

Gesture coding with the NGCS - ELAN system

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The Neuropsychological Gesture Coding System (NGCS) is a tool for empirical gesture research that combines an objective kinetic and a functional analysis of gestures. The NGCS is tailored to the annotation tool ELAN.

The NGCS is based on neuroscience research. While previous gesture classification systems were developed on the basis of gesture observation and their categories were heuristic, the NGCS links the phenomenology to the neurobiology of gestures. The theoretical assumption behind the NGCS is that its main kinetic and functional gesture categories are differentially associated with specific cognitive (spatial cognition, language, praxis) and emotional functions. This implies that the different gesture categories are generated in different brain areas. Studies on split-brain patients in whom the production of specific gesture categories in the right and left hemispheres was examined [1-5] and functional Magnetic Resonance Imaging (fMRI) studies [6] provide evidence that, indeed, the different gesture categories of the NGCS are generated in different brain regions. A second theoretical assumption behind the NGCS is that gestures are medium of communication and expression that conveys information per se. Again, this hypothesis is strongly supported by recent split-brain research: in these subjects, a substantial amount of communicative gestures is generated in the separate right hemisphere, i.e., independently from left-hemispheric language production [1,5]. Thus, the NGCS coding is primarily performed without sound, and only after the gesture analysis has been accomplished, the relation to the verbal context can be analyzed. The NGCS gesture categories are defined by kinetic features only and not by interpretation of the verbal context.

The NGCS consists of two complementary modules: The kinetic analysis (Module I) comprises the coding of gesture laterality, structure, and location. Based on these criteria, Module I coding provides objective, kinetically defined gesture units. In Module II, the gesture units are examined concerning their function: pointing, spatial information, pictorial information, prosodic emphasis, emotional expression, and interactive regulation. The functional analysis has been developed on the basis of gesture types the existence of which different gesture researchers had agreed on [7-11]. In addition, the NGCS includes gesture types derived from apraxia research [12-14]. Each functional main category contains several gesture types. The twenty-three gesture types each are defined by a specific combination of kinetic aspects including hand shape, hand position, path, efforts, planes, kinesphere, gesture space, involvement of body parts other than hands, and gaze.

Thus, the NGCS enables to classify gestures based on their kinetic features alone, i.e., by video analysis without sound. With this procedure, the objectivity of the gesture types is high (Cohen's κ .87) [5]. As a behavioral and neuropsychologically grounded method, the NGCS can be used for a broad range of study designs such as spontaneous gesture production in everyday conversation, structured elicitation of gestures by stimuli, or examinations of patients with brain damage or mental disease. The NGCS is presented in form of an ELAN-template.

ELAN [15] is one of the annotation tools that have come into existence with the maturation of digital media. Originating from the early twenty-first century, it was intended to support audio as well as video annotation and to be versatile enough to accommodate different fields of research. Where some tools specialized in e.g. field linguistics or audio-only speech analysis, ELAN became a member of the group of multimodal annotation tools.

Written in the Java programming language, ELAN is available for Windows, MacOS and Linux. It complies with standards like Unicode and its file format is XML-Schema based. There is support for up to four video files that can either be integrated in the main window or detached in a separate, resizable window. In combination with milliseconds as the time-units, this allows for the best possible spatial as well as temporal inspection of the media.

A basic annotation is a textual label or tag attached to a segment, defined by a begin and an end time, of the media. In ELAN annotations are grouped on tiers or layers; a tier acts as a container for annotations that typically refer to the same kind of events. The user can define and create as many tiers as needed and tiers can be grouped hierarchically.

This is a necessity in most transcription tasks of today; be it in annotation of multiple modalities or in interlinearized annotation of speech. In the case of NGCS separate tiers are created for each gesture category that needs to be coded.

A few features of ELAN make it a particularly useful tool for the kind of research based on a solid theoretical foundation and a well defined classification system, like the NGCS with its more or less standardized gesture types. The first of these features is the Controlled Vocabulary facility. A controlled vocabulary is a user definable list of values that logically belong to the same category or the same group. By creating a number of controlled vocabularies, each holding the values of specific aspects of the gesture types, an incarnation of the theoretical model can be constructed. In the annotation editing process the vocabularies are used to present the proper list of values, thus accelerating the transcription task and making it less error prone. An ELAN Template file holds the skeleton of a transcription file: the definitions of the tiers, their types (i.e. sets of constraints [16]) and the controlled vocabularies. A template document can be used as the basis for new transcription documents. Documents based on the same template constitute a consistent and comparable set of resources. Sharing templates between teams highly improves interoperability of research resources.

The search system of ELAN provides the means to construct complex queries based on the structural and temporal relationship between annotations. The search results can be exported to a tab-delimited text file for further processing in a statistical analysis application.

Thus, the NGCS – ELAN tool enables researchers to conduct objective gesture coding and facilitates quantitative as well as qualitative gesture research.

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