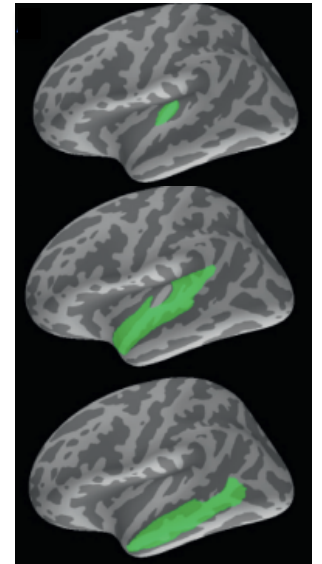# HEARING MORPHEMES

Brains as sound predictors

- Our brains make continuous predictions about the next speech sound (phoneme).

- Surprising sounds drive auditory cortex more.

- **A surprising sound that is part of a new morpheme drives auditory (and surrounding) cortex more than a surprising sound that is just part of the next syllable** (Ettinger, Linzen & Marantz, 2014)

Monomorphemic

bourb**on** (more predictable)

burb**le** (more surprising)

surprising
ending

Bimorphemic

bruis**es** (more predictable)

bruis**er** (more surprising)

surprising
ending that is
a morpheme

kataba كَتَبَ or كتب "he wrote" (masculine)

katabat كَتَبَت or كتبت "she wrote" (feminine)

katabtu كَتَبْتُ or كتبت "I wrote" (f and m)

kutiba كُتِبَ or كتب "it was written" (masculine)

kutibat كُتِبَت or كتبت "it was written" (feminine)

katabū كَتَبُوا or كتبوا "they wrote" (masculine)

katabna كَتَبْنَ or كتبن "they wrote" (feminine)

katabnā كَتَبْنَا or كتبنا "we wrote" (f and m)

yaktub(u) يَكْتُبُ or يكتب "he writes" (masculine)

taktub(u) تَكْتُبُ or تكتب "she writes" (feminine)

naktub(u) نَكْتُبُ or نكتب "we write" (f and m)

aktub(u) أَكْتُبُ or أكتب "I write" (f and m)

yuktab(u) يُكْتَبُ or يكتب "being written" (masculine)

tuktab(u) تُكْتَبُ or تكتب "being written" (feminine)

kitāb كِتَاب or كتاب "book" (the hyph

kutub كُتُب or كتب "books" (plural)

kutayyib كُتَيِّب or كتيب "booklet" (dir

kitābat كِتَابَة or كتابة "writing"

kātib كَاتِب or كاتب "writer" (masculi

kātibat كَاتِبة or كاتبة "writer" (femini

kātibūn(a) كَاتِبُونَ or كاتبون "writers"

kātibāt كَاتِبات or كاتبات "writers" (fe

kuttāb كُتَّاب or كتاب "writers" (broke

katabat كَتَبَة or كتبة "clerks" (broke

maktab مَكْتَب or مكتب "desk" or "off

makātib مَكَاتِب or مكاتب "desks" or "

maktabat مَكْتَبَة or مكتبة "library" or "

maktūb مَكْتُوب or مكتوب "written" (pa

katībat كَتِيبة or كتية "squadron" or

katā'ib كَتَائِب or كتائب "squadrons" (

iktitāb اِكْتِتَاب or اكتتاب "registration"

muktatib مُكْتَتِب or مكتتب "subscribe

muktatab مُكْتَتَب or مكتتب is "subsc

istiktāb اِسْتِكْتَاب or استكتاب "causing

Role of morphology in sound-by-sound prediction of Arabic words

- In Semitic languages such as Arabic and Hebrew, morphemes are arranged in an interleaved manner:

$$K \quad A \quad T \quad A \quad B \quad A$$

root morpheme
ktb

pattern morpheme
-a-a-a

- The morphemes are less "spottable," given the interleaving.

- Does morphological structure nevertheless have important predictive value for brain activity, like in languages in which morphemes are linearly ordered one after the other?

Gwilliams & Marantz, 2015, *BRLN*

Role of morphology in sound-by-sound prediction of Arabic words

- In auditory perception, do Arabic speakers make predictions on the basis of the whole word, or does the root play a special role?

$$K\ A\ T\ A\ B\ A \qquad\qquad p(\,B\mid KATA\,)$$

$$K\ T\ B \qquad\qquad\qquad p(\,B\mid KT\,)$$

Gwilliams, L., & Marantz, A. (2015). Non-linear processing of a linear speech stream: The influence of morphological structure on the recognition of spoken Arabic words. *Brain and language*, 147, 1-13.

Role of morphology in sound-by-sound prediction of Arabic words

- In auditory perception, do Arabic speakers make predictions on the basis of the whole word, or does the root play a special role? **YES!**
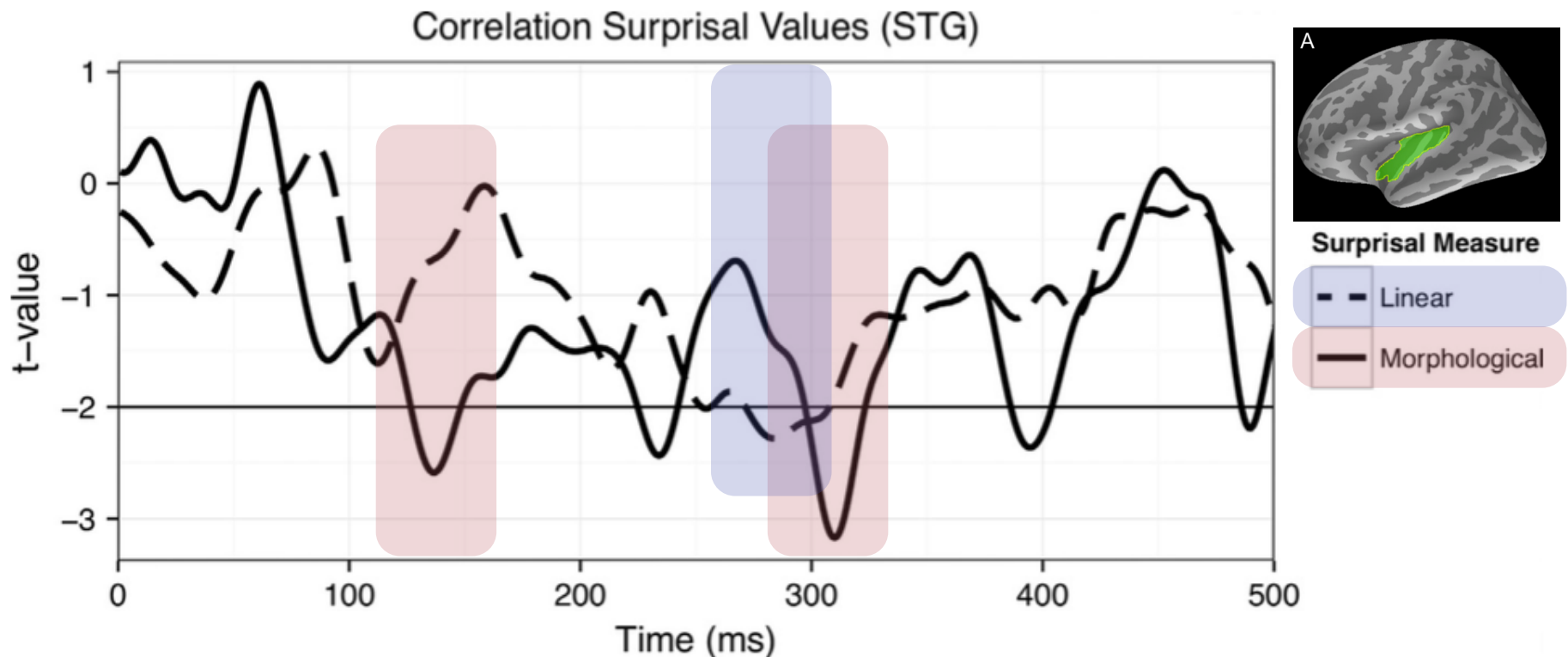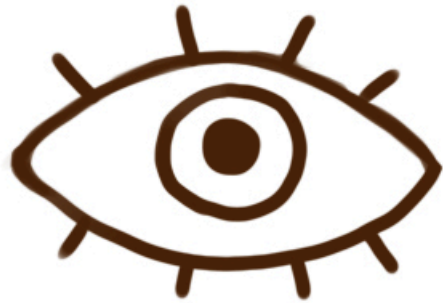

Gwilliams, L., & Marantz, A. (2015). Non-linear processing of a linear speech stream: The influence of morphological structure on the recognition of spoken Arabic words. *Brain and language*, 147, 1-13.

Our brains see morphemes, as one of the earliest stages of visual form word recognition.

Our brains hear morphemes, computing the probabilities of upcoming sounds based on morphological structure.