workability of the paradigm in both English and Norwegian, and got clear positive results in both languages.

The results show that having read an intransitive version of an optionally transitive verb makes it more likely to parse a subsequent verb, either within of outside the current sentence, as intransitive.

2.4.1   The Experiment

A self-paced reading experiment was carried out at the University of Edinburgh with adult first language English speakers, N = 15. The test items (12) were of the type exemplified in 1, where an initial subordinate adjunct contained a optionally transitive verb, with the following argument always belonging to the main clause. The experiment was set up so that the previously read sentence, the prime, always ended with a subordinate clause of the same type as the initial clause in the target. The prime was either tranisitve or intransitive:

Prime transitive: The cat threw up on the floor while the boy was cleaning his room.
Prime intransitive: The cat threw up on the floor while the boy was cleaning.

Both prime and target were presented as moving window self-paced reading, with two words visible at the time, as exemplified for the target below:
Target: While the man was eating his best friend entered the restaurant

All participants did two versions of the test, with 20 minute break in between. Each version of the test contained in total 72 sentences, which were all slightly different in the two versions, except for the test items.

The effect of the prime manipulation significant. A mixed effect linear model was fitted with total reading time from the head noun (?friend? in the example above) as dependent variable, and Prime type (Intransitive or Transitive) as predictor. The models further included random intercept for Subject and Item, and by-subject slopes for Prime type and experiment version. The reading time for the relevant part of the sentence was significantly shorter when the test item had been preceded by a an intransitive prime compared to a transitive prime: β

22

= -95, SE = 40, t value = -2.36. (360 observations, 15 participants, 12 items in two version).

The cat threw up on the carpet while the boy was cleaning (his room):
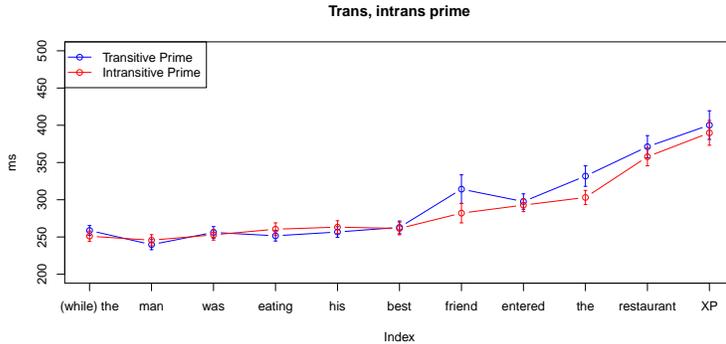
We interpret the result as following: Readers were more likely to assign an initial intransitive parse to the optionally transitive target verb when primed by an intransitive verb, and thus not have to reanalyse the structure at a later stage.

A follow-up experiment was conducted in Norwegian at the University of Tromsø with adult first language speakers of Norwegian. The set up was identical to the English experiment, 12 test items, total 72 sentences, two versions of the test where everyone did both versions. However, in the Norwegian version, the prime was presented within the target sentence as a relative clause modifying the subject. As in the English version, the subordinate clause contained an optionally transitive verb, and the transitivity was manipulated in the prime. The target was a relative clause modifying an indirect object and the following DP:

Transitive prime + target

Kvinnen som strikket en genser gav mannen som spiste en rosebukett til bursdagen i fjor.

?The woman who knitted a sweater gave the man who ate a rose bouquet for his birthday last year.?

Intransitive prime + target

Kvinnen som strikket gav mannen som spiste en rosebukett til bursdagen i fjor.

?The woman who knitted gave the man who ate a rose bouquet for his birthday last year.

(20)   Kvinnan som stickade gav mannen som åt en blombukett i födelsedagspresent.

	Verb	Post1	post2	Post 3
Trans. :	465	458	471	517
Intrans :	563	489	472	480

Again, the effect of the prime manipulation significant. A mixed effect linear model was fitted of the same effect structure as in the experiment 1 with total reading time from the head noun (here, ?flower? in the example above).The reading time for the relevant part of the sentence was significantly shorter when the test item had been preceded by a an intransitive prime compared to a transitive prime: $\beta = -144$, SE = 63, t value = -2.28. (576 observations, 24 participants, 12 items in two version).

The results from the two experiments show that it is possible to influence the lilelihood of the initial parse of optionally transitive verb by first exposing a reader to a transitive or intransitive structure. We want to make the claim that readers will be more likely to parse a variable verb as intransitive when primed by an intransitive clause, either within or outside

the sentence. This is, as far as we are aware, the first experimental result that shows priming in comprehension of transitivity.

The paradigm used in the experiments can be further used to test more specific hypotheses about the structural similarities of different types of intransitive verbs, both within and across languages. More generally, the paradigm can give us new insights into the question whether abstract priming is mainly sensitive to syntactic, semantic or possibly prosodic similarities between different constructions.

This study is our most recent experiment and was accepted as a poster presentation at the most recent AMLaP in Bilbao. While this experiment does not yet clearly advance our understanding on the questions under study in this project, it shows the use of a novel paradigm for testing transitivity effects which is a new contribution to the processing literature. Thus, the paper will be written up as a methods paper for a general processing journal. For our own research questions, we have a number of follow up studies planned that will allow us to probe the Norwegian verb types in *seg* for transitivity profile.

3 Overall Discussion of Results and Big Picture Implications

We found that English and Norwegian differ substantially in their conceptualization of anti-causative verbs. In English the transitive version is formed by simply causativizing an intransitive core. In Norwegian, the transitive appears to be basic, and the *seg*-marked alternate appears to require some kind of self-causing interpretation, or at least one in which the single argument is responsible for its own change of state in some way.

In English, the so called ambiguous verbs did not behave in an intermediate way with respect to transitivity, nor did they have a completely anomalous behaviour because of the ambiguity 'problem'. Rather, we discovered that the English alternating verbs in our test group actually seemed to behave more like intransitives than transitives.

We struggled with establishing whether the *seg*-marked verbs in Norwegian behaved more like transitives or intransitives with respect to processing. One problem we had not anticipated was the lack of clear diagnostic processing effects of transitivity that could be deployed in a convincing way. In the course of devising our experiments, we discovered more surprising differences between English and Norwegian. The first was that unlike English, Norwegian parsing strategies do not automatically seem to assume a direct object immediately following a verb. We discovered significant differences comparing the corpora of the two languages that correlated with this finding.

Finally, because of the lack of diagnostic tests for transitivity, we devised an independent test of our own which we piloted to great success. Essentially, we discovered a new paradigm involving structural priming in comprehension, which we intend to use in further work testing verb types in these two and other languages.

All in all, we performed many more and more methodologically varied experiments than the original project envisaged. We used eye tracking as a methodology in addition to the projected self paced reading, and we visited the University of Edinburgh twice not once to test English speakers there.

We discovered that it is unwise to extrapolate from English to expectations of how processing is going to take place in Norwegian. Assumptions about commensurability in processing (although standard in the literature) turned out to be unwarranted, and this made our project more complex in implementation but also potentially more exciting.

3.1 Expertise Building and Young Researcher Training

During the 3.5 years that the project lasted, the UiT linguistics unit has gone from having no psycholinguistics research to hosting a flourishing and varied experimental environment. The project money contributed by NFR and UiT allowed Lundquist to devote his time to acquiring the statistical and experimental design expertise necessary to do legitimate academic work in this area. When the language acquisition (LAVA) group at CASTL acquired an eyetracker, it was Lundquist who ran the machine, designed the first experiments and did the first statistical analyses. Now, after 3.5 of Transitivity Alternations, Lundquist has been hired in the position of lab manager and statistics consultant for the MIMS group (http://site.uit.no/lava/micro-variation-in-multilingual-acquisition-attrition-situations-mims/) in a førsteamanuensis position for 3 years. The research training and expertise building goals of the project have been amply fulfilled, and the new groups connected to LAVA within CASTL have been beneficiaries of this increase in knowledge of tools and methodologies in the linguistics arena. We think this is exactly the kind of added value that should flow from a project such as this, and it was part of our original proposal to build the expertise that we actually managed to do. We have also uncovered a large number of research questions and follow up experiments that will keep the original project members busy in the future. We anticipate at least two further publications will finally appear based on the experiments completed during the project period.

The presentations and posters connected to the project can also be accessed via the project's website on https://sites.google.com/site/gillianramchand01/home/transitivityalternations

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