Copy Task Construction

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Context

In the creation of digital texts, typing skills are a factor that could influence text production. Therefore, the current copy task is designed to create a set of measures that allows a fine grained analysis of low level typing and motor skills.

Publications

For more information on the Inputlog copy task, we are happy to refer you to the following publications:

- Van Waes, L., Leijten, M., Pauwaert, T., & Van Horenbeeck, E. (2019). A multilingual copy task: Measuring typing and motor skills in Writing with Inputlog. *Journal of Open Research Software, 7*(1:30), 1-8. https://doi.org/10.5334/jors.234 (open access)
- Van Waes, L., Leijten, M., Roeser, J., Olive, T., & Grabowski, J. (underreview). Designing a Copy Task to Measure and Assess Typing Skills in Writing Research. *Journal of Writing research, x*(x).
- Van Waes, L, Leijten, M, Mariën, P and Engelborghs, S. (2017). Typing competencies in Alzheimer's disease: An exploration of copy tasks. *Computers in Human Behavior*, *73,* 311–319. DOI: https://doi.org/10.1016/j.chb.2017.03.050
- Source code and technical documentation:
  - GitHub: https://github.com/Ivanwaes/Inputlog-Copy-Task
  - Zenodo link: https://doi.org/10.5281/zenodo.2908966

Implementation

We have opted for a java based web interface that stepwise guides the participants through the different components of the copy task. A progress bar at the right of the screen indicates the task stages. The interface has been adapted for Chrome, Internet Explorer, Firefox and Safari.
The copy tasks are coded as XML-files and can be created by using the '*Inputlog copy task creator*'. It is our intention to develop a comparable copy task for different languages, based on the same underlying principles.

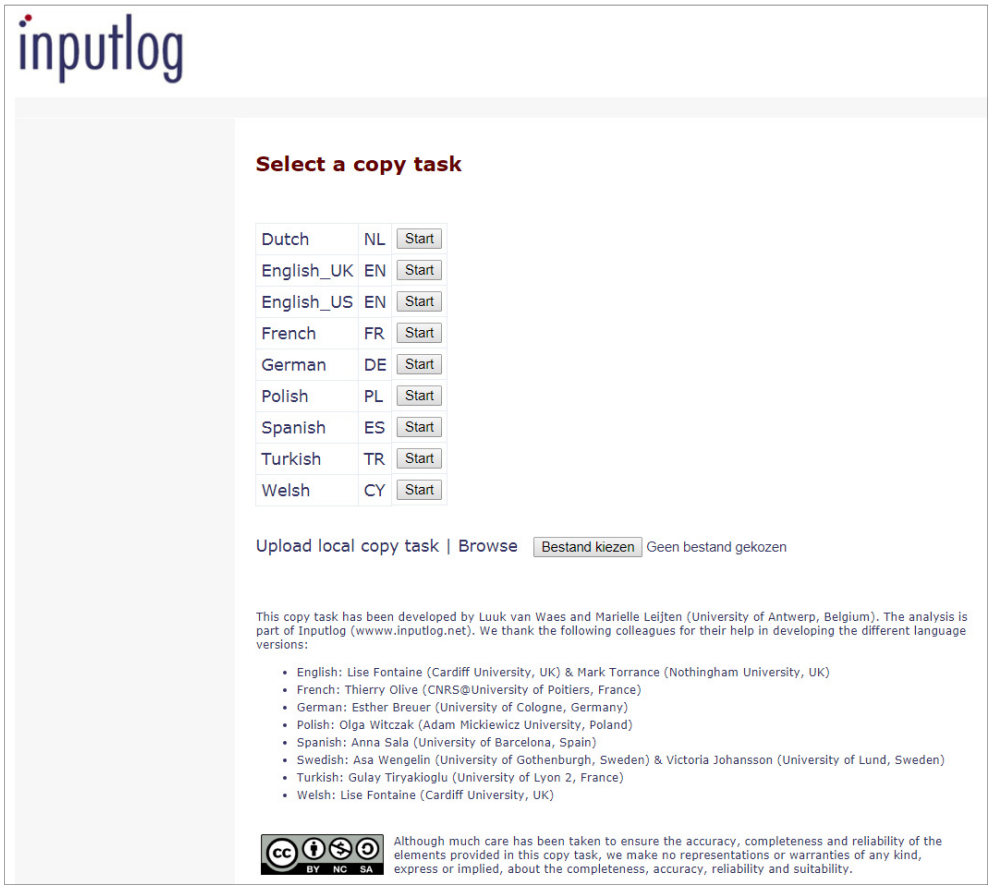
Components

The copy task (e.g., English UK - Qwerty) consists of the following components:

Selection	selection of copy task (language specific)
Identification	participant identification (name, age, gender, session, keyboard)
Introduction	general task instruction
Tapping task	press the 'd' and 'k' key alternatively during 15 s
Sentence	copy a sentence
Example	dummy item explaining word combination tasks
Word combination 1	copy a combination of three words seven times
Word combination 2	copy a combination of three words seven times
Word combination 3	copy a combination of three words seven times
Word combination 4	copy a combination of three words seven times
Consonant groups	copy four blocks of six consonants
Extra information	extra participant information (handedness, hard and software used, education, L1, learning disabilities)
End	thank you (and download)

Language selection

The participants can select a predefined (default) copy task or can upload a specific task. The task can be accessed via the 'Record Tab' in Inputlog or via the following URL: `http://inputlog.ua.ac.be/WebSite/copytask/tasks.html`

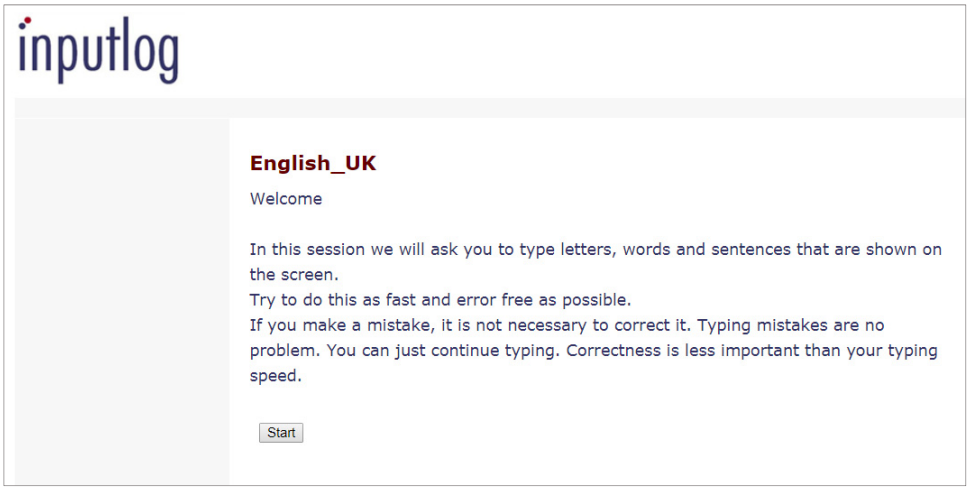


Participant identification

The participants are invited to provide some basic identification information: Name, age, gender, session name (if applicable) and keyboard layout. We also included a privacy notice to obtain consent from the participant, in line with the privacy policy stated in the General Data Protection Regulation (GDPR) of the European Union.

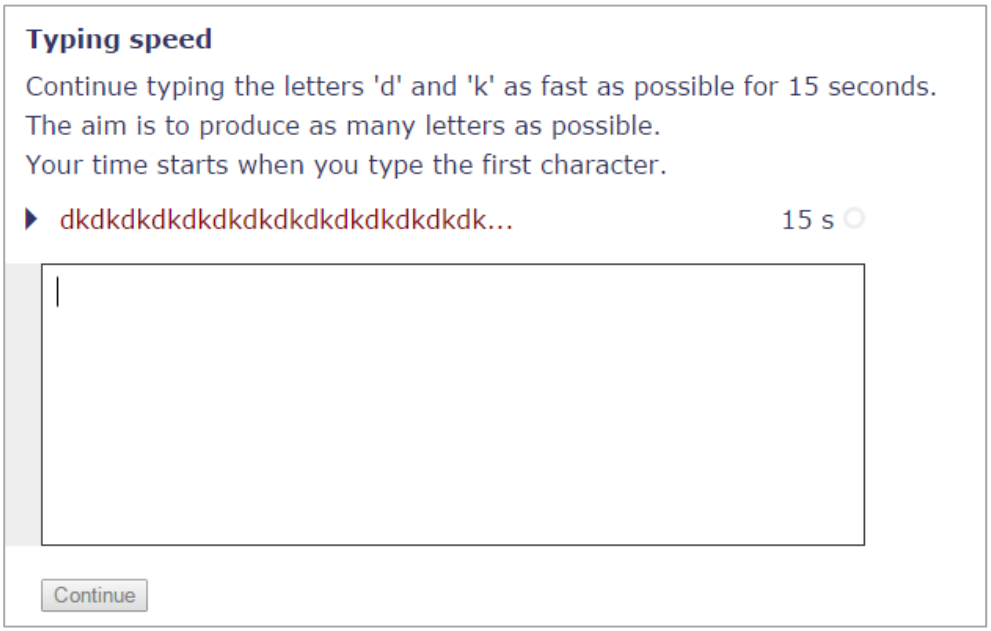
Introduction

The copy task is explained in a few lines.



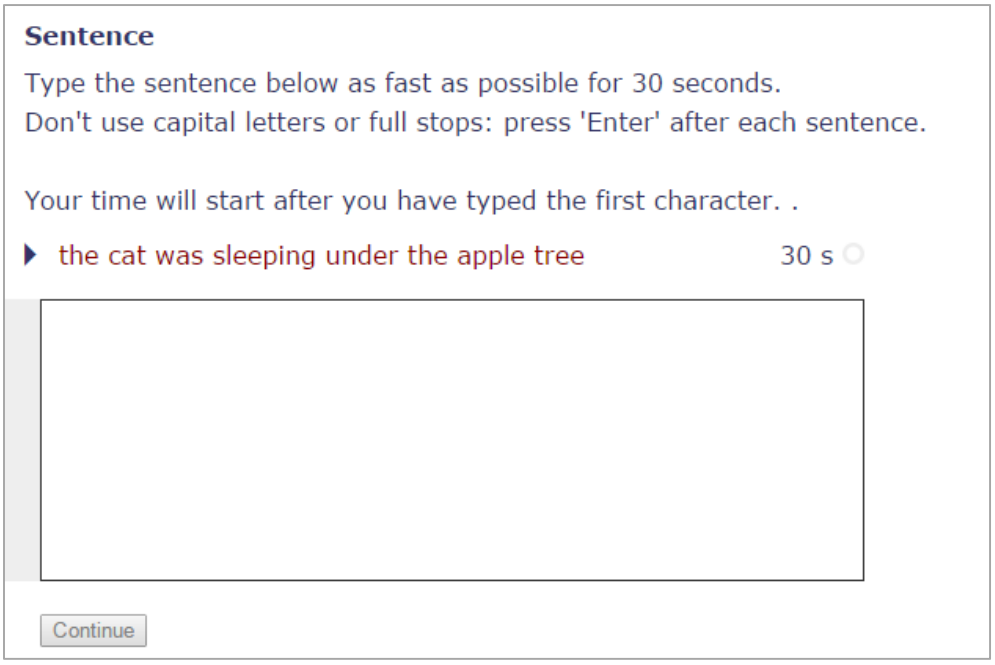
Tapping task

The tapping task intends to measure the fastest motor speed of pressing two keys with alternating hands (viz. 'd' and 'k', resp. a LeftRight and RightLeft hand combination). Finger-tapping tasks are commonly used to study the human motor system. Tapping tasks have the advantage of being simple enough to use in the study of both normal control subjects as well as those with neuropathologies affecting the motor system (Witt et al., 2008).
In this copy task a bimanual, self-paced tapping task is opted for. Participants are asked to type the 'd'-'k' key combination for 15 s. (Salthouse, T.A., 1984). A time circle at the top right corner is used as a time indicator.



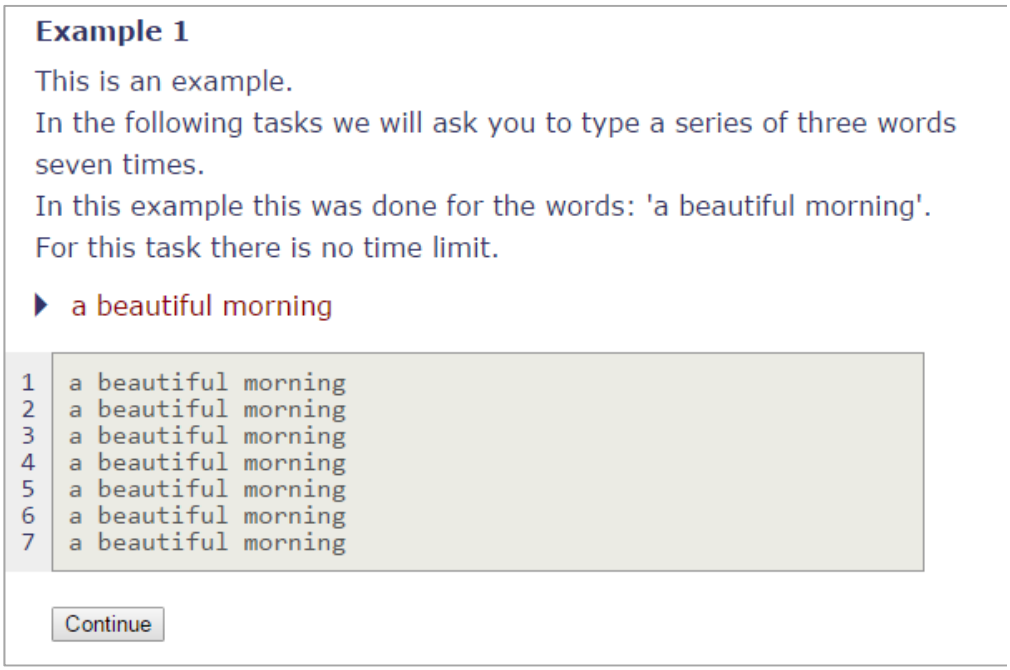
Sentence task

The sentence copy task intends to measure the typing skills related to copying a series of - short high frequency - words in a sentence context. Participants are asked to repetitively type this sentence for 30 seconds.



Example

An example is used to explain the next typing tasks, i.e. the repetitive (seven times) typing of a three word combinations.



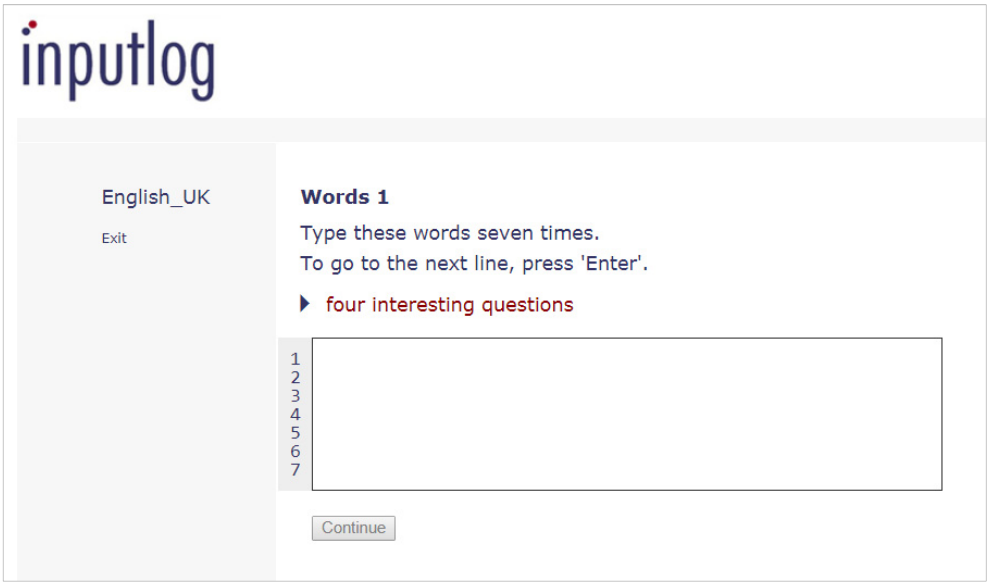
Word combinations 1 to 3 (HF)

Three sets of word combination are presented. In each word combinations high frequent bigrams are implemented spread over three words. Participants are asked to type these word combination seven times.

To create these word combinations we used the following criteria:

- three words per entry
- combination of a numeral + an adjective + a noun
- word length: between 19 and 24 characters in total - [3/4] + [10/12] + [8/10] characters (average number of characters per word combination: *M*: 22.3 (*SD*: 1.6)

- high frequency words (30% highest segment; lemma frequency)
- high frequency bigrams only highest 30 % percentile in CELEX/Subtlex or another comparable corpus based bigram frequency list)
- 18 to 20 high frequent bigrams in total (no LF bigrams)
- on average 3 to 5 bigrams for each hand combination (LL; LR; RL; RR)
- 5 to 7 keyboard adjacent bigrams
- no (or maximum one) repetitive keys



Word combination 4 (LF)

This word combination copy task intends to measure the typing skills related to low frequent bigrams in a three word noun phrase context. Participants are asked to type these word combination seven times.
To create word combination 4 we used the following criteria:

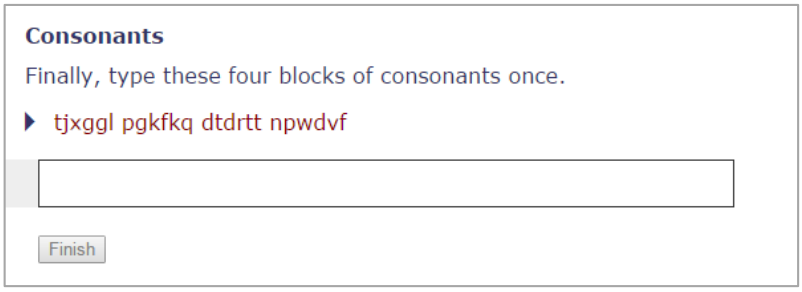
- three words entry
- combination of indefinite determiner/countable + adjective + noun
- word length: between 17 to 21 characters - [3/4] + [7/10] + [6/8] characters (average number of characters per word combination: *M* 19.0 *SD*: 1.3)
- 3/4 low frequent bigrams (< 50% percentile in CELEX/SUBTLEX)
- no (or maximum 1) repetitive keys

Example

English_UK (Qwerty) "Copy task"	word combination 1	word combination 2	word combination 3	word combination 4
Word 1 (numerical)	four	seven	five	some
Word 2 (adjective)	interesting	wonderful	important	awkward
Word 3 (noun)	questions	surprises	behaviours	zigzags
#characters	24	23	23	18
Low Frequent bigrams (LF)	19	18	18	8
High Frequent bigrams (HF)	0	0	0	4
Left-Left (LL)	4	6	1	5
Left-Right (LR)	4	6	2	3
Right-Right (RR)	4	2	5	1
Right-Left (RL)	3	4	2	2
Adjacent keys	7	6	3	4
Repetitive keys	0	0	0	0

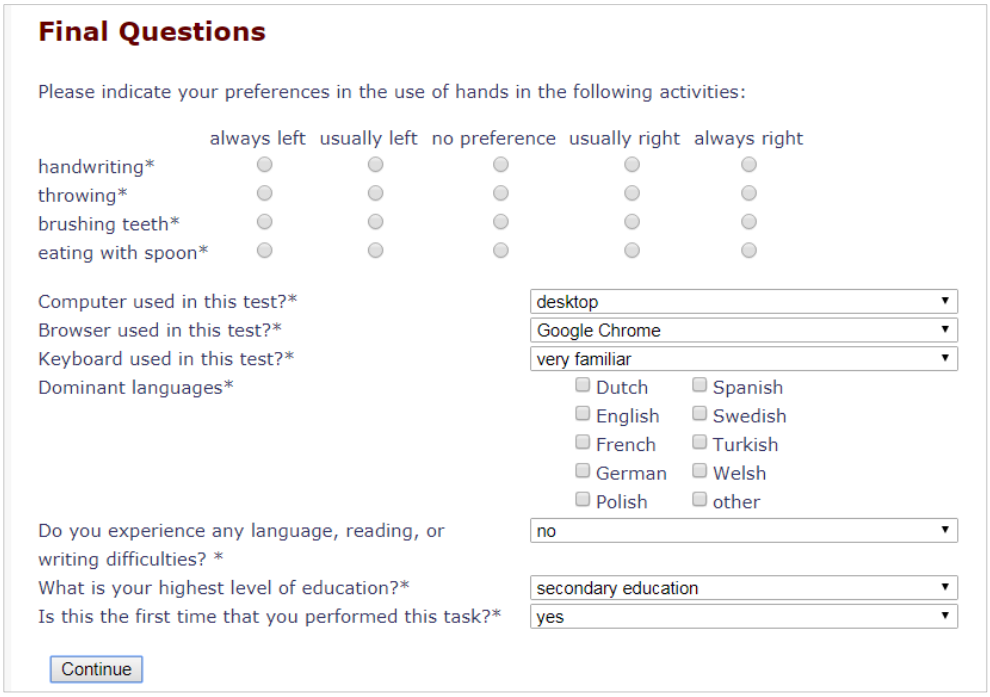
Consonant groups

The consonant copy task intends to measure the typing skills in a non-word context. Participants are asked to copy four blocks of six consonants once.



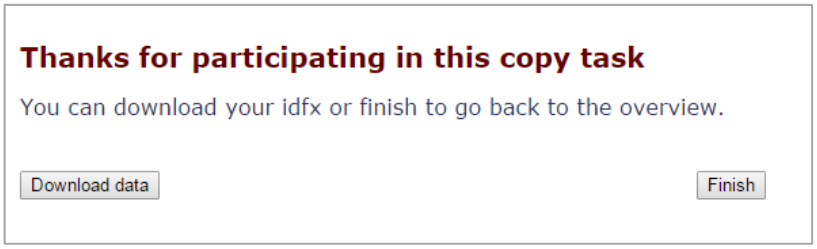
Extra information

We end the task flow with a final set of questions addresses respectively, handedness, hardware and software used, dominant language, reading or writing difficulties, and familiarity with this task.



Data storage

The final screen shows the data storage: online transfer to web server is done automatically and the off-line storage is possible by selecting the 'download' button.



Tools

- CELEX bigram frequency
  https://catalog.ldc.upenn.edu/LDC96L14
  Baayen, R, R Piepenbrock, and L Gulikers. CELEX2 LDC96L14. Web Download. Philadelphia: Linguistic Data Consortium, 1995.
- Subtlex word frequency
  http://crr.ugent.be/programs-data/subtitle-frequencies
  Walter J. B. van Heuven, Pawel Mandera, Emmanuel Keuleers & Marc Brysbaert (2014) SUBTLEX-UK: A new and improved word frequency database for British English, The Quarterly Journal of Experimental Psychology, 67:6, 1176-1190,

DOI:10.1080/17470218.2013.850521

- WordGen
  http://users.ugent.be/~wduyck/wwgman.htm
  Duyck, W., Desmet, T., Verbeke, L., & Brysbaert, M. (2004). WordGen: A Tool for Word Selection and Non-Word Generation in Dutch, German, English, and French. Behavior Research Methods, Instruments & Computers, 36(3), 488-499. (full text available here)
- Coded Excel file: Excel constructed to design a language specific copy task based on the criteria described above (contains frequency list, finger combinations, adjacency).
  Bigram_"Language"_coded_hand_freq_item construction.xlsx
- Inputlog Copy task Creator
  Part of the 'Service' menu in Inputlog 7.1 + manual
- Inputlog: copy task analysis
  Part of the 'Record' and 'Analysis' tab in Inputlog 7.1
  URL: http://inputlog.ua.ac.be/WebSite/copytask/tasks.html
- Keyboard lay-out
  AdjacentCharacters.exe (Eric Van Horenbeeck)
  Script that identifies hand combination, repetion and key adjacency on a keyboard
- Python scripts to extract bigram frequency
  - count_char_bigrams.py (by Maximiliana Behnke <maximiliana.behnke@ed.ac.uk>)
  A small python script that extracts frequency of character bigrams in subtlex corpora.
  - bigram_extraction_output.py (by Mike Kestemont)
  A small python script that extracts frequency of character bigrams in UTF8 csv word frequency lists.
- **Handedness test**
  Veale, JF. (2014). Edinburgh handedness inventory – short form: a revised version based on confirmatory factor analysis. *Laterality. 19(*2),164–177

References

Salthouse, T. A., Rogan, J. D., & Prill, K. A. (1984). Division of attention: Age differences on a visually presented memory task. *Memory & Cognition, 12*(6), 613-620. doi:10.3758/bf03213350

Witt, S. T., Laird, A. R., & Meyerand, M. E. (2008). Functional neuroimaging correlates of finger-tapping task variations: an ALE meta-analysis. *Neuroimage, 42*(1), 343-356.