1. Supplementary Informations for Materials and Methods

1.1. Feature vectors for classifications

- Each of the 14 measures of interaction calculated for EEG segments during the two sessions of rest (14 × 2 classifications).
- Each of the 14 measures during learning, immediate recall, delayed recall after two weeks, immediate recognition, and delayed recognition after two weeks (14 × 5 classifications).
- Each of the 3 MRI feature vectors (3 classifications).
- Neuropsychological test results at baseline (1 classification).

Then, we created combinations of all of these feature vectors:

- All EEG measures during rest with all MRI feature vectors (14 × 2 × 3 classifications).
- All EEG measures during cognitive tasks with all MRI feature vectors (14 × 5 × 3 classifications).
- All EEG measures during rest with the neuropsychological feature vector (14 × 2 × 1 classifications).
- All EEG measures during cognitive tasks with the neuropsychological feature vector (14 × 5 × 1 classifications).
- All MRI feature vectors with the neuropsychological feature vector (3 × 1 classifications).
- All EEG measures during rest with all MRI feature vectors and the neuropsychological feature vector (14×2×3×1 classifications).
- All EEG measures during cognitive tasks with all MRI feature vectors and the neuropsychological feature vector (14×5×3×1 classifications).

1.2. Feature subset selection

Because of the high dimensionality of the data, we implemented a feature subset selection procedure. Specifically, it is known that when this length exceeds the size of the sample, it can cause artificially high accuracies due to overfitting. This is easily the case for the EEG measures of interaction, because here the length of the feature vector is up to 17 × 17 × 6 for the 17 selected channels and the 6 frequency bands.

Classification and feature subset selection was done in a nested design with 3 layers with 5-fold cross validation (an illustration can be found in Figure 1 in the Supplementary section). We implemented an outer layer as a division of the data into 20% of the data for testing the resulting model, and 80% for feature vector optimisation and cross validation, i.e. submitted to the middle layer. The middle layer is a first inner loop, implemented again with 5-fold cross-validation. This loop aims to estimate the consistency of
selected features, since each run yields a different feature vector. The inner layer is a second, thus, nested inner loop, again with 5-fold cross-validation in order to perform adequate feature subset selection. So-called k-fold cross-validation consist of k repetitions of leaving out \( N/k \) samples as the training set, while the remaining \( N - (N/k) \) samples are used during the training step. All subsets were drawn in order to maintain the original proportion of the two groups of participants with vs. without cognitive decline on the respective subscale.

The whole algorithm is described as follows:

1. First, one fifth of the segments were excluded as the outer-layer test set for the final validation step in the outer layer, while the remaining four fifths of segments were used as the outer-layer training set and, thus, submitted to the next step.
2. The outer-layer training set obtained from the outer loop was again divided into 5 equal sized subsets, each one maintaining the proportion of group sizes (with/without decline) from the original sample. For each of these 5 sets, the following steps were repeated:
   - (a) The set was left out, the other 4 sets were merged to form the middle-layer training set.
   - (b) A t-test for the middle-layer training-set segments was calculated between the two conditions, thus yielding one p-value for each entry of the feature vector.
   - (c) The resulting p-values were sorted in ascending order.
   - (d) The feature vector was initiated by taking the feature with the smallest p-value, thus, the initial length was one.
   - (e) For this feature vector, the classification accuracy was calculated with 5-fold cross-validation, thus, the middle-layer training set was divided into an inner-layer 5-fold partition with an inner-layer training-  and testing set
   - (f) Now, the next feature from the sorted list was added. For this feature vector, the inner-layer classification with 5-fold cross-validation was repeated.
   - (g) Now the result was compared to the previous result. The new entry to the feature vector was included only if the condition constraints were met as follows:
     - The classification accuracy obtained with the current feature vector was \( \geq \) the maximum of the previously obtained classification accuracies; that is, the second accuracy had to be \( \geq \) than the first entry; for the 6th entry accuracy was compared to the accuracy of the previously obtained feature vector of 5 entries, which is the vector with the maximal accuracy.
     - If the so far best sensitivity/specificity, or in other words, accuracy for segments of the first condition/second condition, respectively, was lower than 0.75, then the obtained sensitivity had to be \( \geq \) than this maximum.
     - If the so far best specificity/sensitivity, was lower than 0.5, then the obtained specificity had to be larger, that is \( > \) than this maximum.
   - (h) This way, features were added and tested for their contribution to the classification accuracy until all available features were used, or until the feature vector reached a maximum of 30 entries, or if more than a consecutive number of 10% of all available features was not added to the feature vector. If 10% was less than 100 features, than the maximum number of features that were tested was 100 or, if the maximum number of available features was lower than 100, the maximum number.
3. The average length \( N \) of the resulting 5 optimised feature sets was calculated. The number of times each feature was selected across these 5 runs was counted. A final feature vector was formed by including only those features which were selected at least in 2 of the 5 iterations. If this resulted in no features, all features were included that were selected at least in 1 out of 5 iterations. If the resulting feature vector included more than \( N \) features, only the top-most selected 30 features were included. If all features were selected the same amount of times (e.g. one time) a random selection was chosen.
4. The resulting feature vector was used to train a support vector machine on the outer-layer training set, and the resulting model was used to classify the outer-layer test set, which was then used to calculate the general classification accuracy and the within-group accuracy for the two conditions (i.e. sensitivity/specificity).

The threshold of 0.75 was selected as rough estimators for above-chance classification; a value of 0.75 can be considered to be clearly above chance, since the expected chance level would be around 0.5.

1.3. Task

The learning session contained the presentation of 72 pairs of german nouns. The order of the words was kept constant over all participants. Of these pairs of words, 36 had an obvious semantic relationship (such as water - glas), and 36 had no obvious relationship (such as heaven - bookshelf). This variation should ease the remembering for half of the words, while making it more difficult for the second half. First, after presentation of each pair of words, the participant had to indicate whether there was a relationship between the two words or not, by pressing a button on the keyboard. After the button was pressed the participant was prompted on the screen with the question 'Relation between words?' and in a second line below the instruction 'Please spell out the relationship and press button to continue.' In this time window, the participant was requested to spell out the potential relationship that came to his or her
mind. This step allowed us to control for the learning strategy employed by the participants. Thinking of a possible relationship should facilitate learning.

The recall session consisted of 72 trials, repeating the 72 word-pairs from the learning phase in the same order. Each trial was formed by a cued recall and a recognition phase. In the cued recall, only the first word was given on the screen, and a question mark indicated that the second word should be reported. Participants proceeded with a button press to the next screen on which they were asked to spell out the second word or to indicate that they had forgotten it. An experimenter took a note on the correctness of the word. Only identical words were considered as correct, with one exception where the plural of a word was accepted as correct (story - stories). After that, a further button press brought the participant to the recognition phase. Here, next to the cue word, three words were presented. The correct word appeared in a pseudo-randomized order on the three positions, and the participants had to select the correct word via button press.
2. Supplementary Figures

Figure 1: **Classification and feature subset selection procedure.** A nested-cross-validation procedure with an outer-loop for estimation of generalisation and an inner-loop for feature vector optimisation was implemented.
Figure 2: **Neuropsychological scales selected for prediction of executive functions decline.** The bars indicate how often during the cross-validation process a neuropsychological scale was included into the prediction of decline of executive functions. IQ: intelligence quotient; TAP: test for attentional performance; T: T-value; BDI: Beck depression inventory;
Figure 3: S3: Neuropsychological scales selected for prediction of increase in depressive symptoms. The bars indicate how often during the cross-validation process a neuropsychological scale was included into the prediction of decline of executive functions. IQ: intelligence quotient; TAP: test for attentional performance; T: T-value; BDI: Beck depression inventory;
3. Supplementary tables

Table 1: S1: Demographic data and clinical findings on the hippocampus from structural MRI at baseline

| code  | group | age | hand | sex | MRI                                           |
|-------|-------|-----|------|-----|-----------------------------------------------|
| MCI01 | MCI   | 74  | r    | f   | left: mild hippocampal atrophy               |
| MCI02 | MCI   | 73  | r    | m   | bilateral hippocampal atrophy                |
| MCI03 | MCI   | 71  | r    | f   | bilateral mild/moderate hippocampal atrophy  |
| MCI04 | MCI   | 73  | r    | m   | normal                                        |
| MCI05 | MCI   | 76  | r    | m   | bilateral moderate atrophy, left>right        |
| MCI06 | MCI   | 73  | r    | m   | bilateral severe atrophy                     |
| MCI07 | MCI   | 61  | r    | m   | bilateral moderate atrophy, left>right        |
| MCI08 | MCI   | 64  | r    | m   | normal                                        |
| MCI09 | MCI   | 72  | r    | f   | normal                                        |
| MCI10 | MCI   | 49  | r    | m   | normal                                        |
| MCI11 | MCI   | 62  | r    | m   | left: hippocampal malrotation                 |
| MCI12 | MCI   | 60  | r    | f   | normal                                        |
| MCI13 | MCI   | 64  | r    | m   | normal                                        |
| MCI14 | MCI   | 66  | r    | m   | normal                                        |
| MCI15 | MCI   | 63  | r    | f   | normal                                        |
| MCI16 | MCI   | 51  | r    | f   | left: mild atrophy                            |
| MCI17 | MCI   | 51  | r    | m   | normal                                        |
| MCI18 | MCI   | 72  | r    | m   | n.a.                                          |
| MCI19 | MCI   | 69  | r    | f   | normal                                        |
| MCI20 | MCI   | 57  | r/l  | f   | n.a.                                          |
| SCC01 | SCC   | 56  | r    | f   | left: moderate hippocampal atrophy            |
| SCC02 | SCC   | 69  | r    | m   | normal                                        |
| SCC03 | SCC   | 68  | r    | f   | mild bilateral hippocampal atrophy, right>left|
| SCC05 | SCC   | 75  | r    | m   | bilateral minor hippocampal atrophy, right>left|
| TLE201| TLEr  | 50  | r    | m   | right: hippocampal sclerosis                  |
| TLE202| TLEr  | 21  | l    | m   | left: mild hippocampal sclerosis              |
| TLE205| TLEr  | 37  | r    | f   | left: mild hippocampal sclerosis              |
| TLE207| TLEi  | 54  | r    | f   | left: hippocampal sclerosis                   |
| TLE210| TLEr  | 29  | r    | f   | right: hippocampal sclerosis                  |
| TLE212| TLEi  | 38  | r    | f   | normal                                        |
| TLE214| TLEi  | 53  | r    | f   | left: hippocampal cortical dysplasia, hippocampal sclerosis |
| TLE216| TLEr  | 28  | r    | m   | oligodendroglioma grade II, right mesial      |
| TLE217| TLEr  | 26  | r    | m   | normal                                        |
| HC01  | HC    | 41  | r    | m   | normal                                        |
| HC02  | HC    | 67  | r    | f   | bilateral mild hippocampal atrophy           |
| HC04  | HC    | 66  | r    | m   | bilateral mild hippocampal atrophy, left>right|
| HC05  | HC    | 61  | r    | m   | bilateral mild hippocampal atrophy           |
| HC06  | HC    | 49  | r    | m   | normal                                        |
| HC07  | HC    | 52  | r    | f   | normal                                        |
| HC08  | HC    | 66  | r    | f   | left: hippocampal malrotation                 |
| HC10  | HC    | 70  | r    | w   | normal                                        |
| HC13  | HC    | 74  | r    | m   | normal                                        |
| HC16  | HC    | 67  | r    | f   | normal                                        |
| HC17  | HC    | 45  | r    | f   | normal                                        |
| HC18  | HC    | 62  | r    | f   | normal                                        |
| HC19  | HC    | 26  | r    | m   | normal                                        |
| HC20  | HC    | 24  | r    | f   | normal                                        |
| HC21  | HC    | 72  | r/l  | f   | bilateral mild hippocampal atrophy           |
| HC23  | HC    | 61  | r    | f   | bilateral hippocampal atrophy, severe cortical atrophy |

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| nr   | group | age | hand | sex | MRI                             |
|------|-------|-----|------|-----|---------------------------------|
| HC24 | HC    | 59  | r    | f   | left: mild hippocampal malrotation |
| HC26 | HC    | 65  | r    | f   | normal                          |

MCI=mild cognitive impairment; SCC=subjective cognitive complaints; TLEr=right-lateralised temporal lobe epilepsy; TLEl=left lateralised temporal lobe epilepsy; HC=healthy controls
hand=handedness; r=right; l=left; m=male; f=female; n.a. = information not available;
Table 2: S2: Self-reported medications of participants at baseline.

| code  | group | general                                                                 | anti-epileptic drugs | psycho-pharmacological drugs |
|-------|-------|------------------------------------------------------------------------|-----------------------|-------------------------------|
| MCI01 | MCI   | Simvastatin 40mg 1; Enalaprilmaleat/Hydrochlorothiazid 1; Vitamin D 2xweek | 0                     | 0                             |
| MCI02 | MCI   | Ginko 80mg 1-0-1                                                       | 0                     | 0                             |
| MCI03 | MCI   | Atenolol/Nifedipin 1-0-1                                              | 0                     | 0                             |
| MCI04 | MCI   | Bezastad 200mg 1-0-0, Doxazosin 4mg 1/2-1/2-1/2, Rilmenidine 1mg 1-0-0, Amlodipin 5mg 1-0-1, Nebivolol 5mg 1-0-0, Candesartan Cilexetil/Hydrochlorothiazid 16/12.5mg 1-0-0 | 0                     | 0                             |
| MCI05 | MCI   | Bisoprolol 1/2-0-1/2; Metformin 850mg; Simvastatin 80mg 1/2; Tamsulosin 0.4mg; Phenoprocoumon, Furadantin 1-0-1 | 0                     | 0                             |
| MCI06 | MCI   | 0                                                                      | 0                     | 0                             |
| MCI07 | MCI   | Simvastatin 20mg every 2 days                                          | 0                     | 0                             |
| MCI08 | MCI   | 0                                                                      | 0                     | 0                             |
| MCI09 | MCI   | Acenocoumarol 3/4, Sotalol 1, Olmesartanmedoxomil/Hydrochlorothiazid 1, Doxazosin 1 | 0                     | 0                             |
| MCI10 | MCI   | Lisinopril 20/25mg                                                     | 0                     | 0                             |
| MCI11 | MCI   | Acetylsalicylic Acid 1, Enalaprilmaleat/Hydrochlorothiazid 1x, Metformin 1x | 0                     | 0                             |
| MCI12 | MCI   | Ibandronate                                                            | 0                     | 0                             |
| MCI13 | MCI   | Tiotropium 1x, Beclometasone/Formoterol 2x, Acetylsalicylic Acid 1x, Amlodipin 1x | 0                     | 0                             |
| MCI15 | MCI   | Bisoprolol 2.5mg 1-0-0                                                 | 0                     | 0                             |
| MCI16 | MCI   | Bisoprolol 2.5mg 1-0-1                                                 | 0                     | 0                             |
| MCI17 | MCI   | Tizanidin 4 mg 1x evening, Diclofenac 50mg rapid, Ginko 80mg 1-0-1      | 0                     | 0                             |
| MCI19 | MCI   | 0                                                                      | 0                     | 0                             |
| MCI20 | MCI   | Valsartan 1x, Valsartan/Hydrochlorothiazid 1x                          | 0                     | 0                             |
| MCI21 | MCI   | Lisinopril/Hydrochlorothiazid 1x, Atorvastatin 1x, Ginko 2x            | 0                     | 0                             |
| MCI22 | MCI   | 0                                                                      | 0                     | 0                             |
| SCC01 | SCC   | Levothyroxin 100mg 1/2-0-3/4; folic acid, b-vitamins                   | 0                     | Johanicum                     |
| SCC02 | SCC   | Lisinopril/Hydrochlorothiazid 1x                                       | 0                     | 0                             |
| SCC03 | SCC   | Valsartan 1x                                                           | 0                     | Citalopram 1x, Ginko 2x        |

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| Code   | Group | General                      | Anti-epileptic Drugs                                                                 | Psycho-pharmacological Drugs |
|--------|-------|------------------------------|--------------------------------------------------------------------------------------|------------------------------|
| SCC05  | SCC   | Carvediol 25mg 0-0-1, Gliclazide modified release 30mg 2-0-0, Lisinopril Int 20mg 1-0-0, Lisinopril Hct 25mg 1-0-0, Metformin Rtp 850mg 1-1-1, Simvastatin 30mg 0-0-1, Enalapril/Lercanidipin 10/20mg 0-0-1 | 0                            | 0                            |
| TLE201 | TLEr  | 0                            | Levetiracetam 2x                                                                     | 0                            |
| TLE202 | TLEr  | 0                            | Lacosamid 200mg 1-1, Lamotrigin 100mg 1-1, Lamotrigin 50mg 0-1                        | 0                            |
| TLE205 | TLEr  | Ibumetin forte 400mg when necessary | Levetiracetam 1000mg 1-0-1, Lacosamid 100mg 1-0-1                                       | 0                            |
| TLE207 | TLEI  | Acetylsalicylic acid 100mg    | Levetiracetam 3000mg, Lamotrigin 174mg                                               | Trazodin 100mg               |
| TLE210 | TLEr  | Folic acid 1-0-0              | Levetiracetam 1000mg 1-0-1, Levetiracetam 500mg 0-0-1, Lamotrigin 200mg 1-0-1, Lamotrigin 100mg 1-0-1 | 0                            |
| TLE212 | TLEI  | 0                            | Levetiracetam 1000mg 1-1, Levetiracetam 500mg 2-0-2; Perampanel 2mg 0-0-1;             | Piracetam 600mg 1 1/2-1 1/2 |
| TLE214 | TLEI  | Mexalen 500mg 1-1-1           | Lamotrigin 174mg                                                                      | Triazolam 0,25mg 0-0-0-1     |
| TLE216 | TLEr  | 0                            | Zonisamid 150mg                                                                       | Cannabis                     |
| HC01   | HC    | Loratadin 10mg 0-0-1          | 0                                                                                   | 0                            |
| HC02   | HC    | Omeprazol 20mg, Acenocumarol 1/2, Nebivolol 1, Ramipril 1, Bezafibrat, Levothyroxin-Natrium 1 | 0                            | 0                            |
| HC04   | HC    | Losartan, Losartan HCT, Torasemid, Levothyroxin/Iod, Acetylsalicylic acid | 0                            |                              |
| HC05   | HC    | 0                            | 0                                                                                   | 0                            |
| HC06   | HC    | 0                            | 0                                                                                   | 0                            |
| HC07   | HC    | Thyroxin                     | 0                                                                                   | 0                            |
| HC08   | HC    | Dorzolamid/Timolol 1-0-1, Mefenamin acid when necessary 0-4                     | 0                                                                                   | 0                            |
| HC10   | HC    | ?                            | ?                                                                                   | ?                            |
| HC13   | HC    | Acetylsalicylic acid 1/2,     | 0                                                                                   | 0                            |
| HC16   | HC    | 0                            | 0                                                                                   | 0                            |
| HC17   | HC    | 0                            | 0                                                                                   | 0                            |
| HC18   | HC    | Levothyroxin 100mg 1-0-0, Nebivolol 1/2-0-0, Enalapril-maleat/Lercanidipinhydrochlorid 0-0-1 | 0                            | 0                            |
| HC19   | HC    | 0                            | 0                                                                                   | 0                            |
| HC20   | HC    | Levothyroxin 75mg             | 0                                                                                   | 0                            |
| HC21   | HC    | 0                            | 0                                                                                   | 0                            |
| HC23   | HC    | Lisinopril 2x 1/2, Simvastatin 0-0-1                                         | 0                                                                                   | 0                            |
| HC24   | HC    | Thyroxin 50mg                 | 0                                                                                   | 0                            |

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| code | group | general | anti-epileptic drugs | psycho-pharmacological drugs |
|------|-------|---------|----------------------|-------------------------------|
| HC26 | HC    | Metformin 500mg | 2-0-2, 0 | 0 |
|      |       | Thyroxin 100mg  | 1/2-0-0, | 0 |
|      |       | Vildagliptin 50mg | 1-0-1 | 0 |

MCI = mild cognitive impairment; SCC = subjective cognitive complaints; TLEr = right-lateralised temporal lobe epilepsy; TLEl = left lateralised temporal lobe epilepsy; HC = healthy controls
Table 3: S3: Clinical evaluation of the EEGs of all participants included in this study.

| code  | group | EEG1 awake | base | clinical | EEG2 awake | base | clinical |
|-------|-------|------------|------|----------|------------|------|----------|
| MCI01 | MCI   | yes        | 10   | no       | yes        | 10   | no       |
| MCI02 | MCI   | yes        | 10   | no       | yes        | 10   | no       |
| MCI03 | MCI   | yes        | 13   | no       | yes        | 13   | no       |
| MCI04 | MCI   | yes        | 11   | no       | yes        | 11   | no       |
| MCI05 | MCI   | yes        | 10   | no       | yes        | 10   | FS δ T8 |
| MCI06 | MCI   | yes        | 10   | no       | yes        | 10   | FS θ F4 |
| MCI07 | MCI   | wake N1; vertexwaves; α-dropout | 13   | no       | wake N1; vertexwaves; α-dropout | 13   | no       |
| MCI08 | MCI   | wake-N1; α-dropout | 9    | no       | yes        | 9    | no       |
| MCI09 | MCI   | wake-N1; α-dropout | 10   | FS θ F7 | yes        | 10   | FS θ F7 |
| MCI10 | MCI   | yes        | 10   | FS δ P8, P7 | yes        | 10   | FS δ P8, P7 |
| MCI11 | MCI   | yes        | 10   | FS δ F7-T7, T8 | yes        | 10   | FS δ F7-T7, T8 |
| MCI12 | MCI   | yes        | 10   | no       | yes        | 10   | no       |
| MCI13 | MCI   | yes        | 11   | no       | yes        | 11   | no       |
| MCI15 | MCI   | yes; α-dropout | 9    | no       | yes; α-dropout | 9    | no       |
| MCI16 | MCI   | yes        | 10   | FS δ T7, T8 | yes        | 10   | FS δ T7, T8 |
| MCI17 | MCI   | yes        | 10   | FS δ F7, F8 | yes        | 10   | FS δ F7, F8 |
| MCI19 | MCI   | yes; α-dropout | 9    | FIRDA | yes; α-dropout | 9    | FIRDA |
| MCI20 | MCI   | yes        | 10   | no       | yes        | 10   | no       |
| MCI21 | MCI   | yes; α-dropout | 11   | FS δ-θ F7-T7, T8 | yes; α-dropout | 11   | FS δ-θ F7-T7, T8 |
| MCI22 | MCI   | yes        | 12   | FS δ F7, F8 | yes        | 12   | FS δ F7, F8 |
| SCC01 | SCC   | yes        | 11   | -        | yes        | 11   | -        |
| SCC02 | SCC   | yes        | 10   | -        | yes        | 10   | -        |
| SCC03 | SCC   | yes        | 13   | -        | yes        | 13   | -        |
| SCC05 | SCC   | yes        | 13   | FS θ F8 | yes        | 13   | FS θ F8 |
| TLE201| TLEr  | yes        | 10   | no       | yes        | 10   | no       |
| TLE202| TLEr  | yes        | 10   | FS θ F4-F8 | yes        | 10   | FS θ F4-F8 |
| TLE205| TLEr  | yes        | 10   | repetitive sharp-waves F8-T8: 1.5-2/s | yes        | 10   | no       |
| TLE207| TLEr  | yes        | 10   | no       | yes        | 10   | no       |
| TLE210| TLEr  | yes        | 10   | FS δ F8 | yes        | 10   | FS δ F8 |
| TLE212| TLEr  | yes        | 9    | no       | yes        | 9    | no       |
| TLE214| TLEr  | yes        | 10   | no       | -          | -    | -        |
| TLE216| TLEr  | yes        | 12   | no       | wake-N1    | 12   | no       |
| TLE217| TLEr  | yes        | 12   | FS θ F8 | -          | -    | -        |
| HC01  | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC02  | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC04  | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC05  | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC06  | HC    | yes        | 9    | no       | yes        | 9    | no       |
| HC07  | HC    | wake-N1    | 13   | no       | yes        | 13   | no       |
| HC08  | HC    | wake-N1    | 9    | no       | yes        | 9    | no       |
| HC10  | HC    | yes        | 12   | no       | yes        | 12   | no       |
| HC13  | HC    | yes        | 10   | no       | yes        | 10   | no       |

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| code | group | EEG1 awake | base | clinical | EEG2 awake | base | clinical |
|------|-------|------------|------|----------|------------|------|----------|
| HC16 | HC    | yes        | 13   | no       | yes        | 13   | no       |
| HC17 | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC18 | HC    | wake N1; vertexwaves; α-dropout | 12 | FS δ-θ T7, T8 | yes | 12 | FS δ-θ T7, T8 |
| HC19 | HC    | yes        | 10   | no       | wake N1; vertexwaves; α-dropout | 10   | no       |
| HC20 | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC21 | HC    | yes        | 11   | FS θ T8 | yes        | 11   | FS θ T8 |
| HC23 | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC24 | HC    | yes        | 10   | no       | yes        | 10   | no       |
| HC26 | HC    | yes        | 11   | FS δ-θ T7 | yes | 11 | FS δ-θ T7 |

EEG1/2 = results from clinical evaluation of the first and second EEG recording; MCI = mild cognitive impairment; SCC = subjective cognitive complaints; TLEr = right lateralised temporal lobe epilepsy; TLEl = left lateralised temporal lobe epilepsy; HC = healthy controls; awake = wakefulness/sleep signs or stage; FS = focal slowing; FIRDA = frontal intermitted rhythmic delta activity
| code   | lateralisaton | localisation | type            | seizure |
|--------|---------------|--------------|-----------------|---------|
| TLE201 | right         | mesial       | focal S/C       | no      |
| TLE202 | right         | mesial       | focal S/C, FTSG | n.a.    |
| TLE205 | right         | mesial       | focal C, FTSG   | n.a.    |
| TLE207 | left          | mesial       | focal S         | yes     |
| TLE210 | right         | n.d.         | focal S         | no      |
| TLE212 | left          | mesial       | focal C, FTSG   | no      |
| TLE214 | left          | n.d.         | focal C         | no      |
| TLE216 | right         | mesial       | focal C, FTSG   | no      |
| TLE217 | right         | mesial/insular | focal S/C     | n.a.    |

TLE = temporal lobe epilepsy; type = seizure type; seizure = seizures within 24h before/after EEG; n.a. = information not available; n.d. = not defined; S = simple (without loss of consciousness); C = complex (with loss of consciousness); FTSG = focally triggered secondary generalised tonic-clonic seizure.
Table 5: S5: Neuropsychological test results of the sub-groups at inclusion time.

|                                | MCI   | SCC   | TLEr  | TLEl  | HC    |
|--------------------------------|-------|-------|-------|-------|-------|
| **Wechsler's intelligence test, IQ values** |       |       |       |       |       |
| Matrices                        | 108   | 115   | 96.67 | 78.33 | 115.28|
| Mosaics                         | 101.5 | 103.75| 95    | 71.67 | 113.61|
| repeating numbers               | 100.6 | 107.5 | 88.33 | 91.67 | 112.78|
| **Regensburg verbal fluency test, RWT, T-values** |       |       |       |       |       |
| verbal fluency                  | 42.68 | 62.75 | 18.17 | 11    | 63.78 |
| categorical fluency             | 47.9  | 74.75 | 19.83 | 20    | 62.72 |
| semantic fluency                | 63.84 | 88.75 | 16    | 8.33  | 72.78 |
| category transition             | 63.58 | 72    | 4.83  | 11    | 69.89 |
| **verbal memory test, VLMT, T-values** |       |       |       |       |       |
| learning                        | 47.45 | 51    | 47.5  | 40.33 | 52.61 |
| consolidation                   | 37.7  | 40.25 | 49.33 | 46.33 | 45.33 |
| recall                          | 40.55 | 49.25 | 42.83 | 42    | 50    |
| recognition                     | 41.65 | 44    | 43.83 | 43.67 | 48.89 |
| **attentional performance, TAP, T-values** |       |       |       |       |       |
| flexibility (sum)               | 55.84 | 51.75 | 43.75 | 38.67 | 55.61 |
| acoustic reaction 1             | 41.95 | 44    | 42.67 | 37.67 | 41.39 |
| visual reaction 1               | 49.47 | 57.25 | 47.83 | 40.33 | 53.72 |
| errors 1                        | 38    | 50.25 | 44.17 | 35    | 41.67 |
| misses 1                        | 44.90 | 42    | 46    | 34.33 | 48.56 |
| acoustic reaction 2             | 40.78 | 36    | 40    | 29    | 43.44 |
| visual reaction 2               | 52    | 57    | 32.5  | 38    | 52.39 |
| errors 2                        | 40.17 | 42.25 | 45.5  | 37    | 44.17 |
| misses 2                        | 43.17 | 43.75 | 40    | 33.67 | 49.33 |
| MWT IQ                          | 103   | 118   | 93    | 107*  | 116.67|
| DCS, percentile rank            | 54.95 | 55.5  | 18.83 | 27    | 64.83 |
| BDI, sum score                  | 6.89  | 10.75 | 15.25 | 18    | 3.44  |

MCI= mild cognitive impairment; SCC= subjective cognitive complaints; TLEr= right lateralized temporal lobe epilepsy; TLEl= left lateralized TLE; HC= healthy controls; WTS= Wald-type statistics; MWT= Multiple-choice lexical test; DCS= Test for cerebral damage; BDI= Beck's depression inventory
Table 6: Number of samples for each cognitive subdomain classification result per sub-group of participants without and with decline, after data augmentation.

| domain                  | MRI      | EEG         | feature   | PSY      | no decline | decline |
|-------------------------|----------|-------------|-----------|----------|------------|---------|
| executive functions     | structural | recognition 2 | pCOH yes  | 357      | 59         |
|                         | structural | recall 2    | pCOH no   | 357      | 59         |
| visual-verbal memory    | wavelet  | no          | no        | no       | 60         | 70      |
| divided attention       | wavelet  | no          | no        | yes      | 243        | 184     |
| depression              | rest 1   | PDCF yes    | 1514      | 292      |

PSY = psychological scales included; pCOH = partial coherence; iCOH = imaginary coherence; PDCF = partial directed coherence factor
Table 7: Overall accuracy alongside with specificity (percent correctly recognized as showing no decline) and sensitivity (percent correctly recognized as showing decline) separately for neurological populations.

| Prediction | Accuracy | MCI spec | MCI sens | SCC spec | SCC sens | HC spec | HC sens | TLEr spec | TLEr sens | TLEl spec | TLEl sens |
|------------|----------|----------|----------|----------|----------|---------|---------|-----------|-----------|-----------|-----------|
| executive  | 76       | 72       | 62       | *        | 87       | 63      | 80      | 93        | 100       | 92        | *         |
| functions  | 77       | 53       | 81       | *        | 92       | 59      | 77      | 96        | 91        | 90        | *         |
| visual-verbal | 80    | 76       | 100      | 0        | 50       | 100     | 100     | *         | *         | *         | *         |
| memory     | 86       | 100      | 30       | 0        | 100      | 100     | 100     | *         | *         | *         | *         |
| divided    | 81       | 50       | 100      | 100      | 100      | 100     | *       | *         | *         | *         | *         |
| attention  | 79       | 55       | 86       | 100      | 48       | 90      | 73      | 100       | 85        | 100       | 84        |
| depression | 83       | 68       | 89       | 76       | 0        | 97      | 96      | 66        | *         | 100       | 100       |

MCI = mild cognitive impairment; SCC = subjective cognitive complaints; TLEr = right lateralised temporal lobe epilepsy; TLEl = left lateralised temporal lobe epilepsy; HC = healthy controls

* no patient available for evaluation after artefact removal
4. Regions of the automated segmentation based on the Hammer’s atlas

List of the regions according to the Hammer’s atlas. TL: temporal lobe, OL: occipital lobe; CG: cingulate gyrus; FL: frontal lobe; PL: parietal lobe; R: right, L: left;

1. TL hippocampus R
2. TL hippocampus L
3. TL amygdala R
4. TL amygdala L
5. TL anterior temporal lobe medial part R
6. TL anterior temporal lobe medial part L
7. TL anterior temporal lobe lateral part R
8. TL anterior temporal lobe lateral part L
9. TL parahippocampal and ambient gyrus R
10. TL parahippocampal and ambient gyrus L
11. TL superior temporal gyrus middle part R
12. TL superior temporal gyrus middle part L
13. TL middle and inferior temporal gyrus R
14. TL middle and inferior temporal gyrus L
15. TL fusiform gyrus R
16. TL fusiform gyrus L
17. cerebellum R
18. cerebellum L
19. brainstem excluding substantia nigra
20. insula L
21. insula R
22. OL lateral remainder occipital lobe L
23. OL lateral remainder occipital lobe R
24. CG anterior cingulate gyrus L
25. CG anterior cingulate gyrus R
26. CG posterior cingulate gyrus L
27. CG posterior cingulate gyrus R
28. FL middle frontal gyrus L
29. FL middle frontal gyrus R
30. TL posterior temporal lobe L
31. TL posterior temporal lobe R
32. PL inferolateral remainder parietal lobe L
33. PL inferolateral remainder parietal lobe R
34. caudate nucleus L
35. caudate nucleus R
36. nucleus accumbens L
37. nucleus accumbens R
38. putamen L
39. putamen R
40. thalamus L
41. thalamus R
42. pallidum L
43. pallidum R
44. corpus callosum
45. Lateral ventricle excluding temporal horn R
46. Lateral ventricle excluding temporal horn L
47. Lateral ventricle temporal horn R
48. Lateral ventricle temporal horn L
49. Third ventricle
50. FL precentral gyrus L
51. FL precentral gyrus R
52. FL straight gyrus L
53. FL straight gyrus R
54. FL anterior orbital gyrus L
55. FL anterior orbital gyrus R
56. FL inferior frontal gyrus L
57. FL inferior frontal gyrus R
58. FL superior frontal gyrus L
59. FL superior frontal gyrus R
60. PL postcentral gyrus L
61. PL postcentral gyrus R
62. PL superior parietal gyrus L
63. PL superior parietal gyrus R
64. OL lingual gyrus L
65. OL lingual gyrus R
66. OL cuneus L
67. OL cuneus R
68. FL medial orbital gyrus L
69. FL medial orbital gyrus R
70. FL lateral orbital gyrus L
71. FL lateral orbital gyrus R
72. FL posterior orbital gyrus L
73. FL posterior orbital gyrus R
74. substantia nigra L
75. substantia nigra R
76. FL subgenual frontal cortex L
77. FL subgenual frontal cortex R
78. FL subcallosal area L
79. FL subcallosal area R
80. FL pre-subgenual frontal cortex L
81. FL pre-subgenual frontal cortex R
82. TL superior temporal gyrus anterior part L
83. TL superior temporal gyrus anterior part R

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