

The Neuropsychological Gesture (NEUROGES) Analysis System – Behavioral and Automated Analysis in Research of Gesture and Speech Interaction

Instructors



Hedda Lausberg is a Full Professor of Neurology, Psychosomatic Medicine, and Psychiatry at the German Sport University Cologne. Her main research interests are the neuropsychology of expressive movement behavior and the development of methods for the analysis of expressive body movement. She has developed the NEUROGES system in a 10-years research project granted by the German Research Association.



Konrad Juszczyk is an Assistant Professor in Psycholinguistics Department, in Institute of Linguistics at Adam Mickiewicz University in Poznań, Poland. His main research interests are multimodal communication and metaphor in coaching sessions as well as gesture recognition software. Together with Kamil Ciecierski he has developed KINEMO – application for (semi)automatic annotation of hand movements used in interpersonal communication.

Content of the workshop

NEUROGES, developed by Hedda Lausberg, is an objective and reliable system for the analysis of speech-accompanying hand movements and gestures. Up to now, it has been applied for the analysis of hand movements and gestures in more than 500 individuals from different cultures (Germans, U.S. Americans, francophone and anglophone Canadians, Suisse, Koreans, Kenyans, and Papua New Guineans), including healthy individuals as well as individuals with brain damage and with mental illness. A recent review of 18 empirical studies using NEUROGES in combination with ELAN demonstrates a good reliability of the system (Lausberg and Sloetjes 2015).

Since neuropsychological research provides evidence that some gesture types are generated in the right hemisphere independent from left-hemispheric speech production (Feyereisen, 1987; Kita & Lausberg, 2008; Hogrefe et al., 2010), and phenomenologically, the existence of gesture - speech mismatches has been demonstrated (McNeill, 1992; Goldin-Meadow et al., 1993), NEUROGES offers the methodological approach to first analyze gestures as a means of expression per se, i.e., to analyze the mental image behind the gesture, and in a second step to examine the relation between gesture and speech. In a seven steps comprising assessment algorithm, the ongoing stream of hand movement behavior is segmented and classified according to movement criteria into more and more fine-grained units, resulting in a distinct analysis of gestures based on their visual appearance. The analysis algorithm is shown on the website <http://neuroges.neuroges-bast.info/neuroges-analysis-system> and illustrated by video samples.

The aim of the KINEMO software demonstration is to show how it may simplify and speed-up the mundane manual annotation process and raise the transparency and replicability of research in social interaction. Reliability of manual annotation of hand movements depends on researchers, trained raters and on the adequate coding systems (Stec 2014). However, manual annotation of spontaneous gestures used in conversation is known to be very time-consuming and laborious, reaching times 100 longer than the length of the annotated media (Lenkiewicz et al. 2012). Measurements used in research on gestures, such as gesture rate (per minute or per word) and amounts of certain gesture types or gestures with certain features, such as gesture space, hand-shape and orientation or gesture phase can be supported with automatic gesture recognition software. An example of such software is KINEMO.

The input data comes from MS Kinect v2 motion sensor. During recognition phase the program relies on LASG (Bressemer 2013) and NEUROGES (Lausberg 2015) coding systems as the theoretical frameworks. The output data consists of labelled hand movements and can be exported to the MS EXCEL, MPI ELAN or **THEME** software. Evaluation of the software performance was conducted on dialogues and monologues (20 participants and 400 minutes in total) recorded with MS Kinect and KINEMO software. Results of manual annotation ($K=0,6$) were compared with results of automatic annotation and F-score values were obtained for *movement* (0,80), *phasic* (0,62), *in space* (0,70). Other types of hand movements based on NEUROGES, such as *on body* or *in space* from *focus* step or left/right hand dominance from *Formal Relation* step and *baton* or *palm-out* from *type* step are also possible to be recognised and this recognition is in the process of development. We hope to discuss possibilities of its development.

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Workshop program

NEUROGES: *introduction, development and evaluation of the system, examples of annotations* (3h)

BREAK: 30 min.

KINEMO: *demonstration of the software and examples of application for gesture and speech interaction research* (1,5h)

Audience (max. 12 participants)

The workshop is open for any researcher and student involved in empirical gesture research. No pre-existing knowledge is assumed. However, knowledge in the application of the multimedia annotator ELAN is recommended for participants who wish to analyze videos in our practical part. These participants should bring their own laptop and preferably have ELAN installed (<http://tla.mpi.nl/tools/tla-tools/elan/download>).

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