

Danish Project

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Contents

Introduction

1. Database Contents
 - 1.1 Prompting Texts
 - 1.1.1 Passages and Sentences
 - 1.1.2 Numbers
 - 1.1.3 CVC words
 - 1.2 Recorded Corpora
 - 1.2.1 Many Talker Corpus
 - 1.2.2 Few Talker Corpus
 - 1.2.3 Very Few Talker Corpus
 - 1.3 Summary of Recorded Corpora
2. Talker Selection
 - 2.1 Distribution of Talkers on Prompting Texts
 - 2.1.1 Many Talker Distribution on Prompting Texts
 - 2.1.2 Few Talker Distribution on Prompting Texts
3. Recording Protocol
 - 3.1 Recording Environment
 - 3.2 Recording Equipment
 - 3.3 Recording Mode and Prompting Style
 - 3.4 Recording Control
 - 3.5 Recording Procedure
 - 3.6 Integrity Checks

- 3.7 Calibration
- 3.8 Recording Chamber Assessment
- 3.9 Recording Procedure Verification
- 3.10 Collation of Recordings
- 3.11 Data quantity of the Danish EUROM.1 database

Conclusion

References

Introduction

This report documents the database recordings which took place at IES during the spring of 1990 and the spring of 1991.

The database recorded comprise the following three corpora:

- the Many Talker Corpus,
- the Few Talker Corpus,
- the Very Few Talker Corpus.

These were designed to be used within the ESPRIT SAM Project as the Danish part of the SAM EUROM.1 database. The recording of the Many Talker Corpus was controlled by the use of the database recording software EUROPEC, v. 1.2 following the specifications given in the database recording protocols document - SAM-RSRE-8. At the time of recording of the Few Talker and Very Few Talker corpora, new versions of both the protocols and the software have evolved. This report is written with reference to these new versions of the software and protocols, i.e. protocols given in SAM-RSRE-15 (REF 1) and the software EUROPEC v. 4.0 (REF 2). Differences in recording protocols from the standards specified in SAM-RSRE-15 may then either be attributed to differences from the standards specified in SAM-RSRE-8 or to special considerations required to be taken for the recordings at IES. In both cases, these differences, with respect to the present standard, will be pointed out in the report.

The recordings were conducted by three operators, Henrik Christensen, Jan Thomsen and Bjarne Andersen, IES, assisted by Niels Dyhr, Institute of Phonetics, University of Copenhagen. Jan Thomsen and Henrik Christensen conducted the recording of the Many Talker Corpus, and Bjarne Andersen and Niels Dyhr conducted the recording of the Few Talker and Very Few Talker Corpora. The definition and phonotypical transcription of the Passages and Sentences were written by Niels Dyhr. The preparation for CD production was done by Jan Kristiansen, CPK.

1. Database Contents

A total of 66 talkers were selected for the database recordings. As the Many Talker Corpus was specified to contain recordings from only 60 talkers, the 6 extra talkers were selected to ensure error free recordings from at least 60 talkers. Out of these 66 talkers, 60 talkers were selected by means of a postverification and inspection of the recorded material. This document refers to these 60 talkers only, since these are the talkers contained on the distribution media, who constitute the Danish EUROM.1 Many Talker population.

From these 60 talkers, a subset of 12 talkers was selected for a further recording of the Few Talker Corpus. As the Few Talker Corpus was specified to contain recordings from only 10 talkers, the 2 extra talkers were selected to ensure error free recordings from at least 10 talkers. Out of these 12 talkers, 10 talkers were selected by means of a postverification and inspection of the recorded material. Once again, this document refers only to these 10 talkers, since these are the talkers contained on the distribution media, who constitute the Danish EUROM.1 Few Talker population.

The Few Talker Corpus consisted of the same prompting texts as the Many Talker Corpus but with a larger amount of recorded data for each talker, and with the addition of CVC words. Out of the 10 talkers in the Few Talker group, 2 talkers were selected (Very Few Talker group), to perform recording of CVC words embedded in carrier phrases. No extra talkers were selected for these recordings.

1.1 Prompting Texts

The EUROM.1 Prompting Texts consists of three parts - the Passages and Sentences, the Numbers and the CVC words.

1.1.1 Passages and Sentences

The Passages and Sentences consist of 40 passages and 10 blocks of 5 sentences. A passage consists of 5 task-related sentences, whereas the blocks of 5 sentences are designed to compensate for the uneven phoneme distribution in the passages. The sentences within a compensating block are not task-related. The design of the compensating sentences was guided by an analysis of the diphone distribution of phonotypical transcriptions of the passages. A total list of the passages and sentences is found in Appendix A.1 and their phonotypical transcription can be found in Appendix A.2. It should be noted that the two letter naming of the passages and sentences is different from the Many Talker Corpus to the Few Talker Corpus due to the naming of the CVC words. The mapping between the naming is found in Appendix A.1.

One recording take consisted of either a passage or a block of 5 sentences. The 5 sentences were recorded as the last take. A take is defined as "The time over which a subject is invited to complete the production of a specific set of utterances" (Ref 1). In the Few Talker Corpus the block of sentences was split up in two blocks to minimize speaking errors due to a different timing strategy than the one used in the recording of the Many Talker group. Talkers were relatively free to determine the length of pauses between takes.

The passage prompting texts were displayed as one single block and talkers were asked to aim at simulating natural intonation during the task. The sentences from the compensating sentence block were displayed individually, as these sentences are not task-related.

1.1.2 Numbers

The total list of the 100 Numbers can be found in Appendix A.1. The numbers were split up in 5 blocks, each containing 20 numbers, one block being recorded as one single take.

Talkers were instructed to pronounce the following numbers as stated below:

100	"hundrede"	NOT "et hundrede"
1000	"tusind"	NOT "et tusinde"
1020	"tusind og tyve"	NOT "et tusinde og tyve"

The numbers were displayed as a string of digits and not by means of orthographic representation. A contradictory SAM decision was made at the SAM Workshop in Rome (after the IES recordings had taken place), specifying that orthographic display is recommended. However, it was found that talkers were happy with the digital representation, and that they would have had difficulty in pronouncing strings such as "ni tusinde otte hundrede fire og halvfjerds" naturally, instead of the simple string "9874".

1.1.3 CVC words

A total of 114 CVC words were defined. The term CVC is, in fact, rather misleading, since the Danish EUROM.1 CVC words contain both CVC's, CVCV's, CCVCV's and CVVCV's, in which only a single phoneme is varied. However, the term CVC is maintained as a definition of a list of words which are identical (in terms of phonotypical transcriptions) with the exception of a single phoneme.

The CVC words were spoken by all the talkers in the Few Talker group. A total of 16 different CVC word lists defined the 16 blocks, which are found in Appendix A.1. In addition, the block names are also listed here.

One take consisted of one block with the CVC words being displayed one at a time. The correct pronunciation of the CVC words was verified during the recording by a trained phonetician. Furthermore, as regards nonsense words, an additional pronunciation guiding text was displayed, thereby avoiding unnecessary stress on the subject.

Furthermore, the CVC words were recorded embedded in carrier phrases. The carrier phrases are listed in Appendix A.1. Each CVC word was recorded in context in 5 carrier phrases, e.g. 10 carrier words in all. The 10 carrier words were finally recorded as isolated words.

1.2 Recorded Corpora

The corpora were recorded over two years: the Many Talker Corpus was recorded in the spring 1990 and the Few Talker and the Very Few Talker Corpora were recorded in the spring 1991.

1.2.1 Many Talker Corpus

Each of the 60 talkers in the Many Talker group had to speak **[read?]** 4 passages and a block of 5 sentences, a total of 25 sentences. The distribution of blocks was chosen so that each block was spoken by at least 6 talkers, male and female. Following the passages and sentences, each talker from the Many Talker group had to speak all 100 numbers. The total time for a session (from the arrival of the subject until the last spoken word) was, on average, approximately 30 minutes.

1.2.2 Few Talker Corpus

The 10 talkers in the Few Talker group had to speak 15 passages containing 75 sentences and 10 blocks of sentences containing 25 sentences, e.g. a total of 100

sentences. Note that the sentences were blocked differently and the naming were changed compared to the Many Talker Corpus due to different timing strategy. All the 100 numbers were spoken 5 times by all the talkers, that is a total of 500 spoken numbers. The 16 blocks of CVC words were also spoken 5 times to give multiple representations of the CVC words. The total time for a session for each speaker of the Few Talker Corpus was approximately 4 hours. Thus, in most cases the recording was performed over two days (i.e. two sessions) to reduce errors due to a loss of concentration or fatigue.

1.2.3 Very Few Talker Corpus

The Very Few Talker group of 2 persons had to speak the CVC words embedded in carrier phrases. The recording of the embedded CVC words (5 preceding and 5 proceeding carrier words) gives 570 phrases of three words for each talker. Finally, the 10 carrier words were recorded as single words 5 times for each talker. The recording time for the Very Few Talker Corpus was approximately 2 hours.

1.3 Summary of Recorded Corpora

Very Few Talker Corpus (2 subjects):

- 114 CVC words embedded in 5 different carrier phrases
- 10 carrier words, each spoken 5 times

Few Talker Corpus (10 subjects):

- 15 passages, each containing 5 sentences
- 25 compensating sentences
- 100 Numbers, each spoken 5 times
- 114 CVC words, each spoken 5 times

Many Talker Corpus (60 subjects)

- 4 passages, each containing 5 sentences
- 5 compensating sentences
- 100 Numbers

2. Subject Selection

The subjects were selected to ensure a subject variation as wide as possible, according to the guidelines given in (Ref 3). Due to practical circumstances the

talkers were primarily recruited from university staff, students and their relatives. The database turned out to contain 25 female and 35 male subjects, which deviates a little from the required sex distribution.

Included in the database is the file Speakers.dbf - a EUROPEC standard talker description file. Information was retrieved from the subject inquiry forms listed in Appendix A.3, and put into this file. This file is however not available on CD-ROM. Based on the subject inquiry forms, the following age distribution appeared (only age category is listed, as talkers were not requested to tell their specific age - only to specify their age category):

Age Category	Talker ID (Male)	Talker ID (Female)
16 - 25	15 BA* CC CD EJ FK HC KH KT LA LB LM MR NR PA TK	9 AN BC DA GJ LC LD LN UM VN
26 - 35	10 BL BF BR HS JM JT LJ LL OA SD	4 JA KM LO ML
36 - 45	3 HM JO SP	5 IJ JD KJ LE MS
46 - 55	6 EB FC HE JN PD UH	6 EC HG ID IL* IV JS
56 -	1 EH	1 AV

In the above table, talkers from the Few Talker group are marked with bold and talkers from the Very Few Talker group are marked with an asterisk.

2.1 Distribution of Talkers on Prompting Texts

All the talkers were asked to speak all the numbers and all Few Talkers the CVC words, but only a selected part of the sentences and passages. The distribution of the talkers on the sentence and passages groups are listed in the following (see Appendix A.1 for a specification of the group):

2.1.1 Many Talker Distribution on Prompting Texts

Group	Talker ID (Male)	Talker ID (Female)

(Passages, Sentences)		
A1 .. A4 , A5	BA FK CC HE	AN IJ
B1 .. B4 , B5	LM MR EH	DA LC
K1 .. K4 , K5	LA EJ BR PD	UM LO GJ
D1 .. D4 , D5	PA KT OA EB	VN JS
E1 .. E4 , E5	TK NR JM HS SD	IV
F1 .. F4 , F5	HC HM	JA HG KJ
G1 .. G4 , G5	CD LJ FC	JD ML ID
H1 .. H4 , H5	JT JO SP	AV EC MS
I1 .. I4 , I5	LB UH JN	BC LD KM
J1 .. J4 , J5	KH BL LL BF	LN LE IL

In this section only talker distributions on passages and sentences are given since the remaining prompting text types (numbers) did not vary from talker to talker.

2.1.2 Few Talker Distribution on Prompting Texts

Group (Passages)	Talker ID (Male)	Talker ID (Female)
O0 .. O4	BA EB HM	IL
O5 .. O9	BA JO EB HM	
P0 .. P4	BA JO HM	JS
P5 .. P9	JO BL	AN JS
Q0 .. Q4	BL	AN JD JS
Q5 .. Q9	BL	AN JD LD
R0 .. R4		IL JD LD
R5 .. R9	EB	IL LD

Group (Sentences)	Talker ID (Male)	Talker ID (Female)
F0 .. F4	BA HM	IL JD JS
F5 .. F9	JO EB BL	AN LD
Z0 .. Z4	BA HM	IL JD JS
Z5 .. Z9	JO EB BL	AN LD

3. Recording Protocol

3.1 Recording Environment

In Figure 2 the setup for the recordings at IES is shown. The recordings took place in anacoustically damped and soundproof room (please refer to section 3.8 regarding recording chamber assessment).

Between the operator room and the recording room, there was a window (double window glass, distance 20 cm, vacuum between the glasses) through which an overhead projector (OHP) placed in the operator room could display the prompting texts on the wall in front of the talker. This setup was found to be very attractive in terms of prompting text readability and low amount of reflections from monitors compared to the SAM recommendations of placing a monitor in the recording room.

Fig 2 : Recording Environment

The OHP displaying of the prompting texts was made by placing a LCD Screen connected to the PC on top of the OHP glass.

The operators could get in contact with the talker via an intercommunication system. In addition, the operators were continuously listening to the talker via the recording chain.

The subject was placed in a chair with a head-rest to make sure that she/he had a constant distance from and direction to the microphone.

3.2 Recording Equipment

A slightly different configuration of recording equipment (compared to the recommendations in (Ref 1)) was used mainly because the recommended B&K Sound Level Meter could not be guaranteed to be available in the full recording period, and consequently it was decided to use the same fixed configuration for all the recordings:

- a B&K microphone (B&K 4165),
- a B&K microphone preamplifier (B&K 2639)
- and a B&K preamplifier (B&K 2607)

During the recording of the Many Talker Corpus these were all placed in the recording room to suppress noise interference in the transmission between the two rooms. At the time of the recording of the Few Talker and Very Few Talker Part the transmission channel between the rooms had been improved and, therefore, the B&K preamplifier (B&K 2607) was placed in the operators room to ease the adjustment of the gain.

The output from the preamplifier (external filter input) was connected to an analogue filter (Krohn-Hide 3343) in the operator room via coax cables. This filter was chosen, as the output of the preamplifier (B&K 2607) has a DC offset which otherwise would saturate the OROS-board. The cut-off frequency of the high pass filter was 5 Hz.

During the recording of the Many Talker Corpus the output of the analogue filter was further-more connected to a DAT tape recorder (JVC XD-Z1100). The DAT tape recorder was started when the talker entered the recording room and stopped only as the talker left the room in order to gain a high quality backup of the recording including the communication between the operator and the talker.

The Few Talker and Very Few Talker Corpora contained two channel recordings applying a microphone as well as a laryngograph as sensors. The laryngograph was placed in the recording room and connected to the OROS-board via coax cables. In the Many Talker Corpus no sensors apart from the microphone were applied.

The setting of the OROS-board is identical to the recommendations (i.e. 20 kHz sampling frequency, variable input gain, line input) except the oversampling was set to 2 (although the recommendations specify a factor of 4, this is impossible, when the sampling frequency is 20 kHz).

The speech signal and the laryngograph signal were recorded on hard disk, and with frequent intervals the disk was backed up and erased. The backup media were an Everex Tape Stramer during the recording of the Many Talker Corpus and a Magnetic Optical disk during the recording of the Few Talker and Very Few Talker Corpora.

Recording Equipment Summary:

Laryngograph:	Laryngograph Ltd.
Microphone:	B&K 4165
Microphone preamplifier:	B&K 2639
Preamplifier:	B&K 2607
Analogue HP Filter:	Krohn-Hide 3343
DAT:	JVC XD-Z1100
LCD:	Telex Magnabyte

3.3 Recording Mode and Prompting Style

At the time of the Many Talker recording an agreement on recording modes and prompting style had not been found within the SAM project.

After the recording of the Many Talker Corpus had taken place at IES, it was decided within the SAM project to recommend a continuous recording mode which implies that takes are error free and that they should contain no discontinuities. Since this facility within the EUROPEC database recording software was not available at the recording time of the Many Talker part, the EUROPEC software was used in a signal triggered mode in which it was aimed to capture as much non-speech signal as possible outside the start/stop positions of the utterance to enable a later conversion/smoothing of the recordings into a continuous like representation.

The actual setup of EUROPEC in the Many Talker Corpus was as follows:

- Prompting Style - 2 - i.e. Backup-on-fly N utterances. If and when a speaking error is detected (either by the talker or the operator) during a take, the prompting system is backed up to a point before the error and continues from there.
- Recording Mode - 4 - i.e. a take is recorded as a number of segments. Speaking errors are excised from the storage medium, and so there will be one and only one segment per required utterance. The recordings will contain no errors.
- Timing Strategy - Endpoint - i.e. the timing of the prompt is totally controlled by the production of utterances. The display of each new prompt is controlled by the detection of the endpoint of the last utterance.

The relevant parameters selected for this setup were as follows:

- Triggering Level: -30 dB
- Extinction Level: -30 dB
- End Silence: 1000 ms for numbers
2000 ms for passages and sentences
- Signal Head: 200 ms
- Signal Queue: 500 ms for numbers
1500 ms for passages and sentences

The setup of EUROPEC in the Few Talker and Very Few Talker Corpora was according to (Ref 1):

- Prompting Style - 1 - i.e. ABORT TAKE and re-record. If the talker or the operator realizes a speaking error, the take is aborted and the take is re-recorded from the start.
- Recording Mode - 1 - i.e. a take is recorded in one complete segment, errors are not excised. This means that the sampling process is started at the beginning of a take, all the acoustic signal including breath noise, speaking errors are recorded and the sampling process is only stopped at the end of the take.
- Timing Strategy - Mixed - i.e. for each utterance in the corpus, a minimum prompting time is predefined to avoid excessive speaking rate. To ensure that the talker has finished one utterance before the next is prompted a endpoint detection is applied to delay the prompt.

The relevant parameters selected for this setup were as follows:

- Extinction Level: -40 dB

- End Silence: 750 ms

Explanation of terms:

- Triggering Level: Level the signal must reach to trigger the recording process.
- Extinction Level: Level the signal must cross down to be considered as silence.
- End Silence: The duration of silence that will determine the end of the recording.
- Signal Head: Part of the signal before the triggering moment which is kept on the disk.
- Signal Queue: Part of signal after the extinction moment to be kept really on disk.

3.4 Recording Control

As stated in section 3.1 the LCD and OHP were used to display the prompting texts on the wall in front of the talker rather than on a monitor. It was furthermore decided to hide as much as possible any extraneous information given by EUROPEC during the execution of the recordings. Thus, it was decided to hide the level meters (by a piece of paper) for the talkers - only the operators could see these levels, and talkers were consequently not asked to keep to a reference level point when speaking.

The speaking efforts were controlled by choosing adjustment mode 1 - i.e. the level meter gain (amplifier gain) was set to nominal. After the talker had stabilized in level the recording gain was adjusted so that the normal peak level of the speech reached a reference point, 12 dB below peak. The experience was, however, that it was very difficult to make an accurate adjustment.

In the recordings where the laryngograph was applied, the gain setting was set in the same manner as for the speech signal gain. The laryngograph is powered by batteries, and even when charged all night, it may have problems running properly if there are many recordings in one day. The operators had to watch very carefully that the laryngograph signal level was constant during the take.

3.5 Recording Procedure

Two operators were present all the time during the recordings to reduce fatigue effects. During the recordings the one operator was listening to the talker (aiming to discover any speaking errors) and the other was controlling the recordings and the equipment. These initiatives were taken to aim at removing any distracting factors and to help the talkers in concentrating on the recording task without putting stress on them.

Prior to the recordings, talkers had been given a very brief introduction to the recordings.

The session was started by giving talkers a more thorough description of the experiment, and they were asked for the details specified in the talker inquiry form, see Appendix A.3.

Then the prompting texts were presented in paper form to the talker who had a few minutes to examine the material and ask for explanations regarding pronunciation.

Then the talker was taken to the recording room, and the optimal gain setting for the talker was found in accordance to the protocols.

The talkers were urged to ask at any time for a break when needed, and it was generally aimed at creating a non stressing atmosphere for the talker.

3.6 Integrity Checks

The integrity of the item-end-point labelling was not checked 100% (as recommended in (Ref 1)) because it was found to be too time consuming and because it was estimated that the 10 % extra talkers constituted a sufficient replacement material.

Approx. 15% were assessed by using VERIPEC (which is now an integral part of EUROPEC). As a second check, the noise level of the silence recordings was verified to be acceptable in each talker recording.

3.7 Calibration

At the start of each recording day the following calibration signal was recorded: A 4:7 mark-space ratio rectangular wave of 20 Hz and 250 mVpp injected into the microphone body by a Philips PM 5715 pulse generator.

In addition the standard calibration procedure defined in (Ref 1) was followed for each talker.

3.8 Recording Chamber Assessment

Several "balloon" recordings were made in the recording room with the purpose of assessing the quality of the recording room in terms of reverberation time. These recordings were carried out according to the specifications given in (Ref 4).

The recordings have been evaluated at NPL, and the results will be available in an NPL document.

3.9 Recording Procedure Verification

A pilot set of recordings was made at IES and sent to NPL for quality and consistency assessment. These were 10 sec's recordings of a calibration signal, silence (in the recording room), 15 CVC words, 10 numbers and 5 sentences.

The observation from NPL was that an unacceptable noise level was present in the silence recordings, as the average signal level was found to be -57.5 dB and the peak level -48 dB.

However, a further investigation at IES showed that this noise level can primarily be attributed to the infrasound noise level. A digital highpass filtering (cut-off of 50 Hz) of the silence signal resulted in signal levels of -80 dB and -67 dB for average and peak levels respectively. These levels are concluded to be acceptable.

The above analysis and filtering was carried out using a small software package, named PILOT, from IES.

3.10 Collation of Recordings

The recorded material has been collated and is available on 5 CD-ROM's (except for the laryngograph signals and some of the calibration signals, which have been impossible to retrieve from the tapes they were stored on). The laryngograph signals are archived at the recording site.

The directory structure of the database is listed in Appendix A.4.

The database is stored on 5 CD-ROM's, and the data are placed as follows:

- CD #1: Calibration signals.
Configuration files.
Numbers, Many Talker set.
- CD #2: Numbers, Few Talker set.
- CD #3: Passages, Few & Many Talker set.
Sentence, Few & Many Talker set.
- CD #4: CVC, Few Talker set (8 talkers).
- CD #5: CVC, Few Talker set (2 talkers).
Carrier Phrases, Very Few Talker set.
Carrier Words, Very Few Talker set.

The files were automatically named by the recording software EUROPEC. The file naming is as follows:

T T P P X X X X . C N F

File type

S : Sampled speech

L : Laryngograph signal

O : Orthographic file

Nationality

D : Danish

Corpus Index

N : Numbers

S : Sentences

P : Passages

V : CVC words

W : CVC carrier phrases

Serial Number (one number per take)

Prompting Text Name

Talker ID

3.11 Data quantity of the Danish EUROM.1 database

Data quantity of the speech signals (in MByte):

	Numbers	Sentences	Passages	CVC	Carriers	Sum
Few						
1 Talker	54.9	12.1	15.6	70.6	96.1	249.3
10 Talkers	549.6	121.0	156.0	705.9	*192.1	1724.6
Many						
1 Talker	6.9	1.5	3.1	11.6		
60 Talkers	411.0	88.8	187.8	687.6		
Total						
10+60						
Talkers	960.6	209.8	343.8	705.9	*192.1	2412.2

Data quantity of the Laryngograph signals (in MByte):

	Numbers	Sentences	Passages	CVC	Carriers	Sum
Few						
1 Talker	54.9	12.1	15.6	70.6	96.1	249.3
10 Talkers	549.6	121.0	156.0	705.9	*192.1	1724.6

* : Only Very Few Talker set, i.e. 2 talkers.

4. Conclusion

It was the experience that it definitely is required to have two operators working on the database recordings. Supervising the recordings is so tiring that a single operator probably can not meet the high quality requirements setup for this database.

One of the major ideas behind the passages were to have task related material. However it was experienced that it was hard for the talkers to produce natural intonation in the passages as well as the sentences.

In a postverification process which led to the collation of the recordings into a distributable representation, it was concluded that no fatal errors were present.

A further investigation, however, showed that the start/stop positioning within EUROPEC often fails on initial and final fricatives (presumably due to their low energy content). Fortunately this is not a fatal error, as it was found that in ALL the mispositioning cases, the fricatives were included in the "signal head" and/or the "end signal" so that complete utterances have been preserved throughout the database. Consequently, it is highly recommended (in the case of signal triggered mode) to choose the maximum available signal head, i.e. 200 ms.

References

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