



### BACKGROUND

- Past research suggests that morphological complex words (e.g., darkness, hunter) undergo a rapid morphological segmentation early on during visual word recognition. Importantly, this occurs irrespectively of the semantic relationship between the constituent morphemes of these words (e.g. Rastle et al., 2004).
- Evidence for this stems primarily from masked priming studies, paired with a lexical decision task. These studies have repeatedly shown that the recognition of a target word is facilitated by the prior presentation of a semantically transparent (e.g., dealer - DEAL) or a semantically opaque (e.g., corner - CORN) prime, but not by a non-morphological orthographic prime (e.g., public - PUB).
- However, while morphological segmentation has been widely documented during visual word recognition in a native language (L1), it remains unclear whether the same effect occurs during non-native language processing (e.g., see Heyer & Clahsen, 2015 & Diependaele et al., 2011, for contradictory findings), and whether these are modulated by the reader's level of proficiency in their non-native language.

### AIMS

- To examine differences in the morphological processing of words in native (L1) and non-native (L2) language.
- To examine whether and how morphological processing in non-native language is influenced by L2 proficiency.

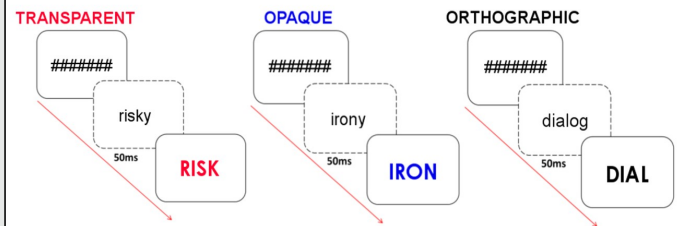
### METHODOLOGY

#### PARTICIPANTS

- 81 native speakers of Italian (26 males, age range 18-33) with English as their second language.
- L2 proficiency was assessed via a battery of tests (phonetic discrimination, spelling, vocabulary, morphological awareness, oral, and reading comprehension).

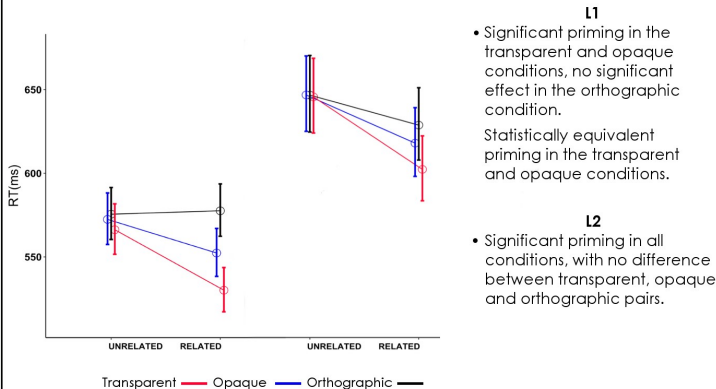
#### DESIGN

- Target stimuli: 50 prime-target pairs in each of three conditions, **transparent**, **opaque**, and **orthographic** (see Figure below), in each of the two languages tested (Italian as L1, and English as L2).
- Paradigm: masked priming with a lexical decision.

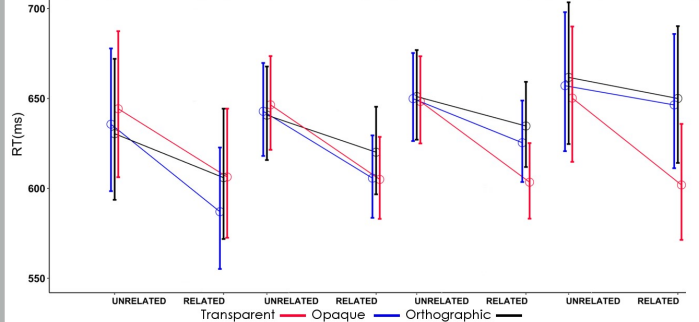


### RESULTS

#### PRIMING IN L1 AND L2



#### PRIMING IN L2 AS A FUNCTION OF PROFICIENCY



- Decrease in opaque and orthographic priming as proficiency increases, and particularly when this latter becomes high. Transparent priming remains constant instead.

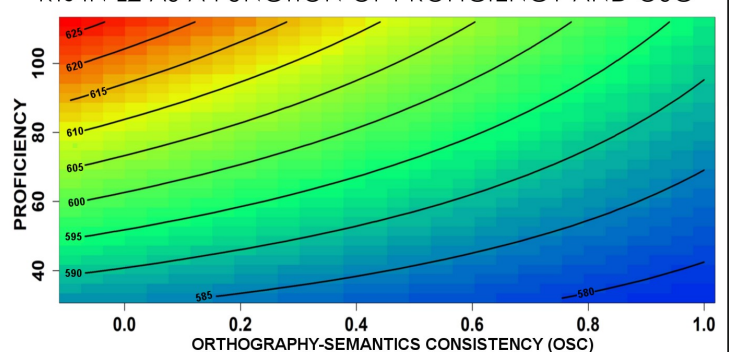
#### ORTHOGRAPHY-SEMANTICS CONSISTENCY

- With higher proficiency L2 readers, RTs to transparent items are quicker overall (i.e., independently of prime relatedness) than to opaque and orthographic items. This is the same pattern found in the L1 literature by Marelli et al. (2015), and explained through **Orthography-Semantics Consistency (OSC)**.
- OSC is the mean semantic similarity between all members of a same orthographic family (e.g., corn, corner, cornet, cornell, cornwall, corns, cornish). Essentially, it tracks how easily we can guess the meaning of a word, based on the presence of a possible stem (or, in principle, of any other orthographic cue). Formally:

$$OSC(t) = \frac{\sum_{x=1}^k f_{r_x} \cos(\vec{t}, \vec{r_x})}{\sum_{x=1}^k f_{r_x}}$$

- Where  $t$  is the target word,  $r_x$  each of its  $k$  orthographic relatives, and  $f_{r_x}$  the corresponding frequencies extracted from English corpora. The OSC measure is a 0-to-1 where values close to 0 identify words that are bad orthographic cues for their associated meanings, and values close to 1 indicate an almost perfect association between form and meaning.
- Based on this definition, one would predict the effect of OSC to grow with proficiency, which is indeed what we observe (see Figure on the right).

#### RTs IN L2 AS A FUNCTION OF PROFICIENCY AND OSC



- Reaction Times (RTs) - color coded from blue, shorter, to red, faster - as a function of OSC and proficiency. The effect of OSC (i.e., the horizontal color gradient) is larger at high proficiency.

### CONCLUSIONS

- Results suggest markedly different priming between L1 and L2.
- Morphological priming in L2 is decisively qualified by proficiency. Low proficiency readers do not make any use of morphology -- their priming pattern is entirely driven by orthographic overlap.
- Readers with higher proficiency capture morphology, but still with one fundamental difference from native speakers, as complex primes are only effective if they are semantically transparent.
- At higher level of proficiency word processing is influenced by the implicit learning of association between form and meaning.

#### References

Diependaele et al. (2011). *Journal of Memory and Language*, 64, 344-358; Heyer and Clahsen (2015). *Bilingualism: Language and Cognition*, 18, 543-550; Rastle et al. (2004). *Psychonomic Bulletin & Review*, 11, 1090-1098; Marelli, et al. (2015). *The Quarterly Journal of Experimental Psychology*, 68(8), 1571-1583.