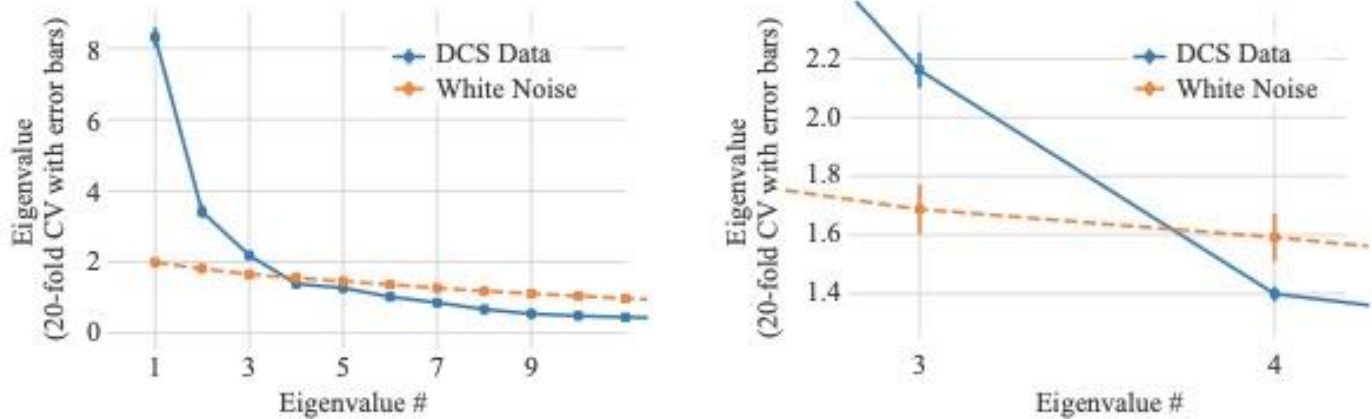
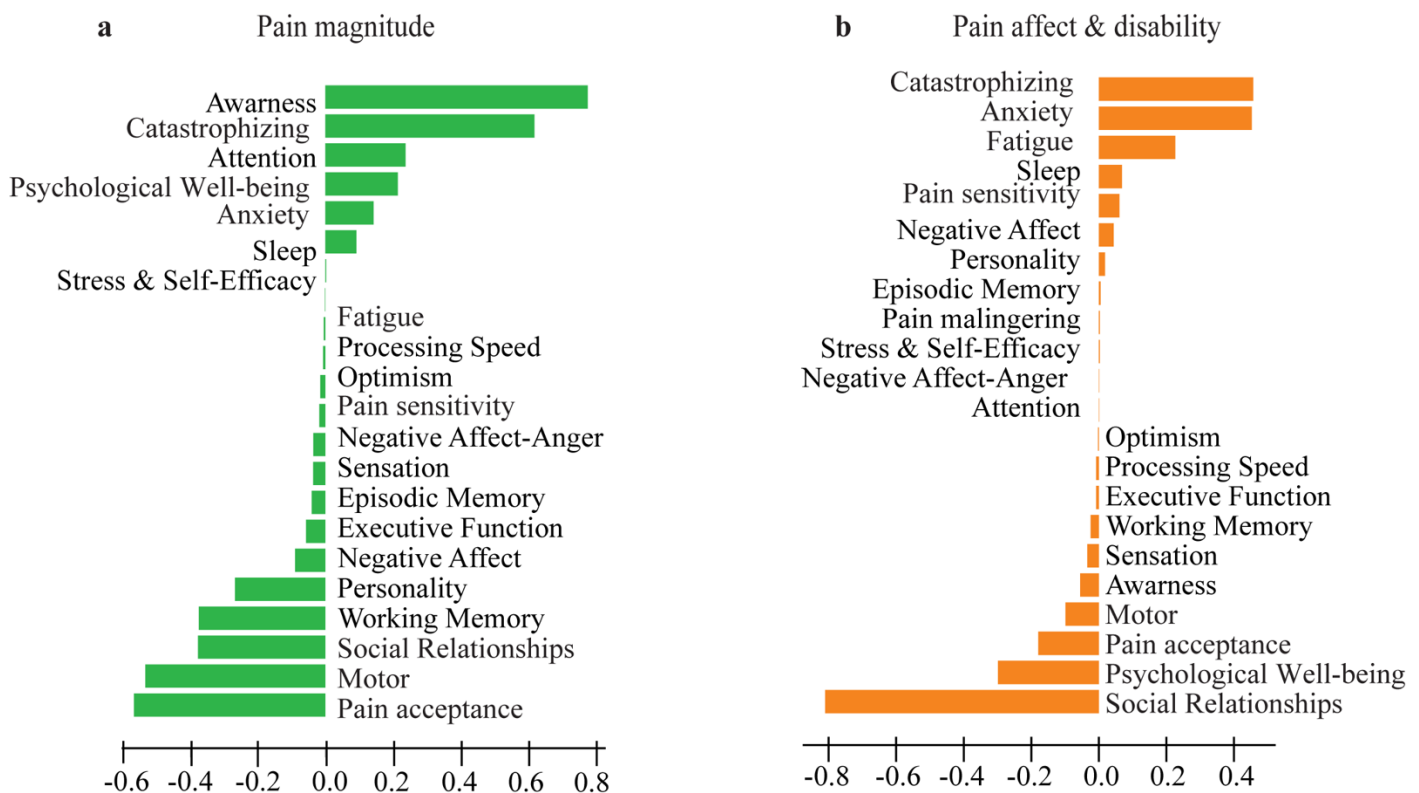


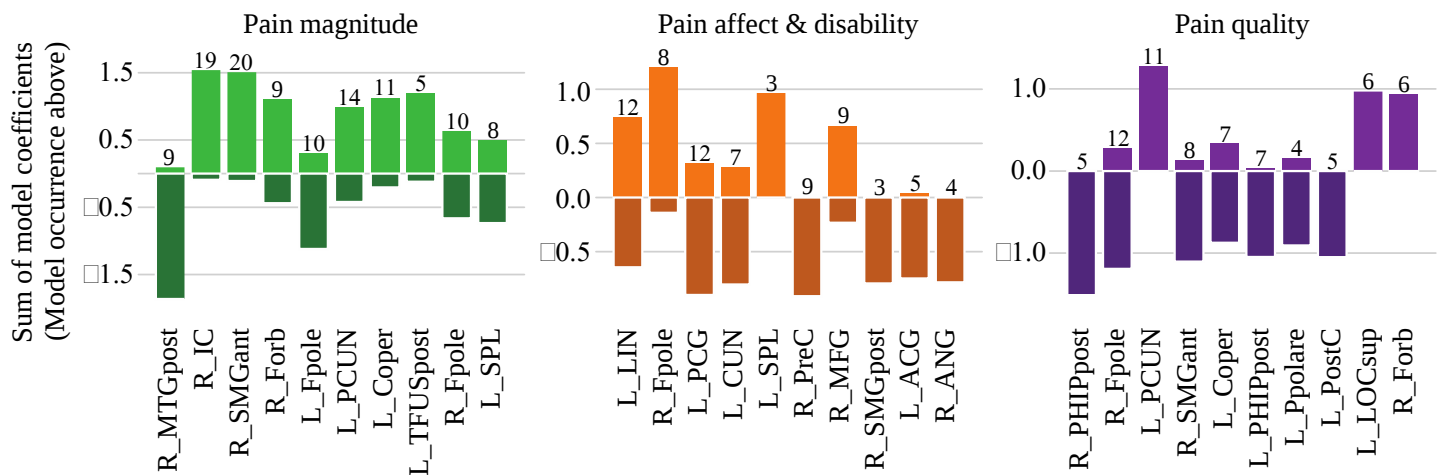
Supplementary Material



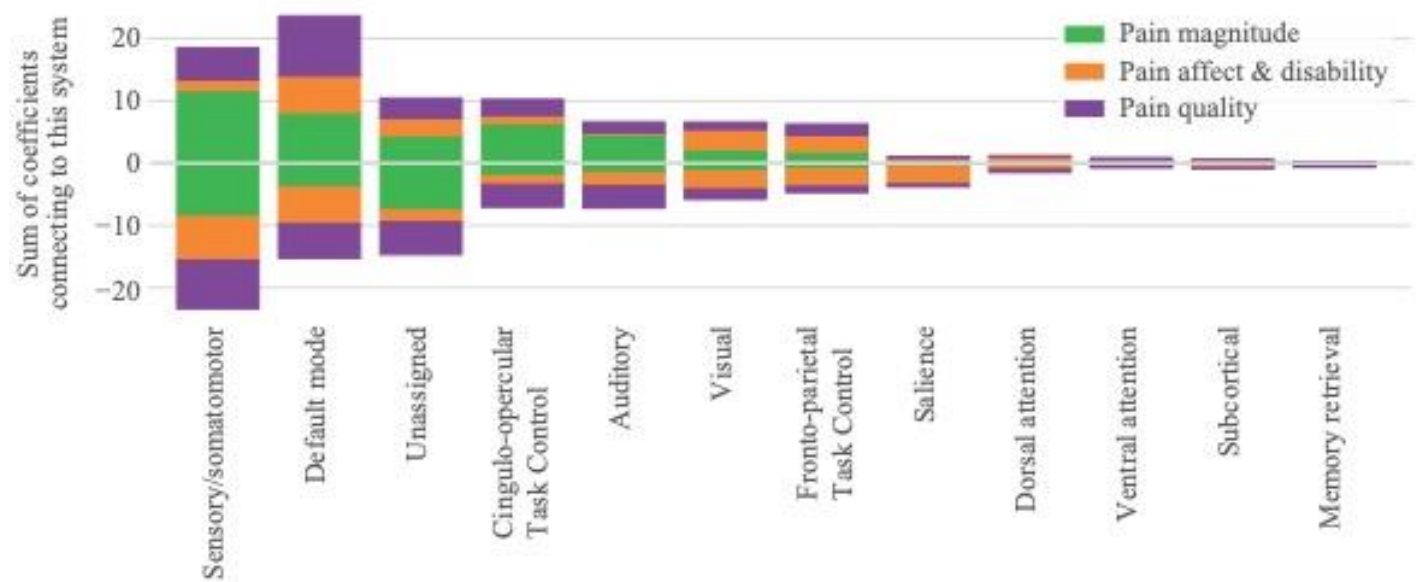
Supplementary Figure 1 – **Parallel analysis for pain domain PCA**. The first panel shows the eigenvalues of the DCS data singular value decomposition in blue versus normally distributed noise eigenvalues in orange. The second panel zooms in on the crossover. The fourth eigenvalue lies below the noise threshold, three components are optimal. Error bars are determined using 20-fold cross-validation.



Supplementary Figure 2 – **Sum model coefficients against pain magnitude and pain affect & disability** (not-selected count as zero in average). The L1-regularized linear models get averaged on bootstrapped DCS data samples. It chooses from 77 independent variables including NIH toolbox tests and DCS psycho-social questionnaire scores.



Supplementary Figure 3 – **Weight of individual Power et al. hubs in the three brain connectivity models.** The positive and negative coefficients of connectivities pointing to all hubs are summed separately. These plots contain the ten largest hubs by absolute model coefficient size. Numbers above the bars indicate the number of models connectivities pointing toward individual hubs.



Supplementary Figure 4 – **High-level similarities and differences of brain network importance in pain-predicting models.** Details are identical to Figure 4.

Supplementary Tables

Pain Dependent Variable	Abbreviation
12-Item Short Form Survey Mental score	SF12_ment
12-Item Short Form Survey Physical score	SF12_phys
Beck Depression Inventory	BDI
McGill Pain Questionnaire Affective	MPQ_affct
McGill Pain Questionnaire Pain Intensity	MPQ_int
McGill Pain Questionnaire Pain Pattern	MPQ_pattern
McGill Pain Questionnaire Sensory	MPQ_sense
McGill Pain Questionnaire Total Score	MPQ_tot
NIH Toolbox Pain Interference Survey CAT Age 18+ v2.0	TB Pain interference
Numeric Rating Scale Pain at Baseline	NRS_V1

Numeric Rating Scale Pain at Randomization	NRS_V0
Oswestry Disability Index	ODI
Pain diary mean	Diary_mean
Pain diary standard deviation	Diary_stdev
painDETECT Questionnaire Strongest Pain	PDQ_NRS_max
painDETECT Questionnaire Average Pain	PDQ_NRS_mean
painDETECT Questionnaire Current Pain	PDQ_NRS_now
painDETECT Questionnaire Total Score	PDQ_tot
Positive and Negative Affect Schedule Negative Affect score	PANAS_neg
PROMIS-57 Depression	PROMIS57_depr
PROMIS-57 Pain Intensity	PROMIS57_int
PROMIS-57 Pain Interference	PROMIS57_intrfrc
PROMIS-57 Physical Function	PROMIS57_phys

Supplementary Table 1 – Pain component dependent variables and their abbreviations in the paper.

Independent Variable	Abbreviation
Attentional control scale (ACS) Total score	ACS_tot
Adult Odor ID Score	
NIH Toolbox Anger-Affect 18-85, theta	
NIH Toolbox Anger-Hostility 18-85, theta	
NIH Toolbox Anger-Physical Aggression 18-85, theta	
Chronic pain acceptance questionnaire (CPAQ) Activity Engagement	CPAQ_active
CPAQ Pain Willingness	CPAQ_will
CPAQ Total Score	
NIH Toolbox DCCS computed score (0-10)	
NIH Toolbox Dexterity - 9 Hole Pegboard - Dominant hand score	TB Dexterity_dom
NIH Toolbox Dexterity - 9 Hole Pegboard - NonDominant hand score	
Emotional attentional control scale (EACS) Score	
NIH Toolbox Emotional Support 18-85, theta	
NIH Toolbox Endurance - 2-minute walk - distance, fee	TB Endurance
Emotional regulation questionnaire (ERQ) Cognitive Reappraisal	
ERQ Expressive Suppression	
NIH Toolbox Fear-Affect 18-85, theta	
NIH Toolbox Fear-Somatic Arousal 18-85, theta	
Five-facet mindfulness questionnaire (FFM) Act with Awareness	
FFM Describe	
FFM Nonjudge	
FFM Nonreact	
FFM Observe	
NIH Toolbox Flanker computed score (0-10)	
NIH Toolbox Friendship 18-85, theta	
NIH Toolbox General Life Satisfaction 18-85, theta	TB Satisfaction
NIH Toolbox Instrumental Support 18-85, theta	

Loss aversion questionnaire (LAQ) Score	
NIH Toolbox List Sorting score	TB List Sorting
NIH Toolbox Locomotion - 4-meter walk - Usual Pace - time, seconds	
NIH Toolbox Loneliness 18-85, theta	
Live orientation test-revised (LOTR) Score	
Multidimensional assessment of interoceptive awareness (MAIA) Attention Regulation	
MAIA Body Listening	
MAIA Emotional Awareness	
MAIA Non-Distracting	
MAIA Not-Worrying	MAIA_not_worry
MAIA Noticing	
MAIA Self-Regulation	MAIA_regu
MAIA Trusting	
NIH Toolbox Meaning and Purpose 18-85, theta	
Neo five factor inventory (NEO) Agreeableness	
NEO Conscientiousness	
NEO Extraversion	
NEO Neuroticism	
NEO Openness	NEO_open
Positive and negative affect schedule (PANAS) positive affect	PANAS_pos
PASS Cognitive	
PASS Escape/Avoidance	PASS_escape
PASS Fear	
PASS Physiological Anxiety	
PASS Total Score	
NIH Toolbox Pattern Comparison Score	
Pain catastrophizing scale (PCS) Helplessness	PCS_help
PCS Magnification	PCS_mag
PCS Rumination	
PCS Total Score	PCS_tot
NIH Toolbox Perceived Hostility 18-85, theta	
NIH Toolbox Perceived Rejection 18-85, theta	
NIH Toolbox Perceived Stress 18-85, theta	
NIH Toolbox Picture Sequence Memory Theta score	
NIH Toolbox Positive Affect 18-85, theta	TB Positive
Patient-reported outcomes measurement information system (PROMIS) Anxiety	PROMIS57_anx
PROMIS Fatigue	PROMIS57_fatig
PROMIS Sleep Disturbance	
PROMIS Social	PROMIS57_social
Pain sensitivity questionnaire (PSQ) Minor	
PSQ Moderate	
PSQ Total Score	
NIH Toolbox Sadness 18-85, theta	
NIH Toolbox Self-Efficacy 18-85, theta	
NIH Toolbox Static Visual Acuity logMAR score	
NIH Toolbox Taste Intensity - Whole mouth: Quinine	

NIH Toolbox Upper Extremity Strength - Grip Strength - Dominant Hand, pounds	
NIH Toolbox Upper Extremity Strength - Grip Strength - NonDominant Hand, pounds	

Supplementary Table 2 – Independent variables of the questionnaire pain component models.

Abbreviation	Full Name
ACG	Anterior Cingulate Gyrus
AMYG	Amygdala
ANG	Angular Gyrus
CAU	Caudate
COper	Central Operculum
CUN	Cuneal Cortex
FMC	Frontal Medial Cortex
FOper	Frontal Operculum
FOrb	Frontal Orbital Cortex
Fpole	Frontal Pole
HES	Heschl's Gyrus
HIP	Hippocampus
IC	Insular Cortex
IFGoper	Inferior Frontal Gyrus, pars opercularis
IFGtriang	Inferior Frontal Gyrus, pars triangularis
IntraCAL	Intracalcarine Cortex
ITGant	Anterior Inferior Temporal Gyrus
ITGpost	Posterior Inferior Temporal Gyrus
ITGto	Temporoccipital part of Inferior Temporal Gyrus
LIN	Lingual Gyrus
LOCinf	Inferior Lateral Occipital Cortex
LOCsup	Superior Lateral Occipital Cortex
MFG	Middle Frontal Gyrus
MTGant	Anterior Middle Temporal Gyrus
MTGpost	Posterior Middle Temporal Gyrus
MTGto	Temporoccipital part of Middle Temporal Gyrus
NAC	Nucleus Accumbens
OFus	Occipital Fusiform Cortex
Opole	Occipital Pole
PAL	Pallidum
ParaCG	Paracingulate Cortex
PCG	Posterior Cingulate Gyrus
PCUN	Precuneous Cortex
PHIPant	Anterior Parahippocampus
PHIPpost	Posterior Parahippocampus
POper	Parietal Operculum
PostC	Postcentral Gyrus
PPolare	Planum Polare
PreC	Precentral Gyrus
PTemporale	Planum Temporale
PUT	Putamen
SFG	Superior Frontal Gyrus
SMA	Juxtapositional Lobule
SMGant	Anterior Supramarginal Gyrus
SMGpost	Posterior Supramarginal Gyrus
SPL	Superior Parietal Lobule
STGant	Anterior Superior Temporal Gyrus

STGpost.	Posterior Superior Temporal Gyrus
Subcallosal	Subcallosal Cortex
SupraCAL	Supracalcarine Cortex
TFUSant	Anterior Division of Temporal Fusiform Cortex
TFUSpost	Posterior Division of Temporal Fusiform Cortex
THA	Thalamus
TOFus	Temporal Occipital Fusiform Cortex
Tpole	Temporal Pole

Supplementary Table 3 – Brain region abbreviations. R_ and L_ stand for right and left hemisphere.

Independent Variable	Pain magnitude	Pain affect & disability
ACS Total Score	0.26128245	-0.0015787
Age	0.01505164	0.00486378
CPAQ Activities Engagement	-0.0159729	-0.120602
CPAQ Pain Willingness	-0.2444776	
CPAQ Total Score	-0.3061405	-0.058667
EACS Total Score	0.06413884	-0.0021671
ERQ Cognitive Reappraisal	-0.0266036	-0.0267943
ERQ Expressive Suppression	0.004709	
FFM Awareness	0.01321268	
FFM Describe	0.03904213	0.00279327
FFM Nonjudge	-0.0375341	
FFM Nonreact	0.07278789	-0.0015273
FFM Observe	-0.019288	-0.0014607
Gender (Female: +1, Male: -1)	-0.0313879	0.00522983
Intercept	0.01736509	-0.0245301
LAQ Total Score	-0.0005947	0.00306978
LOTR Score	-0.0176408	-0.0024617
MAIA Attention Regulation	0.0414767	-0.0205625
MAIA Body Listening	0.01468352	-0.0213587
MAIA Emotional Awareness	0.02192922	-0.0053887
MAIA Non-Distracting	0.00737317	
MAIA Not Worrying	0.39716281	
MAIA Noticing	0.02945731	0.00139199
MAIA Self-Regulation	0.20630685	-0.0090399
MAIA Trusting	-0.0092577	
NEO Agreeableness	-0.0941439	-0.0061103
NEO Conscientiousness	0.0255974	-0.0142787
NEO Extraversion	0.02245582	-0.0051649
NEO Neuroticism	0.00051481	0.04371627
NEO Openness	-0.221916	-1.10E-05
NIH Toolbox Adult Odor ID Score	-0.0359644	-0.0339742
NIH Toolbox Anger-Affect 18-85, theta	-0.0258453	-0.0082236
NIH Toolbox Anger-Hostility 18-85, theta	-0.0697939	

NIH Toolbox Anger-Physical Aggression 18-85, theta	0.06003855	0.00918075
NIH Toolbox DCCS computed score (0-10)	-0.0572222	-0.0079769
NIH Toolbox Dexterity - 9 Hole Pegboard - Dominant hand score	-0.4154423	-0.0020528
NIH Toolbox Dexterity - 9 Hole Pegboard - NonDominant hand	0.08386042	
NIH Toolbox Emotional Support 18-85, theta	0.07594395	-0.0084984
NIH Toolbox Endurance - 2 minute walk – distance	-0.0542475	-0.0886975
NIH Toolbox Fear-Affect 18-85, theta	-0.0859494	
NIH Toolbox Fear-Somatic Arousal 18-85, theta	0.00360258	0.03882926
NIH Toolbox Flanker computed score (0-10)	-0.087741	0.00455564
NIH Toolbox Friendship 18-85, theta	0.01188854	-0.0275855
NIH Toolbox General Life Satisfaction 18-85, theta	0.07177011	-0.062837
NIH Toolbox Instrumental Support 18-85, theta	-0.0258268	-0.0009077
NIH Toolbox List Sorting score	-0.3745583	-0.024273
NIH Toolbox Locomotion - 4 meter walk - Usual Pace - time	-0.0434074	-0.0045836
NIH Toolbox Loneliness 18-85, theta	-0.0162117	0.01825817
NIH Toolbox Meaning and Purpose 18-85, theta	-0.0038701	
NIH Toolbox Pattern Comparison Score	-0.0065844	-0.0079743
NIH Toolbox Perceived Hostility 18-85, theta	0.03274059	0.00047487
NIH Toolbox Perceived Rejection 18-85, theta	-0.0275718	
NIH Toolbox Perceived Stress 18-85, theta		0.00041038
NIH Toolbox Picture Sequence Memory Theta score	-0.0400548	0.00513914
NIH Toolbox Positive Affect 18-85, theta	0.01924489	-0.1292748
NIH Toolbox Sadness 18-85, theta	-0.0070265	0.00474052
NIH Toolbox Self-Efficacy 18-85, theta	0.00260631	0.0023099
NIH Toolbox Taste Intensity - Whole mouth: Quinine	-0.0361743	-0.0184557
NIH Toolbox Upper Extremity Strength - Grip Strength - Dominant Hand, pounds	-0.0553419	-0.0024437
NIH Toolbox Upper Extremity Strength - Grip Strength - NonDominant Hand	-0.0483003	-0.0007149
PANAS Positive Affect	0.14937887	-0.0798893
PASS Anxiety	-0.0117195	0.02432095
PASS Cognitive	0.00778756	
PASS Escape	0.12555665	0.02683135
PASS Fear	-0.0019439	
PCS Helplessness	0.55666458	0.3401996
PCS Magnification	0.01070853	0.0164954
PCS Rumination	0.02873189	0.01085856
PCS Total Score	0.02317265	0.08975406
PROMIS57 Anxiety Score	0.02313963	0.40155614
PROMIS57 Fatigue	-0.0047387	0.22639841
PROMIS57 Sleep Disturbance	0.0920976	0.06092736
PROMIS57 Social	-0.4280945	-0.7919356
PSQ Minor	-0.0018937	0.02188259
PSQ Moderate	0.00605837	0.00668969

PSQ Total Score	-0.0189781	0.04004646
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Supplementary Table 4 –Biopsy&ab **Model coefficients**. Coefficients are averaged over the 20 train-test split samples. Empty cells correspond to variables that have never been selected by the model. If a variable is not selected in a certain sample, it counts as zero toward the average.