

## **The Transitivity Index**

### **Adding hierarchical structure to the transitivity parameters**

Hopper and Thompson (1980) propose that transitivity should be modelled as a scale and not as a categorical property. They propose ten binary (*high* vs. *low*) parameters: PARTICIPANTS, KINESIS, ASPECT, PUNCTUALITY, VOLITIONALITY, AFFIRMATION, MODE, AGENCY, AFFECTEDNESS OF O, INDIVIDUATION OF O. A weakness of this approach is the lack of hierarchical structure among the parameters, thus assuming that all parameters are equally important across constructions (Givón 1995, Malchukov 2006). This paper presents an innovative framework to derive a dynamic, structure-dependent hierarchy for the transitivity parameters.

I take the proposal that transitivity is a scale at face value and derive a continuous weighted measure of transitivity: **The Transitivity Index (TI)**. By virtue of being a *weighted* measure, the TI incorporates the underlying hierarchy among the parameters. Crucially, this hierarchy is not static but determined by the construction the index is applied to. The TI is used to study three phenomena in Spanish: (i) clitic case in causative constructions (1a), (ii) the alternation between the two causatives *dejar* “let” and *hacer* “make” (1b) and (iii) clitic case with reverse-psychological predicates (1c). The data comes from the Web-Dialect version of Corpus del Español (Davies, 2016). The data for (i) and (ii) contain 4589 observations and (iii) contains 4020 observations.

1.
  - a. Lo/le hizo dormir.  
‘He made him(Accusative/Dative) sleep’
  - b. La hizo/ dejó quedarse.  
‘He made/let her stay’
  - c. La/le asustan las arañas.  
‘Spiders frighten her(Accusative/Dative)’

First the data is manually annotated for the transitivity parameters. To calculate the TI for each construction (i-iii) 1000 random forests are fit on 20% of the data with the parameters as independent variables. The dependent variables are CLITIC CASE for (i) and (iii) and CAUSATIVE for (ii). Next, the variable importance is calculated for each random forest. The final weight for each parameter is the mean of the 1000 variable importance scores. With this procedure, we get a numerical value of each parameter weight and their ordering in importance as shown in Table 1 (only the first two shown). After this first step, all *high* values of the parameters are replaced with the numerical weights and all *low* values with zero. The final TI is normalized from 0-1 for ease of interpretation.

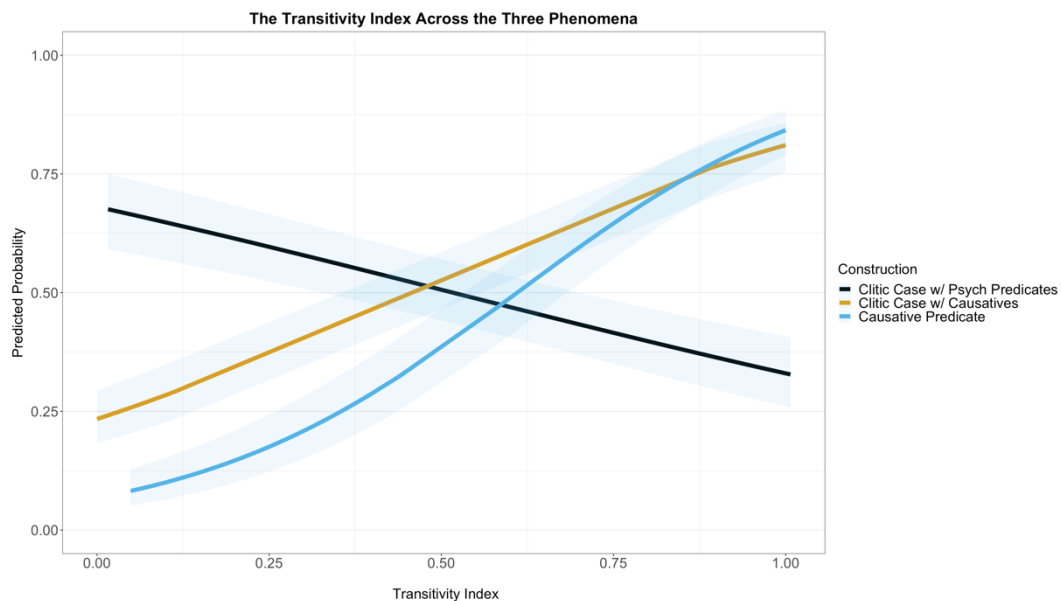
The TI is then used in three different mixed-effects logistic regression models as a predictor of each of the dependent variables in (i-iii). The results are shown in Fig. 1. The plot shows the predicted

probabilities of the dative clitic for (i) and (iii) and of the causative *hacer* ‘make’ for (ii). In a nutshell, the dative clitic is associated with higher transitivity with the causative predicates but with lower transitivity with psych-verbs. The causative *hacer* is associated with higher transitivity.

The advantage of the TI is that it is sensitive to the construction it is applied to because the parameter weights must be calculated for every new construction. In addition, the computation of the TI adds hierarchical structure to the parameters as the weights indicate the relative importance of each parameter for a specific construction. Moreover, since the TI is standardized from 0-1 it can be used to compare different constructions in terms of transitivity both within and across languages.

Clitic Case with Causatives		Causatives		Clitic Case with Psych Verbs	
Parameter	Mean	Parameter	Mean	Parameter	Mean
PARTICIPANTS	0.122	AFFIRMATION	0.129	PUNCTUALITY	0.048
AGENCY SUBJECT	0.007	AGENCY SUBJECT	0.043	NUMBER OBJECT	0.031

**Table 1.** Mean weights of the three most important transitivity parameters.



**Figure 1.** Predicted probabilities from the mixed-effects models with the TI as main predictor and VERB and COUNTRY as random intercepts. The y-axis represents the predicted probabilities of the dative clitic with psychological and causative predicates and of the causative *hacer*.

**References:**

Davies, Mark. (2002). *Corpus del Español*. Available on [http:// www.corpusdelespanol.org](http://www.corpusdelespanol.org)  
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 Hopper, Paul & Sandra Thompson. 1980. ‘Transitivity in Grammar and Discourse’, *Language* (56), 251–299.  
 Malchukov, A. (2006). Transitivity parameters and transitivity alternations. *Case, valency and transitivity*, 77, 329-357.