

Collecting Reaction-Time and Eye-Movement Measurements outside the Traditional Lab-Setting, Using DMDX, ELAN, and CHAT/CLAN

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1 The "traditional" lab-setting

Psycholinguists typically work in an environment that provides them with:

- a well-equipped lab with specialist equipment, such as (proprietary) specialised software and hardware for reaction-time (RT), eye-movement or brain-imaging measurements,
- a well-described language for which resources like grammars, dictionaries, lexical databases or pre-tested stimuli with naming accuracy and response-time information are available,
- a comparatively homogeneous pool of (computer)literate participants from the same culture as the researcher who have either taken part in experiments themselves before or are at least familiar with the concept of experiments.

2 Dealing with the lack of a fully equipped lab

2.1 Cheap and portable equipment

- For RT-measurements, a standard PC or laptop is often sufficient. For work with auditory stimuli or responses, a lightweight headset with a microphone is useful. A high-quality mouse or USB-game pad can be used as a button-pushing response device to provide better timing accuracy than a standard keyboard. For recording equipment, see e.g. <https://linguistics.stanford.edu/research/linguistic-fieldwork/advice-for-undertaking-fieldwork/>, <http://talkbank.org/> and links provided there.
- Not all eye-movement measurements involve reading or require high resolution. For some experimental paradigms, it is only important to determine when a participant looks at a particular object or picture in a set of two to four objects or pictures. This is, for instance, the case in the visual world paradigm, which is commonly used to study the time-course of language comprehension processes in participant groups that do not read (see e.g. Clackson, Felser, & Clahsen, 2011. Huettig, Rommers, & Meyer, 2011; Spivey, Tanenhaus, Eberhard, & Sedivy, 2002; Trueswell 2008). In such experiments, participants' eye-movements to individual objects or pictures in a display are measured while they listen to sentences or short narratives and look at the displays of objects or pictures, some of which were referred to in the stimulus text.

- For such experiments, one can use different types of "poor man's eye-trackers". All of them use a camera to record a video of participants' faces and eyes; and one can use free multimedia annotation software like ELAN (see below) to annotate which object the participant focuses on during a given time-interval. If the experiment involves the display of pictures on a screen or as a projection on a wall or if participants have to press buttons to give answers to questions, free RT-measurement and presentation software such as Linger or DMDX (see below) can be used to control displays or record responses with appropriate timing accuracy. For an overview of set-ups, see: <http://gameswithwords.fieldofscience.com/2010/02/lab-notebook-building-better-eyetracker.html> . Three types are common:
 - a laptop to display pictures, with a built-in video camera to record eye-movements and potentially also a USB-game pad to record push-button responses and a headset.
 - a "box" with positions for pictures or objects in the four corners and a built-in-camera for eye-movement recordings in the middle (with the box potentially created in the fieldwork location to avoid logistic problems), potentially combined with digital voice-recorder or a laptop with a headset to present audio-stimuli
 - a laptop, a camcorder, and a data projector to project pictures on a white wall or screen, potentially with a USB-game pad to record push-button responses, see Figure 1 for picture of the participant, the camcorder and the screen presentation.¹

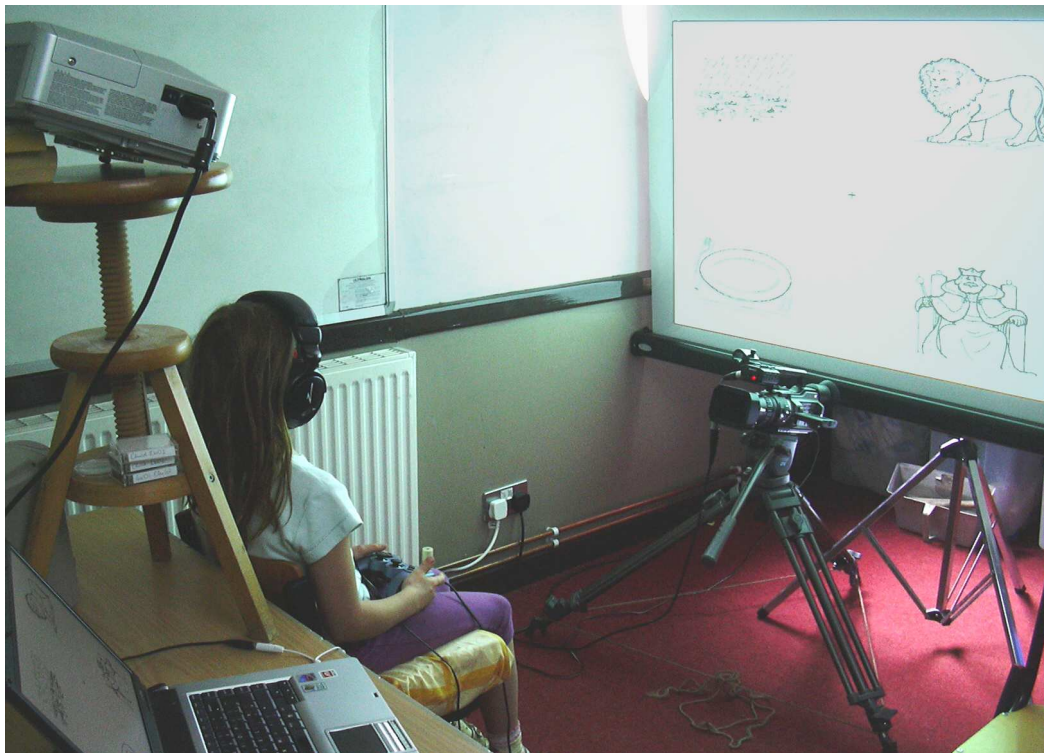


Figure 1: A Poor Man's Eye-tracker - Display, Camcorder, and Participant with Headset

¹ Note that a comparatively small portable projector can be very useful in a fieldwork situation where one can show videos to participants in social situations as well.

2.2 Free Software

RT- and eye-movement measurements can be collected and analysed using a combination of different types of free and open source software instead of proprietary and commercial software:

- RT-measurement software:
 - Linger (<http://tedlab.mit.edu/~dr/Linger/>): a platform-independent software package designed for performing reading, listening, and other sentence processing experiments, but with some flexibility for the design of other experiments,
 - DMDX (<http://www.u.arizona.edu/~kforster/dmdx/dmdx.htm>): a very flexible and powerful Windows-based software package with more options for video/audio/picture-stimuli and a remote testing option, plus support via a website and mailing list.
- web-experiment and online questionnaire software for the collection of data via the internet:
 - overviews: Joinson, 2007; Reips, 2002, 2013; Mason & Suri, 2012
 - websites with links: <http://psych.hanover.edu/research/exponnet.html>, WebExperiment List <http://www.wexlist.net/>, Online Psychology Research UK <http://www.onlinepsychresearch.co.uk/>
 - DMDX:
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/dmdxhremotetestingoverview.htm>,
<http://www.u.arizona.edu/~jforster/dmdx/help/dmdxhremotemonitoring.htm>;
<https://reactiontimes.wordpress.com/2011/05/30/how-to-setup-an-online-experiment-in-dmdx/>
 - WebExp: <http://groups.inf.ed.ac.uk/webexp/>
 - For surveys and rating studies:
Survey Monkey <https://www.surveymonkey.com/>) or
Amazon's Mechanical Turk <https://www.mturk.com/mturk/welcome>)
 - Discussion of methodological issues: Brand & Bradley (2012)
- multi-media annotation software like ELAN (<http://tla.mpi.nl/tools/tla-tools/elan/>): This type of software allows researchers to time-link transcriptions for language-production experiments to audio/video-recordings or to add annotations for eye-movements to a particular section of a video- or audio-file that was created using a "poor man's eye-tracker".
- Sound recording/manipulation/analysis software: software like VirtualDub (<http://www.virtualdub.org/>) can be used to lift audio-tracks of videos and store them as separate wav-files for further analysis or transcriptions in ELAN. Audacity (<http://audacity.sourceforge.net/>) and PRAAT (<http://www.fon.hum.uva.nl/praat/>) can be used to create auditory stimuli or analyse recordings of production experiments.
- Spread-sheet: Instead of software like Excel, one can use the spread-sheet software included in the Open office package for the creation of stimulus lists and scripts and for data entry (<http://openoffice.download-insider.com/>).
- statistics software for data analysis: One can use R instead of proprietary or commercial software packages (<http://www.r-project.org/>; Adler, 2009; Baayen, 2008; Crawley, 2012; Dalgaard, 2008; Everitt & Hothorn, 2011; Gries, 2009a, b). Note that the use of R is not restricted to descriptive and test statistics; R can also be used for corpus-searches.

3 Dealing with a lack of linguistic resources

Psycholinguists working on a well-researched language like English can easily access information about the linguistic properties and distribution of its units (words, constructions, morphemes, phonemes, etc.):

- Corpora and associated search tools for different types of populations (e.g. adult unimpaired native speakers, monolingual and bilingual children, people with language impairments) (<http://talkbank.org/>, <http://www ldc.upenn.edu>; <http://www.sketchengine.co.uk/>; <http://www.mpi.nl/resources/data>)
- Lexical databases with combinations of orthographic, phonological, morphological, syntactic and frequency information (http://www.lcampanelli.org/lexical_databases; <http://www ldc.upenn.edu/Catalog/>), some of them even with RT-data for words (e.g. the British, Dutch, and French Lexicon Projects (<http://crr.ugent.be/programs-data/lexicon-projects>; Keuleers, Lacey, Rastle, & Brysbaert, 2012; Keuleers, Diependaele, & Brysbaert, 2010; Ferrand, New, Brysbaert, Keuleers, Bonin, Méot, Augustinova, & Pallier, 2010).
- Databases with information about semantic relationships between words (e.g. WordNet <http://globalwordnet.org/>)

Due to advances in technology and international collaboration, such resources are becoming available for a growing range of languages and it is always worth checking the websites listed above to see whether any resources have recently been made available for the respective language. Many of these websites also provide information and support for researchers who want to create their own corpora and databases or offer to host and disseminate them for researchers (for support, see also <http://dobes.mpi.nl/> ; <http://www.elarb-archive.org/depositing/>).

If there reliable frequency information is unavailable, one can:

- use internet chat rooms and other online texts in the respective language as the basis for corpus creation (Uthus & Aha, 2013)
- create initial word lists based on fieldwork checklists (e.g. Abbi, 2001; Comrie & Smith; Sutton & Walsh; Swadesh, 1952, 1955), native speaker interviews or existing corpora, even if these corpora are small and unrepresentative for everyday language. Based on this wordlist, you can then create questionnaires, which can be used (online) to obtain
 - subjective frequency rating from a set of at least 20 native participants, which tend to correlate well with corpus-based frequencies and RTs for lexical decision experiments (Schreuder & Baayen, 1997; Kgoro & Eisenbeiss, 2012)
 - semantic relatedness ratings for pairs of words (typically used in studies on priming, see references below).

4 Working with participants from a different or unfamiliar culture

4.1 Stimulus Materials

- In cross-cultural studies, there is a general tension between (i) the desire to keep materials identical for better comparability of results and (ii) the need to avoid offence or confusion due to the use of linguistically or culturally inappropriate materials. All potential stimulus materials should be checked by a native speaker and the resulting set should then be piloted with some potential participants before the actual testing. The following aspects of materials need to be considered and so that materials are as neutral, comprehensible, and inoffensive as possible:
 - Not all participants may be familiar with conventions for picture, comics, and line drawings that researchers from industrialised Western societies are used to, for instance the use of central perspective or the use of wiggly lines to indicate movement and the use of "thought bubbles" in comics. Such devices and conventions must be avoided in stimuli for cross-cultural research. Note also that the same is true in studies with very young children who have not had much exposure to printed material, yet. Moreover, many adult participants across cultures find the use of cartoons insulting as they consider them material for children. Thus, photographs are often a better choice of visual stimulus than drawings or cartoons - if it is possible to obtain them for the required types of objects, people, or actions.
 - Some animals, objects, professions, foods, etc. might be taboo, offensive, or provoke emotional responses that distract from the experiment; for instance the pigs, magicians, sorcerers, witches, etc. that are commonly used in language acquisition studies in Northern and Western countries.
 - It is important to consider norms and "in-group" rules for attire or the behaviour of males, females, and children. Note that this is important even within the same country, which is sometimes underestimated. For instance, some studies require people in stimulus materials to be clearly assigned to one gender; e.g. studies that investigate gender marking of pronouns or adjectives. Researchers in American or European labs then sometimes use drawings of women with heavy makeup, nail polish, skirts, figure-revealing clothing, and traditional female hairstyles or they depict girls with highly gender-stereotyped frilly and pink clothing, nail polish, and jewellery. This can lead to comments and distractions from the experiment when such pictures are used with participants that object to gender-stereotyping. Note that some of these problems can be avoided through the use of photographs instead of drawings as the sex of a person in a photograph is usually much easier to determine without special "markers" than the sex of a person in a drawing.
 - In cross-cultural studies, differences in attire for professions need to be considered as uniforms differ between countries and occasionally even between regions of the same country.

- Participants can be distracted from their task and focus on irrelevant aspects of the stimulus materials when the people that are depicted in stimulus photos, drawings or cartoons look markedly different from the participants themselves with respect to skin and hair colour, hair style, height and size, dress, etc. While some differences cannot be avoided in cross-cultural work, they can be minimized, e.g. by avoiding the depiction of people with piercings, tattoos, unusual hair colours and styles, and other specific properties.
- Even when stimulus items involve familiar objects or animals and professions, participants may experience them in different combinations depending on their culture. For instance, stimulus materials for acquisition studies in American or European labs often depict tigers, lions, and kangaroos together in picture series or even in the same picture, which matches the experience of American and European children, who encounter these animals in zoos and often expect them all to live in the same "jungle". However, in the wild, these animals do not share habitats and their combination in picture materials can cause amusement or confusion when such pictures are shown to participants who have experience with these animals in their natural habitats.
- Pictures should not involve distracting details even if that makes them more attractive. This is particularly important for eye-tracking studies, where patterns on a dress or eye-catching buttons or jewellery in a picture of a person might draw too much attention. A simple "blink" test often already shows avoidable problems: If one closes one's eyes, then briefly opens them for just one "blink", any item or detail that immediately "sticks out", may need to be removed or modified.
- The international picture database is the result of a large international study to provide norms for timed-picture-naming in different languages and cultures (American English, German, Mexican Spanish, Italian, Bulgarian, Hungarian, and the variant of Mandarin Chinese spoken in Taiwan; <http://crl.ucsd.edu/experiments/ipnp/>). Thus, the pictures in this database have been tested for at least some different cultures. They can be searched by lexical parameters, per cent name agreement, RT, and visual complexity.
- The International Affective Picture System is a database of photographs used in emotion research (<http://csea.php.ufl.edu/media/iapsmessage.html>).
- Our website (<http://experimentalfieldlinguistics.wordpress.com/>) will provide further materials, for instance, a list of words that have already been used for work with children in a variety of cultures, with some basic information about gender or noun classes and transitivity of verbs. These words have also been translated and checked for appropriateness by adult native speakers of additional languages.

4.2 **Unfamiliarity with computers or recording equipment**

- Working with participants who are not familiar with computers might require additional training session before the actual experiment. These sessions can make use of tasks that are not directly related to the experiment, but involve the input device(s) for the experiment (e.g. the keyboard or the USB-game pad) and relevant types of displays (e.g. pictures, videos or sound, depending on the experiment).

- If one uses the projector setup in Figure 1 for eye-tracking experiments in a fieldwork setting, it can be introduced as a projector for videos in a social setting first or one can first make video-recordings in naturalistic settings, without the projection of picture stimuli and without pointing the camcorder directly at the face of the participant.
- In a fieldwork situation, it is often useful to first have spontaneous interactions, then record conversations and carry out semi-structured elicitation tasks, and to leave experiments for the end of fieldwork. This will also help to obtain the necessary background information for the experimental study (e.g. frequency questionnaires, piloting of stimuli, etc.).

5 Illiterate Participants

For illiterate participants, one can use or adapt tasks from research fields where reading/writing is irrelevant, inappropriate, or a potential confound, e.g. research on:

- sign language
- early child language acquisition
- clinical populations
- phonology

Thus, text books and handbooks for research methods in these fields can provide a good starting point for the selection of methods (e.g. Ball, Perkins, Müller, & Howard, 2009; Blom & Unsworth, 2010; MacDaniel, MacKee, & Cairns, 1999; Menn & Ratner, 1999; Sekerina, Fernández, & Clahsen, 2008; Wei & Moyer, 2008).

6 Classic Tasks

For overviews of tasks and their uses, see Altmann & Gaskell (2007), Blom & Unsworth (2010), Huettig, Rommers, & Meyer (2011), MacDaniel, MacKee, & Cairns (1996), Sekerina, Fernández, & Clahsen (2008), Traxler & Gernsbacher (2011).

- Investigating lexical representations and lexical access: the lexical decision task
Participants have to decide as fast as possible whether the stimulus that is presented to them is a word like *car* (YES) or a non-word/pseudo-word like *fonkel* (NO)
 - visual lexical decision:
A string of letters is presented on the screen.
 - auditory lexical decision:
A segment of spoken speech is presented via headphones or loudspeakers.

This task is highly sensitive to a variety of factors, including length and frequency: the shorter and more frequent a word is, the faster it can be recognised as a word, due to strong memory traces. This task has often been used to investigate how (morphologically complex) words are stored, with the following rationale: if a particular linguistic unit is stored, then the frequency of this unit should determine response times, in interaction with other factors such as length. Thus, a growing number of studies has used this task to explore whether morphologically complex forms like *walked* are stored as whole units or decomposed into

stems and affixes (*walk*, *-ed*) – or whether both full-form and decomposed representations play a role in processing. Such studies compare words with different stem-frequencies and different whole-form-frequencies to find out whether response times to complex words like *walked* are determined by the frequency of the whole form *walked* (suggesting word-form storage), by the frequency of its components *walk* and, *-ed* (suggesting decomposition) – or by a combination of both (suggesting a combination of whole-form storage and decomposition).

NOTE: For auditory versions, which can be used with illiterate participants, one has to be even more careful when it comes to potential competitors for the target (e.g. words starting with the same sounds like *struggle* and *strung*) as the presence of competitors can have a significant effect on response times.

- Investigating representations for linguistic units and their relationships: priming tasks
Participants respond to a stimulus (=target) after the presentation of another stimulus (=prime). The prior exposure to the prime can facilitate the response to the target by pre-activating the target or a unit that is associated with it. For instance, the presentation of *walked* primes *walk* just as much as the presentation of *walk* itself primes *walk*, compared to an unrelated word (e.g. *sang-walk*). This has been taken as evidence for the decomposition of *walked* into the affix *-ed* and the stem *walk*, which can thus be pre-activated just as much as through the prime *walk* itself. In addition to such word-related priming effects, other studies have found "structural" or "syntactic priming": participants are more likely to produce a given grammatical construction (e.g. a passive sentence like *The cat was chased by the dog*) after reading or hearing a different sentence with the same structure (e.g. the passive sentence *The window was cleaned by the man*) than after a sentence with a different structure (e.g. than after the active sentence *The man cleaned the window*). Such structural priming effects have been taken as evidence for abstract syntactic representations that can be pre-activated by priming. Priming tasks can involve different types of primes (e.g. auditory vs. written) and target responses (e.g. lexical decision for a target word vs. production of a description for a picture or video in a structural-priming experiment), e.g.
 - cross-modal priming:
A word is presented via headphones. After the offset of this word, a string of letters is presented on the PC-screen. Participants have to indicate whether this string is a word or a non-word by pressing one of two buttons (YES/NO).
 - masked priming:
A string of letters (word or non-word) is very briefly presented on the PC-screen, immediately followed by a "mask" (e.g. a series of #s: #####). Then, a string of letters is presented on the PC-screen. Participants have to indicate whether this second string of letters is a word or a non-word, by pressing one of two buttons (YES/NO).
 - production priming:
Participants are presented with a picture or video and a spoken or written sentence describing this stimulus. Afterwards, participants are presented with the next picture or video and asked to describe it themselves.

Note: Versions of priming where both stimuli and targets are presented in spoken form are

not typically used, but they might be worth exploring for participants who cannot read. Versions of production priming with a spoken prime sentence are commonly used in studies with both children and adults and are appropriate for illiterate participants.

- Investigating Syntactic Representations and Processing: Self-Paced Reading, Sentence-Picture-Matching, and the Visual World paradigm

In these experiments, participants are exposed to sentences in an incremental fashion and their button-presses and/or eye-movements are measured to study (i) participants' interpretation of sentences, (ii) the time-course of processing or (iii) potential sources of processing difficulties. Different types of experiments focus on

- self-paced reading:

Participants read through a text on the PC-screen in their own pace, by pressing buttons to consecutively display individual words or phrases on the screen. The display time for each word or phrase is measured to determine which parts of a sentence take longer to read, which indicates increased processing difficulty. The experiment may also contain some questions about the text. These questions give participants a reason to actually read the text – and they give you a chance to check whether they did this. The answers typically do not provide you with information about participants' interpretation of the sentence. Reading experiments are obviously only appropriate for literate participants. Variants with audio-stimuli are possible in principle, but require even more control for the length of the individual segments and potential competitors for the words that are presented (similar to issues arising for auditory lexical decision experiments).

- sentence-picture-matching:

Participants see two pictures on computer screen, followed by a sound file with a sentence. They have to press a button to indicate which sentence matches the picture. This task allows you to investigate both (i) the choice of picture, which provides information about participants' interpretation of the sentence, and (ii) the RT, which gives you information about processing difficulties. However, as you only measure RTs for the entire sentence, you cannot tell at which point these processing difficulties occurred. This task has been employed in studies with both adults and children and can be used in studies with illiterate participants.

- visual world paradigm:

Participants' eye-movements to individual objects on a box or to pictures in a wall-projection display are measured while they listen to sentences or short narratives and look at the displays of objects or pictures, some of which were referred to in the stimulus text. When participants are asked to manipulate real objects, their actions can be analysed as well. For instance, when they have a frog sitting on a napkin and another frog and a napkin, one can see which of the two frogs they first pick up when they are asked to "put the frog on the napkin in the basket". When pictures are displayed on a screen, the display is controlled by RT-software like DMDX, and one can also measure RTs for button-press responses to questions about the stimuli. Both versions have been used in studies with adults and children and are appropriate for illiterate participants.

7 DMDX²

DMDX is an experimental presentation control and RT-measurement software, designed and supported by Jonathan and Ken Forster, Department of Psychology, University of Arizona. It is restricted to Windows, but free, flexible, powerful, reliable, and supported by a very active mailing list.

7.1 Getting Started

- official website and tips for getting started:
 - <http://www.u.arizona.edu/~jforster/dmdx.htm>
 - http://www.uta.edu/faculty/jeffreyw/psyling/language-processing/DMDX%20tutorial_revised.pdf
- mailing list: DMDX-request@psy1.psych.arizona.edu.
- Reference: <http://www.u.arizona.edu/~kforster/dmdx/DMDX%20Timing.pdf>

7.2 DMDX and TimeDX

- DMDX - presents stimuli and records responses with ms-accuracy, based on a script that determines basic parameters of the experiment (e.g. presentation times, screen colour, input devices) and the order and way in which items are displayed. Experiments can involve simple text displays or the script can call up additional media files with auditory or visual stimuli.
- Before DMDX can run, TimeDX is needed to set and check software and hardware features of the PC/laptop (Millisecond Timer, Refresh rate, Select Video Mode, Time Video Mode) and additional input devices (e.g. USB-game pad)
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhoverview.htm>
[http://dionysus.psych.wisc.edu/MediaWiki/index.php/Downloading_and_configuring_DMDX_and_TimeDX_\(Rebecca_Gloria\)](http://dionysus.psych.wisc.edu/MediaWiki/index.php/Downloading_and_configuring_DMDX_and_TimeDX_(Rebecca_Gloria))

7.3 TimeDX

After downloading DMDX and TimeDX, click on the TimeDX icon and follow these steps:

- Close all other programmes and disable your wireless connection to avoid interruptions from pop-up messages and interference (NOTE: do the same while running an experiment using DMDX).
- The first time, TimeDX is running, you need to select the video/sound driver you want to work with (not the default).
- Check that the **Millisecond Timer** is working: and try restarting the machine if it is not working
Menu > Basic Tests > Millisecond Timer Test. Start this test and let it run for a while, then press Stop to finish it. This test provides you with information about timing accuracy -- most callback latencies should be around 1 ms, with a standard deviation of no more than .3 ms.
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhtiming.htm>

² This introduction is based on information from the DMDX website, the DMDX-mailing list, and web-materials by Nan Jiang, Matt Davis, John Curtin, Mike Ford, Jeffrey Witzel.

- In order to set and check the video mode you will use, you need to do the following:
Menu > Basic Tests > Select **Video Mode**
Select a video mode that is supported by your PCI card and click on Do Test. This should show the text "TimeDx" on your screen. Press Escape, return to the Video Mode menu and select "Done". Make sure you write down the video mode information as you can later use it for your DMDX script. For instance when you see "1024x768 (60Hz) 16 bit (65536 colour) RGB", you would include "<vm 1024, 768, 768, 16, 60>" in your DMDX script for your experiment. For help with video modes, see:
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhvideomodes.htm>
- Determine your refresh rate, the time it takes to redraw the screen from top to bottom, using your chosen video mode. This ms-interval can be used in the script. For instance, if your refresh rate is 16.ms, that is one "tick" and you can later specify your presentation times using these ticks as units instead of ms. Select the basic test for the **Refresh Rate**. If the picture of crossing lines does not stabilize, you may need to play around a bit trying out different combinations of tick-boxes on the menu (to take into account properties of your drivers, etc.).
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhrefreshrate.htm>
- Go to the Advanced Tests and click on **Time Video Mode** and select the Vertical Retrace Sync Test. After performing the test, you **MUST** save the value to the registry by pressing the button: "Saved Last Used Values in Registry", otherwise you will get error messages about the video mode when you try to run your script in DMDX. If you get too many errors and time-outs, try this again after a restart. If problems persist, we found it useful to go back to the Refresh rate menu and try out different options there.
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhverticalretracesyncthread.htm>
- Make sure all the devices you later want to use in your experiment are connected and use the **Input test** from the basic test menu to test your input devices (keyboard, USG-game pad, mouse, etc.) are working. The names of the devices and their buttons will be required in your script, Note that the numbers that are printed on game pad buttons are not necessarily the numbers that are used internally to address the buttons. So it is crucial that you determine the numbers of the buttons using the Input test.
When you start the test, the top box shows you a list of devices that are currently connected to the computer. When you select one by clicking on it and hit the Test button, you see the numbers or names of the buttons (you can use either in the script, for non-English names, use the numbers with the "#"). You can then find out which of the buttons/keys on your devices have which numbers/names by pressing them and watching what gets highlighted on the screen.
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/timedxhinput.htm>
<http://psy1.psych.arizona.edu/~jforster/dmdx/help/dmdxhinput.htm>

7.4 Running an Existing Experiment in DMDX

- Close all other programmes and disable your wireless connection to avoid interruptions from pop-up messages and interference.
- Click on the DMDX icon on your desktop.
- Use “browse” to locate the script, which has to be a file in rtf-format (see below).
- After selecting the appropriate file choose the “Syntax Check” button to check for any possible mistakes in the file.
- Use “Run” to start the experiment
- When the experiment is finished, press “Escape” (Esc) to exit the window and save the result file.

7.5 Reasons for Potential Problems

- The video mode in the script has not been properly set up in TimeDX, with values saved in the registry (Fixing this requires Time Video Mode). You have either not run TimeDX before or you have not saved the values for your video mode after the Time Video Mode test.
- The script tries to call up input devices that are not connected. They need to be plugged in.
- The name of your device or the names of keys/buttons that you use in the script are not the same as the ones you are shown in the Input test.
- The script tries to call up media files that are not in the experiment folder.
- Your script does not have the proper format: it is not an rtf-file, line delimiters like ";" or brackets are missing, or there are other formal errors (see below).

7.6 Files Required for a DMDX experiment

DMDX allows for sound, video and picture files to be presented along with text at particular time windows. Video, sound and picture files are **Stimulus files**. All lines of text that represented to the participants, along with further details about their presentation and RT-measurements, are part of another file, namely the **Item file**. This file also calls up the wav-files, mov-files, etc. that are used as stimulus files. Both stimulus and item files should be placed in the same folder before running the experiments.

<http://psy1.psych.arizona.edu/~jforster/dmdx/help/dmdxhitemfiles.htm>

The Item file consists of all the information regarding the text presented to the participant (bold, italics, etc) along with the *instructions* that DMDX will have to follow when running the experiment. These “instructions” or “commands” will inform the software about what stimuli needs to be presented at what time etc. The item file determines (amongst other things):

- which stimuli should be presented to participants,
- for how long the stimuli should be presented,
- when the measurement for response times should start,
- what should be considered as a correct or incorrect response.

Item files are **rtf** (rich text format) files. The Item file can be created in programmes like Microsoft Word or Open Office and then saved as **rtf**. The information available in the Item file is divided into two sets of lines: (i) header lines and (ii) item lines.

7.7 Header Lines

A header line is the starting point for every Item file. It sets the parameters for the experiment. As can be seen in Figure 2 and Figure 3, headers always start with <ep> ("extended parameters") and end with <eop> ("end of parameters"), while the order of the other parameters is flexible, as long as each individual parameter is enclosed in angle brackets and parameters are separated by blanks. Table 1 provides an overview of common parameters (see the DMDX webpage for additional information).

```
<ep> <cr> <fd 30 <d 59> <t 1500> <id keyboard> <mnr "+Left  
Arrow"> <mpr "+Right Arrow"><dbc 210210210> <dfs 36> <dwc 0> <vm  
1024,768,768,16,60> <nfb> <eop>
```

Figure 2: An Example Header Line for a Visual Lexical Decision Experiment using Keyboard Inputs

```
<ep><azk> <cr> <fd 17> <d 169> <t 2500> <vm 1024, 768, 768, 16,  
60> <id keyboard> <id "Logitech RumblePad 2 USB">  
<MapPositiveResponse +Button 4> <MapNegativeResponse +Button 5>  
<dbc 255255255> <dwc 0> <nfb> </ep>
```

Figure 3: An Example Header Line for an Auditory Lexical Decision Experiment using Game Pad Inputs

Header Line	Name	Function
<cr>	Continuous Running	Without this, DMDX would pause after each item and wait for the participant to request the next item (as in a self-paced reading task).
<fd>	Default Frame Duration	This tells DMDX for how long each “frame” (stimulus word or picture) should be displayed. FDs are measured in ticks and the length of a tick for a given set-up can be determined using the Refresh Rate test in TimeDX (see above). For instance, for a video card running at a refresh rate of 60Hz, one tick will last approximately 16.67ms.
<d>	Delay	The delay is measured (in ticks) from end of one item to the start of the next. This delay needs to be long enough to allow DMDX to load all stimuli for next item.
<t>	Time-out measured in milliseconds	This tells DMDX how long to wait for participants to make a response. If no response has been made before this time then the program moves on to the next item (this could affect the timing of the item)
<req>	Enable Request input	This allows DMDX to show stimuli on the screen after the participant has requested that through pressing a button (e.g. in a self-paced reading task).
<N>	Number of items	This informs DMDX about the exact number of items in the file
<Azk>	Output data to an ASCII text file	This ensures that the results will be exported as ASCII text.
<id>	Identify Device	This provides DMDX with information about the devices from which the responses should be recorded, e.g. keyboard, mouse, or USB-game pad. The correct name of the device can be found using the Input test in TimeDX.
<nfb>	No feedback	This tells DMDX that no feedback should be given to participants’ responses.
<dbc>	Default Background	The default background is white. If you want to change the color, you need to use specific codes, e.g: <ul style="list-style-type: none"> • 255000000 for red • 000255000 for green • 255255255 for white (all colors) • 000000000 for black (no colors)

		<ul style="list-style-type: none"> • 210210210 for a light gray Colours are defined in RGB format by three numbers from 0-255 representing the brightness of each gun.
<dw>	Default Writing Color	The default writing color is black. If you want to change the color, you need to use specific codes, see above.
<dfs>	Default Font Size	The font size you use to introduce your text will be the default one. In case that you need to add text in Bold or Italics you should do that when typing the text in the individual items lines.
<In>	Set Text display now	In case that text displayed on the screen goes further than one line, this will specify where it should be presented.
<vm>	Video Mode	<p>This parameter refers to the video mode that was tested using TimeDX before the experiment. Video Modes are specified using five numbers, e.g. <vm 1024, 768, 768, 16, 60>:</p> <ul style="list-style-type: none"> • 1024 number of pixels horizontally, • 768 number of pixels vertically • 768 number of scan lines • 16 number of bits of color • 60 refresh rate (available on XP only) <p>One can also use <vm desktop> to specify that the desktop video mode will be used. .TimeDX provides you with the option to select the Desktop mode of the respective machine for the test and then save the resulting values in the registry. Using <vm desktop> can be useful as one can avoid changing the vm-parameter in scripts if one works with a set of computers that have been set up for different desktop video modes.</p>

Table 1: DMDX Header Parameters

If you are using a game pad to record responses, you need to specify which button should be used for a “Yes-Positive” response and which as a “No-negative” response, using the <MapPositiveResonse...>- and <MapNegativeResonse...>-parameters respectively (see Figure 3). If you are using the keyboard as an input device, the RIGHT and LEFT SHIFT buttons are mapped to yes/no respectively. If you want to specify other buttons, you can map them using the same procedure as for an external input device. The use of parameters for different input devices and their buttons or keys is illustrated in Figure 2 and Figure 3.

7.8 Item Lines

An Item line holds all the information related to the items, referring to the actual conditions tested. Information regarding the particular stimulus, such as sound files, display times for particular items, etc. are included here (see Figure 4 and Figure 5).

```
0 "Press SPACEBAR to start";
+11 * "elefant" /;
+12 * "flower" /;
-23 * "fonkel" /;
+14 * "cap" /;
0 "The END! Thank you for your participation";
```

Figure 4: Example Item Lines for a Visual Lexical Decision Experiment

```
0 ;
11 / <wav 2> "Introshort" / ;

+1 / <fd 120> <bmp> "blank" / <bmp> "F38" / <wav 2> "F38" / <fd
180> <bmp> "F38" / <wav 2> "Q_F38" / * <t 10000> <bmp> "F38"
<cr>;
+2 / <fd 120> <bmp> "blank" / <bmp> "15a-c" / <wav 2> "15a" / <fd
180> <bmp> "15a-c" / <wav 2> "Q_15" / * <t 10000> <bmp> "15a-c"
<cr>;
-3 / <fd 120> <bmp> "blank" / <bmp> "F14" / <wav 2> "F14" / <fd
180> <bmp> "F14" / <wav 2> "Q_F14" / * <t 10000> <bmp> "F14"
<cr>;

12 / <wav 2> "end" ;
```

Figure 5: Example Lines for a Visual World Experiment

Similar to the header line, item lines have particular parameters that they should follow. These parameters need to be set again by the user. See Table 2 below for more information regarding the parameters used and see the DMDX webpage for additional information)

Name/Symbol	Function
+/-	Informs DMDX whether the “yes” (+) or “no” (-) response is the correct answer for that item
^	Indicates that the correct response is no response
=	Indicates that any response could be correct
+/- 0098	The number after the +/- is the item number. Each item should have a unique number since the output will refer to these numbers.
*	This marks the point at which DMDX should start measuring RTs.
%	If an item needs to be presented for a time that differs to the standard frame duration set in the header line, % can be used to specify the new duration. You can add “ms” before % if you want to count the time duration in milliseconds rather than in ticks.
/	This marks the end of a frame. This is when the screen is cleared
;	This marks the end of an Item. At this point DMDX will either wait for a response or a time-out and then move on to the next item.
“#####”	To display more than one word at a time simply add another frame to each item line.
0 “Press SPACEBAR to start”;	Before individual item lines you should add this starter line
0 “The END! Thank you for taking part.”;	After the last item line, you should add this end line
“!”	Use this if you want to add any comments to your item file since lines starting with this symbol will be ignored by DMDX
<wav 2>	This keyword should be introduced before every wav file since it informs DMDX that a speech file should be played.

Table 2: DMDX Item Line Components

For more example files, see <http://experimentalfieldlinguistics.wordpress.com/> and http://www.u.arizona.edu/~kforster/dmdx/examples_of_scripts.htm

8 ELAN

ELAN is a free multi-media annotator developed by the Max-Planck-Institute in Nijmegen and supported by a mailing list). It allows you to create, edit, visualize and search annotations for video and audio data that are time-linked to the media stream.

8.1 Getting started

Webpage (<http://tla.mpi.nl/tools/tla-tools/elan/>) with:

- downloads,
- documentation,
- tutorials,
- example files,
- mailing list,
- information for citing ELAN.

8.2 Features and Potential Uses of ELAN

ELAN has the following properties that make it a useful tool for psycholinguists and fieldworkers: ELAN

- is free, Java/XML-based and plat-form independent (Windows, Mac, Unix)
- has user interfaces for several languages.
- can display both speech and video signals.
- can combine up to four video signals with one audio file, allowing the user to compare signals from different cameras covering different angles of the room or different views of a gesture or sign.
- allows users to define a large number and different types of annotation tiers/lines.
- enables researchers to time-link transcriptions and other types of annotations to the media stream; and annotations can be linked to other annotations or even parts of other annotations. For instance, the transcription of an utterance can be linked to a section of the video and then speech-act codes can be linked to the transcription of the utterance and part-of-speech codes to its individual words.
- allows researchers to use different character sets (Unicode).for their annotations.
- has a broad range of export/input options:
 - Exported tab-delimited text files can be used to create tables for text documents or spread sheets for further quantitative and statistical analyses.
 - Annotations can be imported and exported between ELAN and Shoebox or CHAT and
 - ELAN works together with PRAAT for phonetic analysis of the sound files.
- provides some built-in search options.
- has a silence recognizer that helps to identify parts of the media file with silence, which can be skipped in the transcription process.
- has a metadata annotator.

Psycholinguists and fieldworkers can use ELAN to

- transcribe and annotate/code video/audio data from spontaneous speech samples and semi-structured elicitation tasks
- transcribe and annotate/code video/audio data from production experiments, with the option of measuring voice-onset times using the time-codes that link annotations to the video/audio-stream.
- annotate sign language and gesture data
- analyse eye movements in eye-movement studies with "poor man's eye-trackers"
- create and use comprehension exercises for the language-learning fieldworker or transcription exercises for their transcribers

8.3 Annotation, Media, and Template Files

ELAN creates a link between

- one or more media files (preferably MPEG and wav
- one annotation file created by ELAN (.eaf-file) or imported from Shoebox, CHAT, Transcriber

This connection does not lead to any modifications of the media file. When you open the annotation file, it calls up the media file(s) and the time-codes stored in the annotation file point to particular time-points in the media file.

Using a video file in combination with an eaf-file alone allows video and sound display. However, if an additional wav-file is added, a waveform is also displayed, which is very useful for distinguishing between quiet and speech phases during the transcribing process (see Figure 6). If a separate audio-file is used, one has to ensure that the video file(s) and the audio file are starting at exactly the same point so that they are synchronized. One can also lift the audio off the video, which guarantees synchronization. This can be achieved very easily by using free conversion software like VirtualDub (<http://www.virtualdub.org/>): one simply opens the video-file and stores it as a wav-file.

If you want to create several eaf-files with the same structure, i.e. the same types of annotation tiers, etc., you can create an eaf file and then save the structure as a template file, which is similar to a style document in word processing packages. This template can then be used to create new eaf-files with the same structure, but different content, see below.

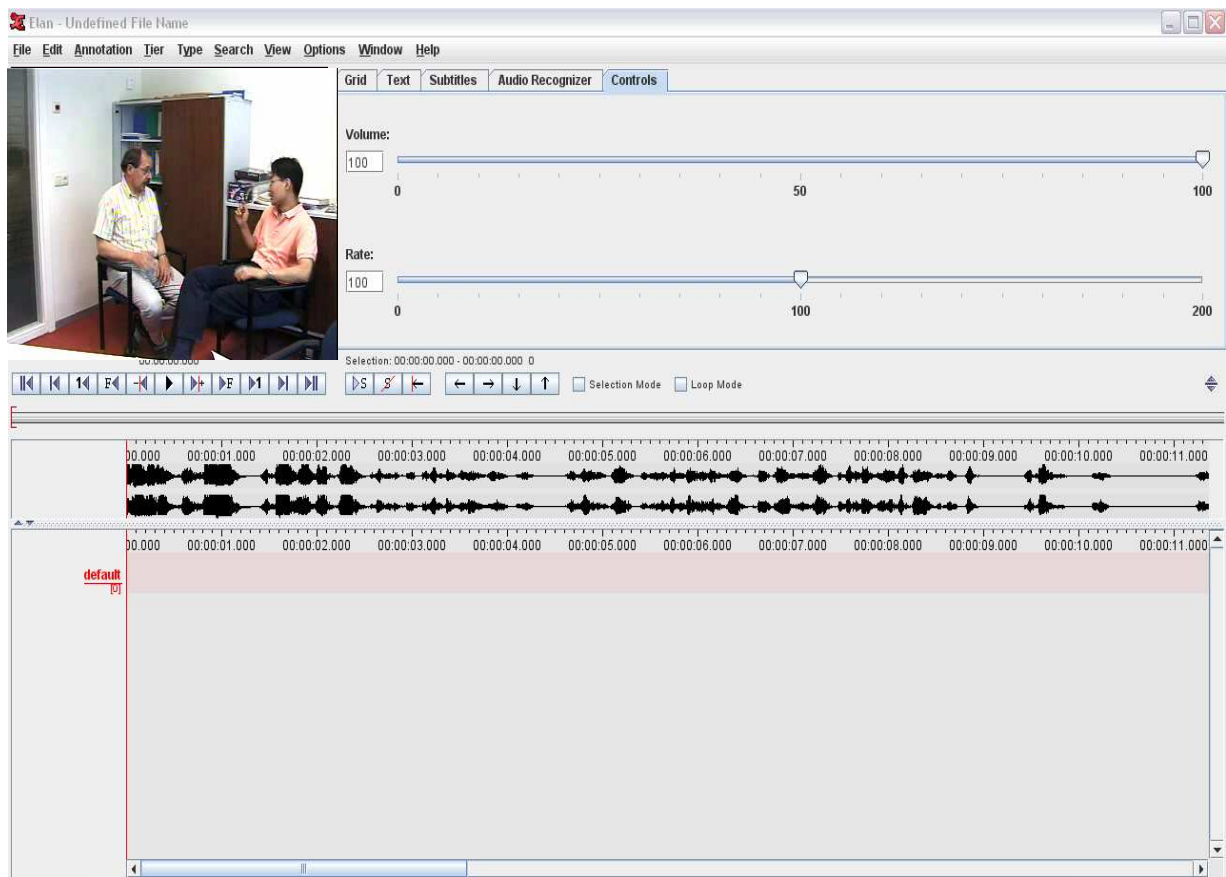


Figure 6: An ELAN file

8.4 Creating an Annotation File

- Start ELAN from the programme list or a desktop icon.
- Choose “FILE > NEW” (Ctrl+N)
- Browse and select your media files - and a template file if desired – from the box on the left and transfer them to the box on the right using the ">>>" button.
- Choose “OK” to create the annotation file. This can take a few seconds.
- Save the new file immediately using “FILE > SAVE AS” (Ctrl +Shift +S).

Choose “FILE>Automatic Backup> 1 minute” to activate automatic backups made by the software every minute.

NOTE: You cannot create an annotation file by trying to open a video-file in ELAN. You can only use FILE > OPEN if you have already created and saved an eaf-file and want to continue working on it.

8.5 The ELAN window

The ELAN window provides a wide range of functions, see Figure 7 and Table 3.

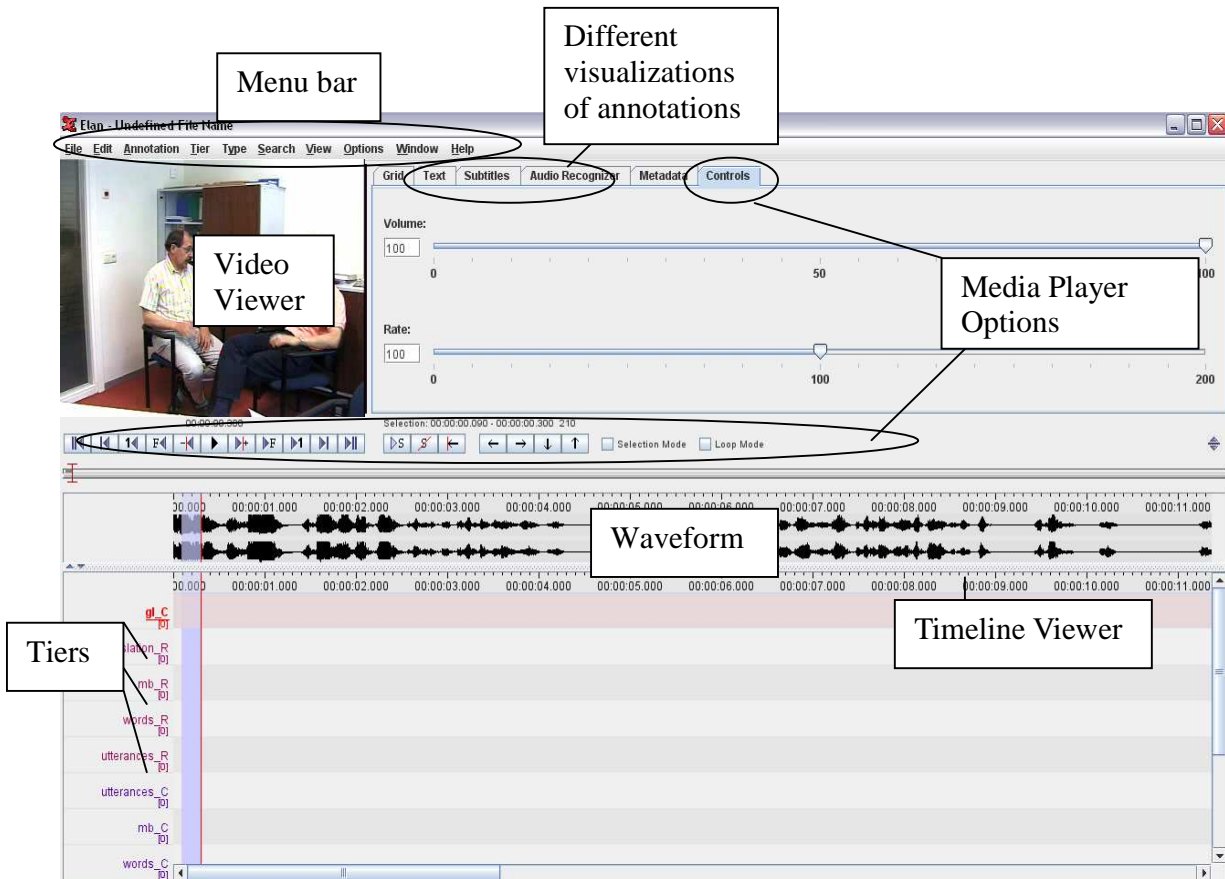


Figure 7: ELAN annotation window

Element	Function
Menu bar	program commands
Media Player options	controls playback
Video Viewer	displays video image
Waveform Viewer	displays waveform
Tiers	displays names given to annotation lines
Timeline Viewer	working with / displaying annotations
Different visualization of annotations	working with / displaying annotations

Table 3: Functions of ELAN window

Viewers, you can adjust the rate at which the video plays, from very slow to twice normal speed. If your video includes audio, there is also a volume control.

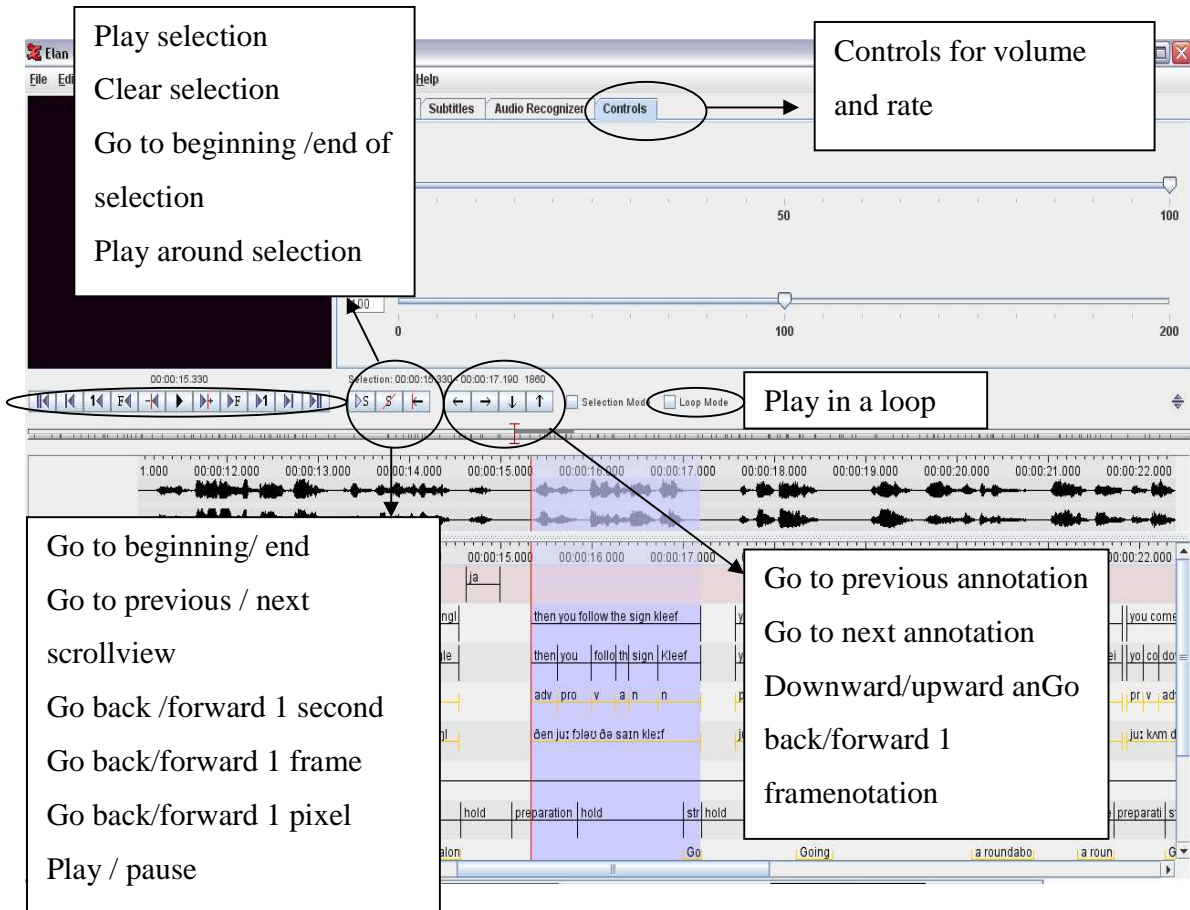


Figure 9: Navigating through ELAN

8.7 Annotations

An annotation is any type of information that is added to a video/audio recording. That can be an orthographic or a phonetic transcription of the speaker's utterance, a gloss or translation, or further coding of the utterance (e.g. part-of-speech coding, morphological coding). Time linked annotations allow for a better and thorough study of a video/audio recording since they enable the user to:

- move quickly from one part of the video/audio file to another by selecting
- different annotations.
- play each annotated segment of the video/audio file as many times as necessary, at a variety of speeds.
- search through the annotations for particular characteristics.

In order to create annotations in ELAN, you:

- use the media player control buttons to start / stop the media player; (Ctrl + SPACE)
- identify which speaker is talking. The person talking corresponds to a **tier** on the left hand side of your screen
- roughly identify the segment for your first annotation (on the timeline)
- click on the first millisecond of your selected segment on the timeline viewer (below the wave form) and drag with the mouse to the end of your selected segment. The segment you selected will become blue.



Figure 11: Segment selection

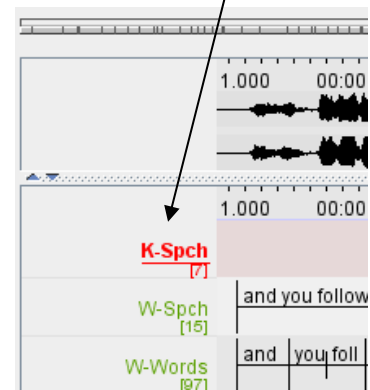


Figure 10: Tiers and Timeline

- Right-click on the junction of the selection and the active tier, i.e. the tier for the speaker you want to transcribe.
- Use one of three options to create a new annotation:
 - choose “New Annotation Here” from the pop-up menu
 - double click on the selection to open a white square “edit box”
 - press “Alt + N”
- Enter text in the edit box that appears.
- Save/confirm your annotation by hitting “Ctrl+Enter” (Command+Enter on Mac)..

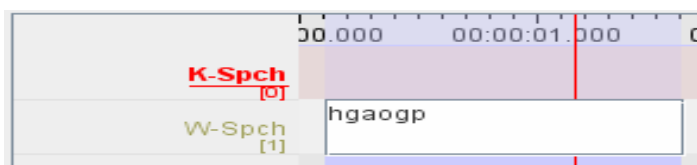


Figure 12: Edit box

- Click the “play selection” button with the "S" and the red diagonal line to check whether your annotation is correct (Shift + Space)
- It may be helpful to play the same selection again and again in a “Loop Mode” (Ctrl+L). Loop Mode will allow you to hear the selection in a very slow pace. Any problems with unclear syllables or sounds can then be clarified. Put the crosshair at the end of the selection by using the button with the arrow and the red line. If the crosshair is not at the end, Loop Mode gets turned off immediately when you start playing the selection.
- Check the Loop Mode box and press “play selection” button
- When you stop the playback, Loop Mode is automatically turned off.
- Using the “play” button from the keys below the video will start the video/audio, but it will not stop at the end of the selection. The “play selection” button will restrict itself to the selection (annotation) you have selected.
- You can copy the annotation that you have created or you can modify it, e.g. by changing its value, by merging it with the next annotation, by modifying the time. You can do this by right-clicking and opening a pop-up menu or by going to the drop-down menu for ANNOTATION.
- You can change the timing by highlighting the annotation (turning the marker line blue), pressing Ctrl+Alt and using the mouse to drag the edges of the annotation until you have reached the desired time point.

Annotations can be visualized in subtitle, grid or text viewer (see Figure 13). In the subtitle viewer, annotations are divided according to speaker without providing any further details. Even though further details may not be provided, the subtitle viewer allows for annotations from other speakers to appear. The grid viewer provides further information regarding the actual beginning, ending and duration of the annotation in relation to the timeline. The text viewer provides all the utterances (annotations) of one speaker into a text format without any information regarding duration.

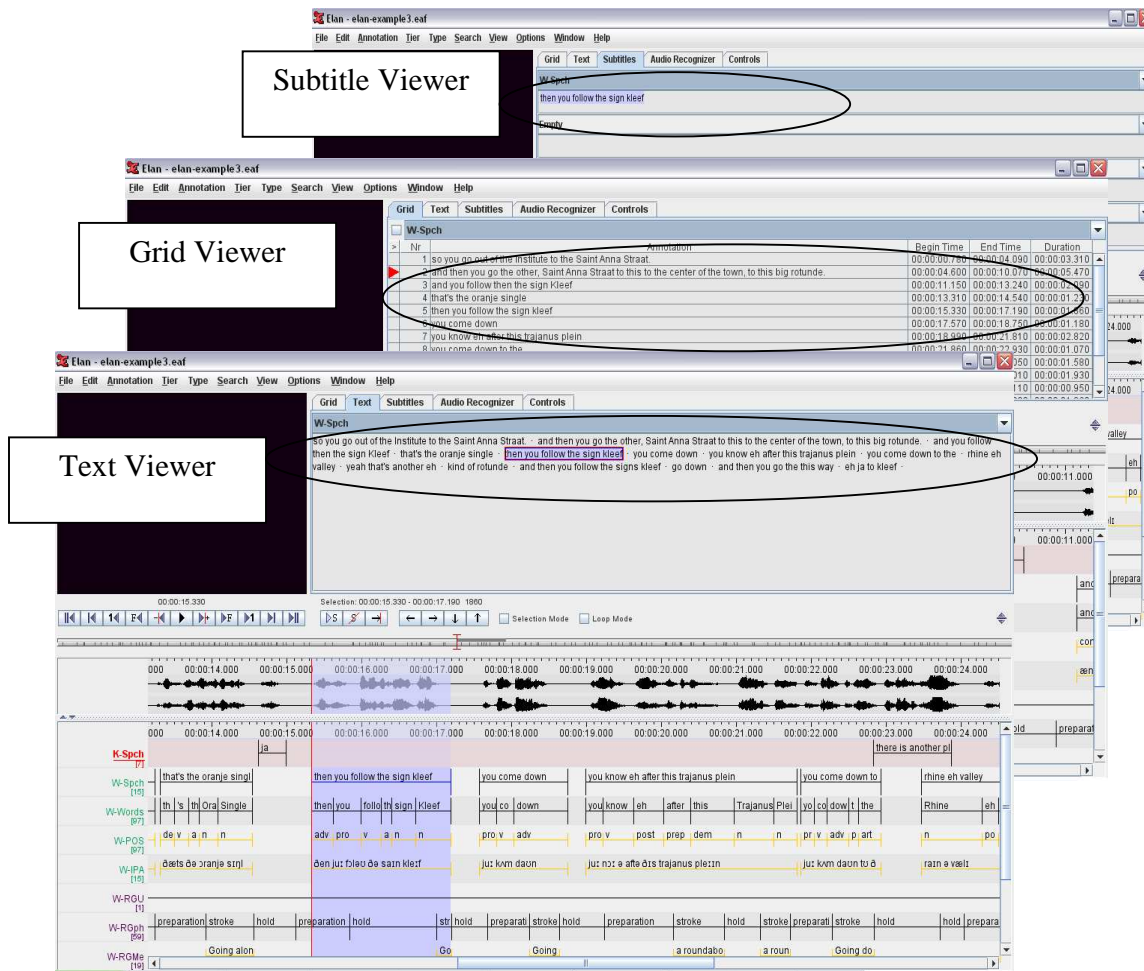


Figure 13: Different Visualizations of Annotations

8.8 Tiers

A tier is, a set of annotations that share the same characteristics, e.g., one tier containing the orthographic transcription of the speaker's utterances, and another tier containing the free translation of these utterances. In ELAN, tiers appear as lines below the media window. Tiers are different across data sets and depend on the conditions tested. In Table 4, the first tier *st* refers to the sentence as it has been uttered by the speaker. *Wd* refers to the word level, *mb* to the morpheme level and *gl* to the morphological gloss. There is also a tier for comments. Tiers can be added and defined as necessary. For instance, if the data were not in English, there could also be a tier labelled *ft*, for free translations of the sentence. In contrast, in the Visual World tier arrangement (Figure 14) there are only two tiers, one referring to the item being tested (item) and the other to the seconds (segmentation) corresponding to eye movements.

St	Sentence	<i>The cat likes milk</i>				
Tx	Text	<i>The</i>	<i>Cat</i>	<i>likes</i>	<i>milk</i>	
Wd	Words	<i>The</i>	<i>Cat</i>	<i>likes</i>	<i>milk</i>	
Mb	Morphemes	<i>The</i>	<i>Cat</i>	<i>like-</i>	<i>-s</i>	<i>milk</i>
Gl	Gloss	<i>Det-nom</i>	<i>Sg-nom</i>	<i>V-</i>	<i>-3rd p sg</i>	<i>Sg-acc</i>
Com	comment	<i>The child</i>	<i>Was laughing</i>	<i>While...</i>		

Table 4: Tier set for transcriptions with grammatical coding

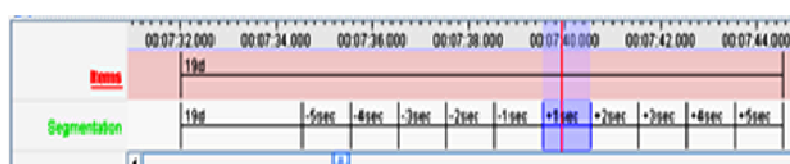
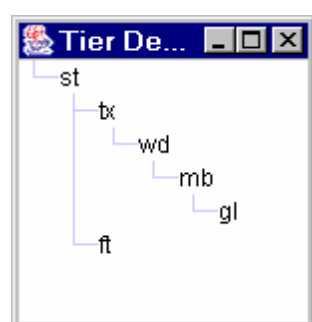


Figure 14: Visual World annotation and tiers

There are two types of tiers:

- Independent tiers contain annotations that are linked directly to a time interval, i.e., they are “time-alignable”.
- Referring tiers contain annotations that are linked to annotations on another tier (i.e., to annotations on their so-called “parent tier”).

This is illustrated in Figure 15.



TIER	DEPENDENCY	
st	independent	parent of tx and ft
tx	referring	parent of wd
wd	referring	parent of mb
mb	referring	parent of gl
gl, ft	referring	-

Figure 15: Dependencies between tiers

If you put your mouse pointer on one of the tiers a blue pop-up box will appear. This box includes information regarding the relations between tiers as well as their linguistic types (see below).

Parent tiers and their dependent tiers are linked in such a way that any changes made to the parent affect the child but not vice versa. Most importantly, deleting a parent tier will delete all corresponding dependent tiers.

8.9 Linguistic Types

Each tier is assigned to a “Linguistic Type”. Each linguistic type specifies a number of constraints that hold for all tiers assigned to that type. Such constraints are bundled into so-called ‘stereotypes’. The following four stereotypes are currently available – see Figure 16 and Figure 17 for concrete examples:

Linguistic Type	In/ Dependent	Kind of Annotation	Tier
“None”	independent	<ul style="list-style-type: none"> • The annotation on the tier is linked to time axis. • Two annotations cannot overlap 	st / item
“Time Subdivision”	referring	<ul style="list-style-type: none"> • The annotation on parent tier can be subdivided, and each of the subdivisions can be linked to time axis • They differ from annotations on independent tiers because they are assigned to an interval contained within that of the parent annotation 	tx / segmentation
“Symbolic Subdivision”	referring	<ul style="list-style-type: none"> • The annotation on the parent tier can be subdivided, but the subdivisions cannot be linked to time axis 	wd, mb
“Symbolic Association”	referring	<ul style="list-style-type: none"> • The annotation on the parent tier cannot be subdivided • There is a one-to-one correspondence between the parent annotation. Eg. Free translation 	gl, ft

Table 5: Linguistic Types

Note that a linguistic type can refer to only **ONE** of the stereotypes at a time. Many tiers can correspond to a linguistic type.

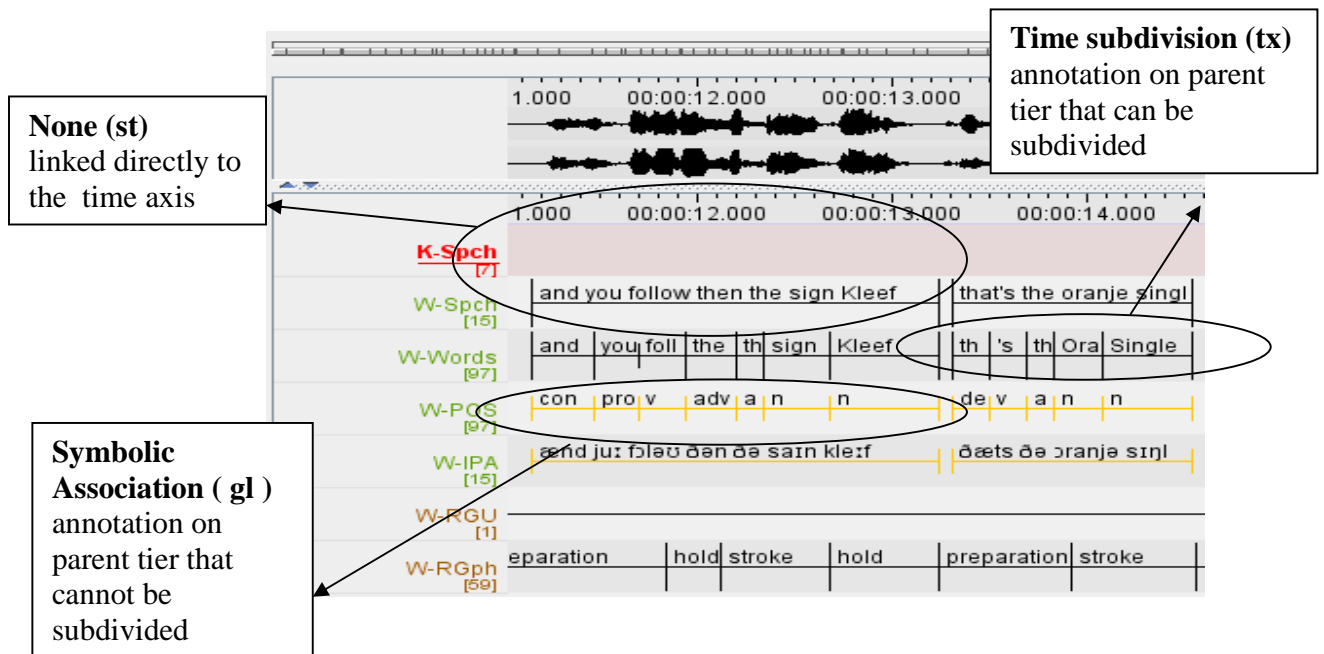


Figure 16: Linguistic Types (relations)

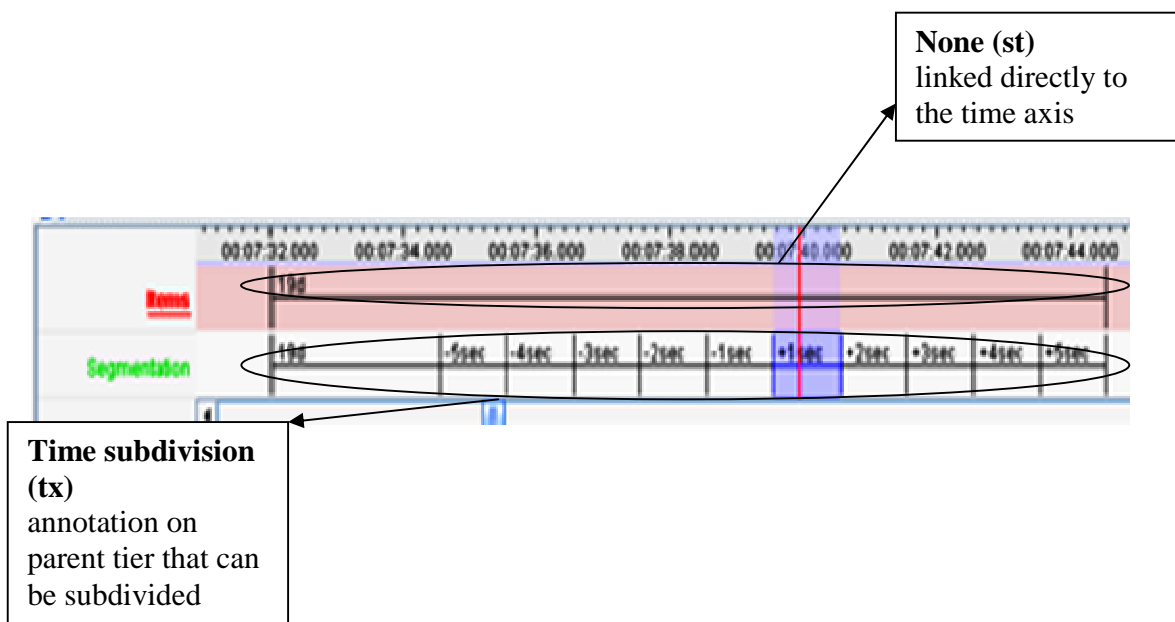


Figure 17: Linguistic Types (relations) for the coding of eye-tracking experiments

In order to create a new type, you:

- select "Type" from the menu bar
- select "Add New Linguistic Type..." (Ctrl + Shift + T)
- enter a name for the new type in the dialog box, e.g. "Default" or "Transcription". Accept all other default settings and click the "Add" button. Close the dialog.

8.10 Linguistic types can be changed or deleted, but note that changing a linguistic type affects all tiers associated with that linguistic type:

- Go to “Menu” choose “Type”
- Select “Change Linguistic Type...”
- Choose from the “Current Types” box which linguistic type you want to modify
- The linguistic type you choose will be highlighted blue
- The properties of this linguistic type will appear in the “change” box below
- make all the appropriate changes and press “change”

8.11 Creating and Modifying Tiers

Once linguistic types are set, tiers can be assigned to types. Following the relations established tiers can be created.

- Go to “Menu” and select “Tier > Add New Tier...”
- In the dialog enter a name for the new tier (e.g. “text, ortho”) and optionally a participant’s name.
- Since this is the first tier you are creating, it has no parent tier. Therefore, the "Parent Tier" box should be filled with "None" (figure 25).
- Select a type that you have created (e.g. the "Default-it" in the example above).
- Select the language, depending on what and how you intend to transcribe/annotate.
- You can choose “More Options” for choosing particular colours and scripts for your tier.
- Once you finish with all your options you can select “Add” and your tier will be added on your screen.
- Note: any modifications you make using “Tier > Change Tier Attributes...” will affect annotations and other child tiers. In order to avoid problems if you to switch parent tiers ELAN offers a “Change Parent” alternative.
 - Go to “Menu” and choose “Tier > Change Parent of Tier”.
 - Choose which tier you want to change
 - Press “Next”
 - Select the NEW parent and press “Next”
 - The selection and the changes you have made to the tier is highlighted in blue
 - Press “finish”

8.12 Templates

A template is a special ELAN annotation file, an “empty shell” that contains a setup for doing annotations (tier names along with linguistic types associations) in a particular way, but without any annotations or attached media files. When having many files to annotate, templates save a lot of work and make it easier to annotate several videos in the same way (Eisenbeiss & Sonnenstuhl, 2011) since linguistic types and tiers do not need to be introduced with every new set of data. In order to save the relations between the linguistic types and tiers that we have created, you:

- go to “Menu” choose “File > Save as Template” (Ctrl + Alt + Shift + S)
- name the file and press “ok”

The template file will have the extension “etf”. You can add/delete more tiers in a template as long as you save it under a different name. This allows you to adjust your template on your particular file of data, see Table 6 and Table 7 for examples.

Speaker	Tier Name	
	Transcription	Comment
First child, Lenny	CH1	CH1_COM
Second child, Leon	CH2	CH2_COM
third child, Liam	CH3	CH3_COM
Fourth child, Luna	CH4	CH4_COM
Mother, Natalie	MOT	MOT_COM
Father, Ole	FAT	FAT_COM
Researcher, Sonja	SON	SON_COM

Table 6: An Example Template for Multi-Participant Transcriptions in Family Settings (Eisenbeiss & Sonnenstuhl, 2011)

The template in Table 6 is an example of a template for multi-participant recordings in a family setting. It contains one tier/line for the transcription for each participant and one line for corresponding comments (referring to the respective transcription tier). Transcription tiers have the type TRANSCRIPTION (independent, default language English). Comment tiers have the type COMMENT (referring, symbolic association, default language English).

Speaker	Tier Names			
	Phonetic Transcription in turns	Phonetic Transcription in utterances	Grammatical analysis	Free translation
Participant	CH	CH_UT	CH_GRA	CH_ft
Researcher	RES	RES_UT	RES_GRA	RES_ft

Table 7: An Example Template for Research+Participation Recordings

The template in Table 7 is an example of a template for phonetic transcriptions of recordings where participants are interacting with researchers, e.g. in an elicited production or priming experiment. For each speaker, the template contains one tier for the phonetic transcription of entire turns, such as an answer to an elicitation prompt, which might involve several utterances (independent, parent of transcriptions in utterances and free translation, IPA). For each participant, the template also contains one tier where the transcriptions for turns are sub-divided into transcriptions for individual utterances (referring to the turn-transcription tier, parent of grammatical analysis, IPA, time subdivision). In addition, there is one tier for the grammatical analysis/gloss for the individual utterances (referring to the utterance transcription tier, symbolic subdivision, default English Language). Finally, the template contains tiers for free translation

(referring to Phonetic Transcription in turns, Symbolic Association, English default language).

Figure 18 shows an example for ELAN-annotations of eye-movement data from a "poor-man's eye-tracker". The Template contains one tier for the item (independent, parent of the Segmentation) and one segmentation tier for the coding of the eye-movement during a given time window, which refers to the tier with the item information.

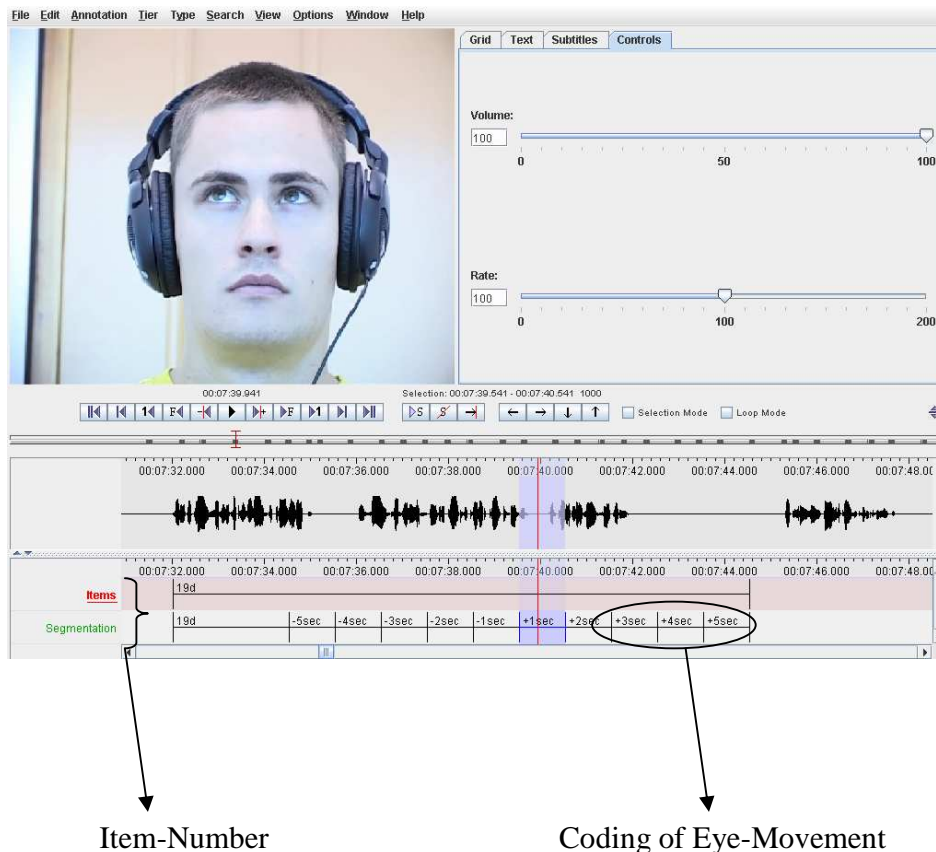


Figure 18: Template for Eye Movement Coding with "Poor man's eye-tracker"

8.13 Exporting Text from ELAN

While annotations can be sorted and visualized in different ways, saving the annotations as text allows researchers to use them independently of ELAN and employ additional tools to search through them or to annotate them, e.g. by using a part-of-speech tagger. ELAN allows for many text or other forms to be created and exported. These can be seen under: "Menu > File > Export As...".

Psycholinguists who have transcribed (elicited) production data often want to obtain word frequency lists, calculate measures like MLU (mean length of utterance), or search for utterances with particular words or annotations. For this purpose it can be useful to export data into the CHAT format of the CHILDES database as this allows you to use the CLAN tools for this database. Note that one can also use CLAN tools to semi-automatically add part-of-speech codes

and re-import the coded data into ELAN. The export to CHAT format involves the following:

- Go to “Menu > File > Export As...”
- Choose “Chat File...”
- Then the “Export CHAT file...” window opens (Figure 19)
- Name the tiers by introducing 3 characters in the “label” boxes plus additional information in the remaining fields. Note that the CHAT format requires capitals for independent tiers (e.g. *CHI for the transcription of the child's utterances) and lower case for the dependent tiers (e.g. %mor for a morphological coding tier).
- Press “Export” and save the file.

Main Tier	Label	Full Name	Role	ID	Language
<input checked="" type="checkbox"/> K-Spch	*				en
<input checked="" type="checkbox"/> W-Spch	*				en
<input checked="" type="checkbox"/> W-RGU	*				en
<input checked="" type="checkbox"/> K-RGU	*				en

Dependent Tier	Label
<input checked="" type="checkbox"/> W-Words	%
<input checked="" type="checkbox"/> W-POS	%
<input checked="" type="checkbox"/> W-IPA	%
<input checked="" type="checkbox"/> W-RGph	%
<input checked="" type="checkbox"/> W-RGMe	%
<input checked="" type="checkbox"/> K-RGph	%
<input checked="" type="checkbox"/> K-RGMe	%

Output options

Add master media time offset to annotation times

Annotation times on separate line

Include language line (%lan)

Export...

Figure 19: Export CHAT file

9 CHAT/CLAN

The most commonly used transcription format for language acquisition research (and many other types of psycholinguistic corpus research) is the CHAT format of the Child Language Data Exchange System, CHILDES (MacWhinney, 2000, <http://childes.psy.cmu.edu/>) <http://childes.psy.cmu.edu/manuals/chat.pdf>, see Wei & Moyer, 2009, for adaptations of CHAT for multi-lingual data). The CHILDES database contains:

- transcript data from monolingual and bilingual children with and without impairments
- a broad range of languages, but a strong focus on English data
- longitudinal and cross-sectional data partially with corresponding media-files
- naturalistic samples and elicited data (e.g. picture book descriptions)
- encoding of linguistic information for some files

The database itself is useful for the creation of experiments with language learners and other participants – even if it does not contain any data for the language under study. Searches in this database allow researchers to:

- find out which concepts children in different cultures express early or late,
- in which context, children and adults (parents, grandparents, or visitors) are using particular constructions or grammatical markers, which is very useful to know for the construction of felicitous contexts and prompts for elicited production experiments.

Using the CHAT format for transcription of elicited production data allows the researcher to use the CLAN-search-tools provided by CHILDES (<http://childes.psy.cmu.edu/manuals/clan.pdf>),

9.1 The Format of a CHAT transcript

- @BEGIN
- @Participants
- [other headers]
- *JOE: [spoken material]
- %mor: [morpho-syntactic coding]
- *INT: [spoken material]
- %mor: [morpho-syntactic coding]
- @End

9.2 Tiers

- three letters followed by a colon and a tab
- obligatory: @ Participants, on the second line of the transcript; e.g.:
@Participants: JOE Joe child, INT Interviewer
- optional; e.g.:
 - @Birth of Learner: ...
 - @Age of Learner: ...
 - @Date: ...

9.3 Main Tier

- what was actually said, one utterance per tier
- introduced by "*", the three-letter code for the participant and a tab; e.g.:
*JOE: the boy put the leash on the cat.
- orthographical transcription in lower case Latin letters; except for proper nouns (e.g. *John*) and "I"
- numbers spelled out (*ten*, not *10*)
- normalisation of phonetically deviant forms (phonetic information about forms can be presented on a %pho dependent tier)

9.4 Dependent Tiers with further annotations

%mor [morphosyntactic coding]
%pho [phonological coding]
%syn [syntactic coding]
%err [errors]
%com [comments]
%spa [speech acts]

9.5 Main Tier Markers

- unfilled pauses: #
- filled pauses: eh@fp
- interruption: +/.
- self-interruption: +//.
- repetition w/o correction: [/]
- repetition with correction: [//]
- unintelligible speech: xxx
- material coded on phonol. tier: yyy
- doubtful material: [?] or [=? text]
- omitted parts of words: ()
- to refer to more than one word: <>

9.6 CLAN

CLAN allows you to do some basic counts and searches. You can also use CLAN for semi-automatic annotations (similar to the software package Shoebox that many fieldworkers use).

9.7 CLAN Windows

- the commands window where you specify the folders, files, and commands you want to use
- the CLAN output window, where you will see the results of your searches. If you have not specified an output file, your results will be displayed in this window. If you have saved your outputs into a file (as you will be asked to do for this exercise), you will not be able to see it in the output window, but the name and location of the output file will be displayed in the output window.

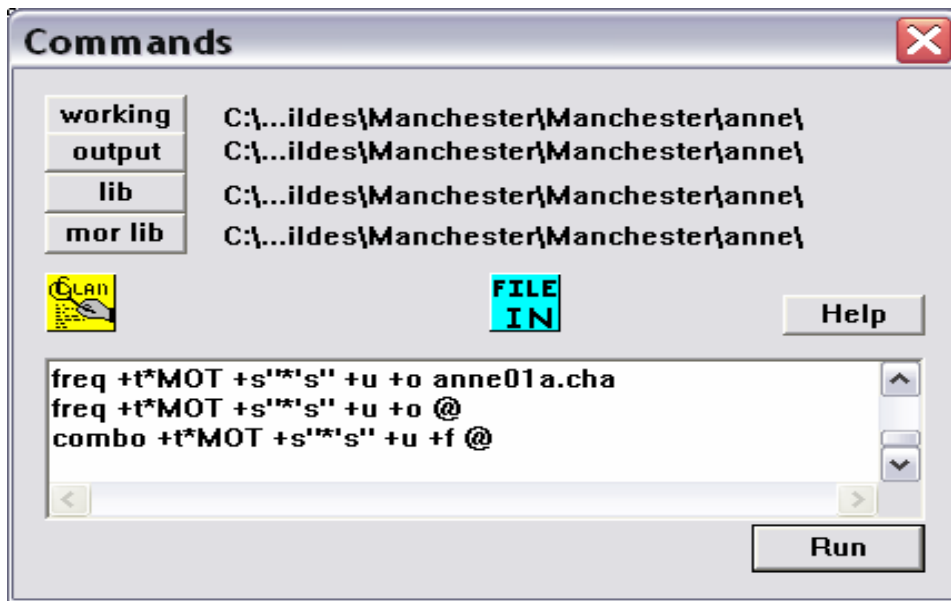


Figure 20: The CLAN command window

9.8 CLAN Steps

- specify your WORKING DIRECTORY, where the files you will be working with are stored
- specify your output directory, where any output files will be stored
- select a command (type of select from CLAN)
- select one or more transcription files for analysis (type name or select from FILE IN)
- optionally use some so-called switches to modify the commands.

9.9 Core CLAN Commands

FREQ: will provide you with type and token frequency information
 COMBO: will find utterances matching a given set of criteria
 MLU: will calculate the MLU (mean length of utterance)

9.10 Useful Switches

+f saves output to file. For each transcription that you have chosen to analyse, an output file will be generated. By default, this output file will have the name of the transcription file and an extension that will show you which command was used to create the output (e.g. freq, mlu or cmb).

+s searches for a string in a file

+t restricts the search to a particular tier – e.g. the tier of a particular speaker

+u treats all files together

+o orders FREQ lists according to token frequency

+w –w1 and +w1 provide one preceding/following line, -w2 and +w2 will provide two preceding/following lines, etc.

9.11 Search Strings

^	immediately followed by
+	inclusive OR
!	logical NOT
*	“joker”
“”	strings including blanks, etc. should be put in quotes

9.12 Some Examples (searching the US English BROWN corpus)

freq sarah134.cha (frequency list of all words)

combo +sthank* +t*CHI sarah134.cha
(all child utterances with “thank”)

combo +s"*'s*" +t*MOT sarah134.cha
(all maternal utterances with “s”: John’s hat/here)

combo +s"aux|**" +t*CHI +t%MOR sarah134.cha
combo +s"aux|**" +t%MOR sarah134.cha
(all auxiliaries (produced by child))

The following commands will count definite and indefinite articles in the child’s speech or in the mother’s speech. Note: the child’s tier might have a different name in a different corpus. Often, it is "CHI", but it may be an abbreviation for a name, e.g. "CAR" for "Carsten". Thus, you have to check the header of the transcript to see which names the tiers for the individual speakers have

freq +t*CHI +sthe
freq +t*MOT +sa
freq +t*MOT +san

If article omissions are annotated in the transcript with 0a or 0the or 0an, you can use this command to search for them: **combo +s0a**

If not, you use the freq command to create a list of all words and then reduce it to a list that only contains potential nouns (by hand). Note that some potential nouns occur more frequently as a verb, but may appear as a noun (e.g. *I run-V* vs. *I am going for a run-N*). Such words should be included in the search list as you cannot be sure whether they appear as a noun or a verb. Based on the list of nouns, you create a file (simple ASCII text format, not doc or docx format), with all the noun forms from the frequency list, one per line. The file should not contain empty lines or special characters (e.g. the "+" that is used to indicate compounding). You can use * to replace special characters.

The content of this file could look like this:

cat
dog
house
horse
horses

Save this file as text only and give it a memorable name (e.g. noun.txt). Then, you can search for all the words in this file: **combo +t*CHI +s@noun.txt @**

If you want to search for all wh-elements, you can use this command: **combo +swh***

Note: this will find all words starting with *wh*, including words that are not wh-elements (e.g. *wheat*). If you want to search for all wh-element, you can use freq to find out the wh-words in the transcripts and search for them individually or using a text file that lists them all.

combo +t*CHI +s@wh_word.txt @

9.13 Why is it not working?

- You have blanks/spaces where they should not appear, e.g. "+s car"
- You do not have blanks/spaces where they should appear.
- You are using a file and +s@... to search and:
 - This file is not in the right format (not a simple text file).
 - You have special characters in this file.
 - The file is not in the working directory.
 - The file is open in another programme.
- You have not selected files. Note: when you select files via FILE IN, a "@" character appears in the command box. However, typing this character in yourself will not work.
- The data is not in the working directory.
- The data is not in proper CHAT format: occasionally, data exported from other programmes contains line breaks or special characters that should not occur. This can create problems and you need to check your files first for consistency with the CHAT format.
- The command (FREQ, COMBO, etc.) has to come first, before any switches like "+f".

Further Research Tools and Databases

<http://experimentalfieldlinguistics.wordpress.com/>

<http://www.asha.org/research/researcher-tools/databases/>

<http://dionysus.psych.wisc.edu/MediaWiki/index.php/Software>

Appendix: DMDX Example Scripts

1. Visual lexical decision, using a specific video mode

```
<ep> <cr> <fd 30 <d 59> <t 1500> <id keyboard> <mnr "+Left  
Arrow"> <mpr "+Right Arrow"><dbc 210210210> <dfs 36> <dwc 0> <vm  
1024,768,768,16,60> <nfb> <eop>
```

! This version of the task only takes keyboard input, no game pad
required

! Item number XY;
! X=condition (1=word, 2=pseudo-word);
! Y=Trial number;

```
0 "Press SPACEBAR to start";  
+11 * "elefant" /;  
+12 * "flower" /;  
-23 * "fonkel" /;  
+14 * "cap" /;  
0 "The END! Thank you for your participation";
```

2. Visual lexical decision, using the desktop video mode

```
<ep> <cr> <fd 30 <d 59> <t 1500> <id keyboard> <mnr "+Left  
Arrow"> <mpr "+Right Arrow"><dbc 210210210> <dfs 36> <dwc 0> <vm  
desktop> <nfb> <eop>
```

! This version of the task only takes keyboard input, no game pad
required

! Item number XY;
! X=condition (1=word, 2=pseudo-word);
! Y=Trial number;

```
0 "Press SPACEBAR to start";  
+11 * "elefant" /;  
+12 * "flower" /;  
-23 * "fonkel" /;  
+14 * "cap" /;  
0 "The END! Thank you for your participation";
```

3. Auditory Lexical Decision

```
<ep><azk> <cr> <fd 17> <d 169> <t 2500> <vm 1024, 768, 768, 16, 60> <id keyboard> <id "Logitech RumblePad 2 USB"> <MapPositiveResponse +Button 4> <MapNegativeResponse +Button 5> <dbc 255255255> <dwc 0> <nfb> </ep>
```

! This version of the task takes keyboard input to start and game pad responses;

! Item number XY;

! X=condition (1=word, 2=pseudo-word);

! Y=Trial number;

```
0 "Press SPACEBAR to start";
+11 <wav 2> * "elephant" /;
+12 <wav 2> * "flower" /;
-23 <wav 2> * "fonkel" /;
+14 <wav 2> * "cap" /;
0 "Thank you for taking part in our experiment.";
```

4. Visual world

```
<cr> <ep> <azk> <fd 60> <d 60> <vm 1024, 768, 768, 16, 60> <id keyboard> <mnr "+Left Arrow"> <mpr "+Right Arrow"> <dbc 255255255> <dwc 0> <clfb> <eop>
```

! if you want to use the game pad;

! replace the following with the next line;;

! <id keyboard> <mnr "+Left Arrow"> <mpr "+Right Arrow">;

! <id "Logitech RumblePad 2 USB"> <mpr "+Button 5"> <mnr "+Button 4">;

```
0 ;
```

```
11 / <wav 2> "Introshort" / ;
```

```
+1 / <fd 120> <bmp> "blank" / <bmp> "F38" / <wav 2> "F38" / <fd 180> <bmp> "F38" / <wav 2> "Q_F38" / * <t 10000> <bmp> "F38" <cr>;
```

```
+2 / <fd 120> <bmp> "blank" / <bmp> "15a-c" / <wav 2> "15a" / <fd 180> <bmp> "15a-c" / <wav 2> "Q_15" / * <t 10000> <bmp> "15a-c" <cr>;
```

```
-3 / <fd 120> <bmp> "blank" / <bmp> "F14" / <wav 2> "F14" / <fd 180> <bmp> "F14" / <wav 2> "Q_F14" / * <t 10000> <bmp> "F14" <cr>;
```

```
12 / <wav 2> "end" ;
```


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Acknowledgements

This handout is based on a ms. by Sonja Eisenbeiss (*Experimental Linguistics in the Field – Opportunities, Challenges, Resources, and Ethical Issues*, University of Essex), and reference lists or tutorials for DMDX, ELAN, CHAT/CLAN, and linguistic fieldwork by the other co-authors. We also made use of the respective tutorials and manuals provided in the list of references and as links in the text of this handout. We benefited greatly from tutorial materials and discussions with Ayesha Kidwai, Jawaharlal Nehru University.

Work on these tutorial materials was supported by a series of projects on fieldwork and psycholinguistics that we are currently pursuing in a network between the University of Essex, Jawaharlal Nehru University, and the University of Konstanz, with activities funded by the Teaching and Learning Innovation Fund of the University of Essex (TALIF), the JNU-Essex Development Fund (JEDF), the Konstanz-Essex Development Fund (KEDF), and the UK-India Education and Research Initiative (UKIERI).

NOTE

We will upload further tutorials and example files on our webpage: <http://experimentalfieldlinguistics.wordpress.com/>. Contributions are very welcome.