



## The Human Affectome

Daniela Schiller<sup>a,\*</sup>, Alessandra N.C. Yu<sup>b,\*</sup>, Nelly Alia-Klein<sup>c</sup>, Susanne Becker<sup>d,e</sup>, Howard C. Cromwell<sup>f</sup>, Florin Dolcos<sup>g,h</sup>, Paul J. Eslinger<sup>i</sup>, Paul Frewen<sup>j</sup>, Andrew H. Kemp<sup>k</sup>, Edward F. Pace-Schott<sup>l,m</sup>, Jacob Raber<sup>n,o</sup>, Rebecca L. Siltan<sup>p</sup>, Elka Stefanova<sup>q,r</sup>, Justin H.G. Williams<sup>s</sup>, Nobuhito Abe<sup>t</sup>, Moji Aghajani<sup>u,v</sup>, Franziska Albrecht<sup>w,x,y,z</sup>, Rebecca Alexander<sup>aa,ab</sup>, Silke Anders<sup>ac,ad</sup>, Oriana R. Aragón<sup>ae,af</sup>, Juan A. Arias<sup>ag,ah</sup>, Shahar Arzy<sup>ai</sup>, Tatjana Aue<sup>aj</sup>, Sandra Baez<sup>ak</sup>, Michela Balconi<sup>al</sup>, Tommaso Ballarini<sup>w</sup>, Scott Bannister<sup>am</sup>, Marlissa C. Banta<sup>an</sup>, Karen Caplovitz Barrett<sup>ao,ap</sup>, Catherine Belzung<sup>aq</sup>, Moustafa Bensafi<sup>ar</sup>, Linda Booij<sup>as,at</sup>, Jamila Bookwala<sup>au</sup>, Julie Boulanger-Bertolus<sup>av</sup>, Sydney Weber Boutros<sup>n</sup>, Anne-Kathrin Bräscher<sup>aw,ax</sup>, Antonio Bruno<sup>ay</sup>, Geraldo Busatto<sup>az</sup>, Lauren M. Bylsma<sup>ba</sup>, Catherine Caldwell-Harris<sup>bb</sup>, Raymond C.K. Chan<sup>bc</sup>, Nicolas Cherbuin<sup>bd</sup>, Julian Chiarella<sup>as,at</sup>, Pietro Cipresso<sup>be,bf</sup>, Hugo Critchley<sup>bg</sup>, Denise E. Croote<sup>bh,bi</sup>, Heath A. Demaree<sup>bj</sup>, Thomas F. Denson<sup>bk</sup>, Brendan Depue<sup>bl</sup>, Birgit Derntl<sup>bm</sup>, Joanne M. Dickson<sup>bn</sup>, Sanda Dolcos<sup>g,h</sup>, Anat Drach-Zahavy<sup>bo</sup>, Olga Dubljević<sup>bp,r</sup>, Tuomas Eerola<sup>am</sup>, Dan-Mikael Ellingsen<sup>bq</sup>, Beth Fairfield<sup>br,bs</sup>, Camille Ferdenzi<sup>ar</sup>, Bruce H. Friedman<sup>bt</sup>, Cynthia H.Y. Fu<sup>bu,bv</sup>, Justine M. Gatt<sup>bw,aa</sup>, Beatrice de Gelder<sup>bx</sup>, Guido H.E. Gendolla<sup>by</sup>, Gadi Gilam<sup>bz,ca</sup>, Hadass Goldblatt<sup>cb</sup>, Anne Elizabeth Kotynski Gooding<sup>bj</sup>, Olivia Gosseries<sup>cc</sup>, Alfons O. Hamm<sup>cd</sup>, Jamie L. Hanson<sup>ce</sup>, Talma Hendler<sup>cf,cg</sup>, Cornelia Herbert<sup>ch</sup>, Stefan G. Hofmann<sup>ci</sup>, Agustin Ibanez<sup>cj,ck,cl,cm</sup>, Mateus Joffily<sup>cn</sup>, Tanja Jovanovic<sup>co</sup>, Ian J. Kahrilas<sup>p</sup>, Maria Kangas<sup>cp</sup>, Yuta Katsumi<sup>cq,h</sup>, Elizabeth Kensinger<sup>cr</sup>, Lauren A.J. Kirby<sup>cs</sup>, Rebecca Koncz<sup>ct,cu</sup>, Ernst H.W. Koster<sup>cv</sup>, Kasia Kozłowska<sup>cw</sup>, Sören Krach<sup>cx</sup>, Mariska E. Kret<sup>cy</sup>, Martin Krippel<sup>cz</sup>, Kwabena Kusi-Mensah<sup>da,db,dc</sup>, Cecile D. Ladouceur<sup>dd</sup>, Steven Laureys<sup>cc</sup>, Alistair Lawrence<sup>de,df</sup>, Chiang-shan R. Li<sup>dg</sup>, Belinda J. Liddell<sup>bw</sup>, Navdeep K. Lidhar<sup>dh</sup>, Christopher A. Lowry<sup>di</sup>, Kelsey Magee<sup>bj</sup>, Marie-France Marin<sup>dj,dk</sup>, Veronica Mariotti<sup>dl</sup>, Loren J. Martin<sup>dh</sup>, Hilary A. Marusak<sup>co,dm</sup>, Annalina V. Mayer<sup>cx</sup>, Amanda R. Merner<sup>bj</sup>, Jessica Minnier<sup>dn</sup>, Jorge Moll<sup>do</sup>, Robert G. Morrison<sup>p</sup>, Matthew Moore<sup>g,h,dp</sup>, Anne-Marie Mouly<sup>dq</sup>, Sven C. Mueller<sup>cv</sup>, Andreas Mühlberger<sup>dr</sup>, Nora A. Murphy<sup>ds</sup>, Maria Rosaria Anna Muscatello<sup>ay</sup>, Erica D. Musser<sup>dt</sup>, Tamara L. Newton<sup>du</sup>, Michael Noll-Hussong<sup>dv</sup>, Seth Davin Norrholm<sup>co</sup>, Georg Northoff<sup>dw</sup>, Robin Nusslock<sup>dx</sup>, Hadas Okon-Singer<sup>dy</sup>, Thomas M. Olinio<sup>dz</sup>, Catherine Ortner<sup>ea</sup>, Mayowa Owolabi<sup>eb,ec</sup>, Caterina Padulo<sup>ed</sup>, Romina Palermo<sup>ee</sup>, Rocco Palumbo<sup>ed</sup>, Sara Palumbo<sup>ef</sup>, Christos Papadelis<sup>eg,eh</sup>, Alan J. Pegna<sup>ei</sup>, Silvia Pellegrini<sup>dl</sup>, Kirsi Peltonen<sup>ej,ek</sup>, Brenda W.J.H. Penninx<sup>v</sup>, Pietro Pietrini<sup>el</sup>, Graziano Pinna<sup>em</sup>, Rosario Pintos Lobo<sup>dt</sup>, Kelly L. Polnaszek<sup>p</sup>, Maryna Polyakova<sup>en</sup>, Christine Rabinak<sup>eo</sup>, S. Helene Richter<sup>ep</sup>, Thalia Richter<sup>dy</sup>, Giuseppa Riva<sup>be,eq</sup>, Amelia Rizzo<sup>ay</sup>

\* Correspondence to: Departments of Psychiatry and Neuroscience, and Friedman Brain Institute, Icahn School of Medicine at Mount Sinai, New York, NY, USA.

\*\* Correspondence to: Neuroqualia (NGO), NSCC, 229a Forrester Hall, 36 Arthur Street, Truro, Nova Scotia, Canada.

E-mail addresses: [daniela.schiller@mssm.edu](mailto:daniela.schiller@mssm.edu) (D. Schiller), [alessandra.yu@icahn.mssm.edu](mailto:alessandra.yu@icahn.mssm.edu) (A.N.C. Yu), [leroy.lowe@neuroqualia.org](mailto:leroy.lowe@neuroqualia.org) (L. Lowe).

<sup>1</sup> These authors contributed equally.

Jennifer L. Robinson<sup>er</sup>, Pedro Rosa<sup>az</sup>, Perminder S. Sachdev<sup>ct,es</sup>, Wataru Sato<sup>et</sup>,  
 Matthias L. Schroeter<sup>w,x</sup>, Susanne Schweizer<sup>eu,ev</sup>, Youssef Shiban<sup>dr,ew</sup>, Advaith Siddharthan<sup>ex</sup>,  
 Ewa Siedlecka<sup>bk</sup>, Robert C. Smith<sup>ey</sup>, Hermona Soreq<sup>ez</sup>, Derek P. Spangler<sup>fa</sup>, Emily R. Stern<sup>fb,ax</sup>,  
 Charis Styliadis<sup>fc</sup>, Gavin B. Sullivan<sup>fd</sup>, James E. Swain<sup>fe</sup>, Sébastien Urben<sup>ff</sup>,  
 Jan Van den Stock<sup>fg</sup>, Michael A. vander Kooij<sup>fh</sup>, Mark van Overveld<sup>fi</sup>,  
 Tamsyn E. Van Rheenen<sup>fj</sup>, Michael B. VanElzakker<sup>fk</sup>, Carlos Ventura-Bort<sup>fl</sup>, Edelyn Verona<sup>fm</sup>,  
 Tyler Volk<sup>fn</sup>, Yi Wang<sup>bc</sup>, Leah T. Weingast<sup>fo</sup>, Mathias Weymar<sup>fl,fp</sup>, Claire Williams<sup>k,fq</sup>,  
 Megan L. Willis<sup>fr</sup>, Paula Yamashita<sup>di</sup>, Roland Zahn<sup>bv</sup>, Barbra Zupan<sup>fs</sup>, Leroy Lowe<sup>ft,\*\*</sup>

<sup>a</sup> Department of Psychiatry, the Nash Family Department of Neuroscience, and the Friedman Brain Institute, at the Icahn School of Medicine at Mount Sinai, New York, NY, United States

<sup>b</sup> Nash Family Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY 10029, United States

<sup>c</sup> Department of Psychiatry and Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, United States

<sup>d</sup> Department of Cognitive and Clinical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, J5, 68159 Mannheim, Germany

<sup>e</sup> Integrative Spinal Research Group, Department of Chiropractic Medicine, University Hospital Balgrist, University of Zurich, Balgrist Campus, Lengghalde 5, 8008 Zurich, Switzerland

<sup>f</sup> J.P. Scott Center for Neuroscience, Mind and Behavior, Department of Psychology, Bowling Green State University, Bowling Green, OH 43403, United States

<sup>g</sup> Beckman Institute for Advanced Science & Technology, University of Illinois at Urbana-Champaign, Urbana, IL, United States

<sup>h</sup> Department of Psychology, University of Illinois at Urbana-Champaign, Champaign, IL, United States

<sup>i</sup> Departments of Neurology, Neural & Behavioral Science, Radiology, and Public Health Sciences, Penn State Hershey Medical Center and College of Medicine, Hershey, PA, United States

<sup>j</sup> Departments of Psychiatry, Psychology and Neuroscience at the University of Western Ontario, London, Ontario, Canada

<sup>k</sup> School of Psychology, Faculty of Medicine, Health & Life Science, Swansea University, Swansea, United Kingdom

<sup>l</sup> Harvard Medical School and Massachusetts General Hospital, Department of Psychiatry, Boston, MA, United States

<sup>m</sup> Department of Psychiatry, Massachusetts General Hospital, Boston, MA, United States

<sup>n</sup> Department of Behavioral Neuroscience, Oregon Health & Science University, Portland, OR 97239, United States

<sup>o</sup> Departments of Neurology, Radiation Medicine, Psychiatry, and Division of Neuroscience, ONPRC, Oregon Health & Science University, Portland, OR, United States

<sup>p</sup> Department of Psychology, Loyola University Chicago, Chicago, IL, United States

<sup>q</sup> Faculty of Medicine, University of Belgrade, Serbia

<sup>r</sup> Neurology Clinic, Clinical Center of Serbia, Serbia

<sup>s</sup> Griffith University, Gold Coast Campus, 1 Parklands Dr, Southport, QLD 4215, Australia

<sup>t</sup> Institute for the Future of Human Society, Kyoto University, 46 Shimoadachi-cho, Yoshida Sakyo-ku, Kyoto, Japan

<sup>u</sup> Institute of Education & Child Studies, Section Forensic Family & Youth Care, Leiden University, the Netherlands

<sup>v</sup> Department of Psychiatry, Amsterdam UMC, Location VUMC, GGZ InGeest Research & Innovation, Amsterdam Neuroscience, the Netherlands

<sup>w</sup> Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

<sup>x</sup> Clinic for Cognitive Neurology, University Hospital Leipzig, Leipzig, Germany

<sup>y</sup> Division of Physiotherapy, Department of Neurobiology, Care Sciences and Society, Karolinska Institutet, Stockholm, Sweden

<sup>z</sup> Karolinska University Hospital, Women's Health and Allied Health Professionals Theme, Medical unit Occupational Therapy & Physiotherapy, Stockholm, Sweden

<sup>aa</sup> Neuroscience Research Australia, Randwick, Sydney, NSW, Australia

<sup>ab</sup> Australian National University, Canberra, ACT, Australia

<sup>ac</sup> Department of Neurology, University of Lübeck, Lübeck, Germany

<sup>ad</sup> Center of Brain, Behavior and Metabolism, University of Lübeck, Lübeck, Germany

<sup>ae</sup> Yale University, 2 Hillhouse Ave, New Haven, CT, United States

<sup>af</sup> Cincinnati University, Marketing Department, 2906 Woodside Drive, Cincinnati, OH 45221-0145, United States

<sup>ag</sup> Department of Statistics, Mathematical Analysis, and Operational Research, Universidade de Santiago de Compostela, Spain

<sup>ah</sup> The Galician Center for Mathematical Research and Technology (CITMAGA), 15782 Santiago de Compostela, Spain

<sup>ai</sup> Department of Medical Neurobiology, Hebrew University, Jerusalem, Israel

<sup>aj</sup> Institute of Psychology, University of Bern, Fabrikstr. 8, 3012 Bern, Switzerland

<sup>ak</sup> Universidad de Los Andes, Bogotá, Colombia

<sup>al</sup> International Research Center for Cognitive Applied Neuroscience, Catholic University of Milan, Milan, Italy

<sup>am</sup> Durham University, Palace Green, DH1 1TA Durham, United Kingdom

<sup>an</sup> Lebanon VA Medical Center, Lebanon, PA, United States

<sup>ao</sup> Department of Human Development & Family Studies, Colorado State University, Fort Collins, CO, United States

<sup>ap</sup> Department of Community & Behavioral Health, Colorado School of Public Health, Denver, CO, United States

<sup>aq</sup> UMR 1253, iBrain, Université de Tours, Inserm, Tours, France

<sup>ar</sup> Research Center in Neurosciences of Lyon, CNRS UMR5292, INSERM U1028, Claude Bernard University Lyon 1, Lyon, Centre Hospitalier Le Vinatier, 95 bd Pinel, 69675 Bron Cedex, France

<sup>as</sup> Department of Psychology, Concordia University, Montreal, Canada

<sup>at</sup> CHU Sainte-Justine, University of Montreal, Montreal, Canada

<sup>au</sup> Department of Psychology, Lafayette College, Easton, PA, United States

<sup>av</sup> Department of Anesthesiology and Center for Consciousness Science, University of Michigan, Ann Arbor, MI, United States

<sup>aw</sup> Department of Clinical Psychology, Psychotherapy and Experimental Psychopathology, University of Mainz, Wallstr. 3, 55122 Mainz, Germany

<sup>ax</sup> Nathan Kline Institute for Psychiatric Research, Orangeburg, NY, United States

<sup>ay</sup> Department of Biomedical, Dental Sciences and Morpho-Functional Imaging – University of Messina, Italy

<sup>az</sup> Laboratory of Psychiatric Neuroimaging (LIM-21), Departamento e Instituto de Psiquiatria, Hospital das Clinicas HCFMUSP, Faculdade de Medicina, Universidade de Sao Paulo, Sao Paulo, Brazil

<sup>ba</sup> Departments of Psychiatry and Psychology; and the Center for Neural Basis of Cognition, University of Pittsburgh School of Medicine, Pittsburgh, PA, United States

<sup>bb</sup> Department of Psychological and Brain Sciences, Boston University, Boston, MA, United States

<sup>bc</sup> Neuropsychology and Applied Cognitive Neuroscience Laboratory, CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China

<sup>bd</sup> Centre for Research on Ageing, Health, and Wellbeing, Australian National University, Canberra, ACT, Australia

<sup>be</sup> Applied Technology for Neuro-Psychology Lab., Istituto Auxologico Italiano (IRCCS), Milan, Italy

<sup>bf</sup> Department of Psychology, University of Turin, Turin, Italy

<sup>bg</sup> Psychiatry, Department of Neuroscience, Brighton and Sussex Medical School (BSMS), University of Sussex, Sussex, United Kingdom

<sup>bh</sup> Departments of Psychiatry and Neuroscience, Icahn School of Medicine at Mount Sinai and Friedman Brain Institute, New York, NY 10029, United States

- <sup>bi</sup> Hospital Universitário Gaffrêe e Guinle, Universidade do Rio de Janeiro, Brazil
- <sup>bj</sup> Department of Psychological Sciences, Case Western Reserve University, Cleveland, OH, United States
- <sup>bk</sup> School of Psychology, University of New South Wales, Sydney, NSW, Australia
- <sup>bl</sup> Departments of Psychological and Brain Sciences and Anatomical Sciences and Neurobiology, University of Louisville, Louisville, KY, United States
- <sup>bmm</sup> Department of Psychiatry and Psychotherapy, Tübingen Center for Mental Health, University of Tübingen, Tübingen, Germany
- <sup>bn</sup> Edith Cowan University, Psychology Discipline, School of Arts and Humanities, 270 Joondalup Dr, Joondalup, WA 6027, Australia
- <sup>bo</sup> The Faculty of Health and Welfare Sciences, University of Haifa, Haifa, Israel
- <sup>bp</sup> Institute for Biological Research "Siniša Stanković", National Institute of Republic of Serbia, Belgrade, Serbia
- <sup>bq</sup> Department of Diagnostic Physics, Division of Radiology and Nuclear Medicine, Oslo University Hospital, Oslo, Norway
- <sup>br</sup> Department of Humanistic Studies, University of Naples Federico II, Naples, Italy
- <sup>bs</sup> UniCamillus, International Medical University, Rome, Italy
- <sup>bt</sup> Department of Psychology, Virginia Tech, Blacksburg, VA, United States
- <sup>bv</sup> School of Psychology, University of East London, United Kingdom
- <sup>bv</sup> Centre for Affective Disorders, Institute of Psychiatry, Psychology and Neuroscience, King's College London, United Kingdom
- <sup>bw</sup> School of Psychology, University of New South Wales, Randwick, Sydney, NSW, Australia
- <sup>bx</sup> Department of Psychology and Neuroscience, Maastricht University, Maastricht, the Netherlands
- <sup>by</sup> Geneva Motivation Lab, University of Geneva, FPSE, Section of Psychology, CH-1211 Geneva 4, Switzerland
- <sup>bz</sup> The Institute of Biomedical and Oral Research, Faculty of Dental Medicine, Hebrew University of Jerusalem, Jerusalem, Israel
- <sup>ca</sup> Systems Neuroscience and Pain Laboratory, Stanford University School of Medicine, CA, United States
- <sup>cb</sup> Department of Nursing, Faculty of Social Welfare & Health Sciences, University of Haifa, Haifa, Israel
- <sup>cc</sup> Coma Science Group, GIGA Consciousness & Centre du Cerveau2, University and University Hospital of Liege, Liege, Belgium
- <sup>cd</sup> Department of Biological and Clinical Psychology/Psychotherapy, University of Greifswald, Greifswald, Germany
- <sup>ce</sup> Department of Psychology, University of Pittsburgh, Pittsburgh, PA 15206, United States
- <sup>cf</sup> Tel Aviv Center for Brain Function, Wohl Institute for Advanced Imaging, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel
- <sup>cg</sup> School of Psychological Sciences, Tel-Aviv University, Tel Aviv, Israel
- <sup>ch</sup> Department of Applied Emotion and Motivation Psychology, Institute of Psychology and Education, Ulm University, Ulm, Germany
- <sup>ci</sup> Department of Clinical Psychology, Philipps University Marburg, Germany
- <sup>cj</sup> Universidad de San Andres, Buenos Aires, Argentina
- <sup>ck</sup> National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina
- <sup>cl</sup> Latin American Brain Health Institute (BrainLat), Universidad Adolfo Ibáñez, Santiago, Chile
- <sup>cm</sup> Global Brain Health Institute (GBHI), University of California San Francisco (UCSF), United States and Trinity College Dublin (TCD), Ireland
- <sup>cn</sup> Groupe d'Analyse et de Théorie Economique (GATE), 93 Chemin des Mouilles, 69130 Écully, France
- <sup>co</sup> Department of Psychiatry and Behavioral Neurosciences, Wayne State University, Detroit, MI, United States
- <sup>cp</sup> Department of Psychology, Macquarie University, Sydney, Australia
- <sup>cq</sup> Department of Neurology, Massachusetts General Hospital and Harvard Medical School, Charlestown, MA, USA
- <sup>cr</sup> Department of Psychology and Neuroscience, Boston College, Boston, MA, United States
- <sup>cs</sup> Department of Psychology and Counseling, University of Texas at Tyler, Tyler, TX, United States
- <sup>ct</sup> Centre for Healthy Brain Ageing, Discipline of Psychiatry and Mental Health, University of New South Wales, Sydney, Australia
- <sup>cw</sup> Specialty of Psychiatry, The University of Sydney, Concord, New South Wales, Australia
- <sup>cx</sup> Department of Experimental Clinical and Health Psychology, Ghent University, Ghent, Belgium
- <sup>cw</sup> University of Sydney Medical School, Sydney, Australia
- <sup>cx</sup> Social Neuroscience Lab, Translational Psychiatry Unit, University of Lübeck, Lübeck, Germany
- <sup>cy</sup> Leiden University, Cognitive Psychology, Pieter de la Court, Waassenaarseweg 52, Leiden 2333 AK, the Netherlands
- <sup>cz</sup> Faculty of Natural Sciences, Department of Psychology, Otto von Guericke University Magdeburg, Universitätsplatz 2, Magdeburg, Germany
- <sup>da</sup> Department of Psychiatry, Komfo Anokye Teaching Hospital, P. O. Box 1934, Kumasi, Ghana
- <sup>db</sup> Department of Psychiatry, University of Cambridge, Darwin College, Silver Street, CB3 9EU Cambridge, United Kingdom
- <sup>dc</sup> Behavioural Sciences Department, School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
- <sup>dd</sup> Departments of Psychiatry and Psychology and the Center for Neural Basis of Cognition (CNBC), University of Pittsburgh, Pittsburgh, PA, United States
- <sup>de</sup> Scotland's Rural College, King's Buildings, Edinburgh, Scotland
- <sup>df</sup> The Roslin Institute, University of Edinburgh, Easter Bush, Scotland
- <sup>dg</sup> Connecticut Mental Health Centre, Yale University, New Haven, CT, United States
- <sup>dh</sup> Department of Psychology, University of Toronto Mississauga, Mississauga, ON, Canada
- <sup>di</sup> Department of Integrative Physiology and Center for Neuroscience, University of Colorado Boulder, Boulder, CO, United States
- <sup>dj</sup> Department of Psychology, Université du Québec à Montréal, Montreal, Canada
- <sup>dk</sup> Research Center, Institut universitaire en santé mentale de Montréal, Montreal, Canada
- <sup>dl</sup> Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy
- <sup>dmm</sup> Merrill Palmer Skillman Institute for Child and Family Development, Wayne State University, Detroit, MI, United States
- <sup>dn</sup> School of Public Health, Oregon Health & Science University, Portland, OR, United States
- <sup>do</sup> Cognitive Neuroscience and Neuroinformatics Unit, D'Or Institute for Research and Education, Rio de Janeiro, Brazil
- <sup>dp</sup> War Related Illness and Injury Study Center (WRIISC), Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, United States
- <sup>dq</sup> Lyon Neuroscience Research Center, CNRS-UMR 5292, INSERM U1028, Université Lyon, Lyon, France
- <sup>dr</sup> Department of Psychology (Clinical Psychology and Psychotherapy), University of Regensburg, Regensburg, Germany
- <sup>ds</sup> Department of Psychology, Loyola Marymount University, Los Angeles, CA, United States
- <sup>dt</sup> Center for Children and Families, Department of Psychology, Florida International University, Miami, FL, United States
- <sup>du</sup> Department of Psychological and Brain Sciences, University of Louisville, Louisville, KY, United States
- <sup>dv</sup> Psychosomatic Medicine and Psychotherapy, TU Muenchen, Langerstrasse 3, D-81675 Muenchen, Germany
- <sup>dww</sup> Mind, Brain Imaging and Neuroethics Research Unit, University of Ottawa Institute of Mental Health Research, Royal Ottawa Mental Health Centre, Canada
- <sup>dx</sup> Department of Psychology and Institute for Policy Research, Northwestern University, 2029 Sheridan Road, Evanston, IL, United States
- <sup>dy</sup> School of Psychological Sciences, University of Haifa, Haifa, Israel
- <sup>dz</sup> Department of Psychology, Temple University, 1701N. 13th St, Philadelphia, PA, United States
- <sup>ea</sup> Thompson Rivers University, Department of Psychology, 805 TRU Way, Kamloops, BC, Canada
- <sup>eb</sup> Department of Medicine and Center for Genomic and Precision Medicine, College of Medicine, University of Ibadan; University College Hospital, Ibadan, Oyo State, Nigeria
- <sup>ec</sup> Blossom Specialist Medical Center Ibadan, Oyo State, Nigeria
- <sup>ed</sup> Department of Psychological, Health and Territorial Sciences, University of Chieti, Chieti, Italy
- <sup>ee</sup> School of Psychological Science, University of Western Australia, Perth, WA, Australia
- <sup>ef</sup> Department of Surgical, Medical and Molecular Pathology and of Critical Care, University of Pisa, Pisa, Italy
- <sup>eg</sup> Jane and John Justin Neuroscience Center, Cook Children's Health Care System, Fort Worth, TX, United States
- <sup>eh</sup> Department of Bioengineering, University of Texas at Arlington, Arlington, TX, United States
- <sup>ei</sup> School of Psychology, University of Queensland, Saint Lucia, Queensland, Australia

- <sup>ej</sup> Research Centre for Child Psychiatry, University of Turku, Turku, Finland
- <sup>ek</sup> INVEST Research Flagship, University of Turku, Turku, Finland
- <sup>el</sup> IMT School for Advanced Studies, Lucca, Italy
- <sup>em</sup> The Psychiatric Institute, Department of Psychiatry, University of Illinois at Chicago, Chicago, IL, United States
- <sup>en</sup> Neurology Department, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany
- <sup>eo</sup> Department of Pharmacy Practice, Wayne State University, Detroit, MI, United States
- <sup>ep</sup> Department of Behavioural Biology, University of Münster, Badestraße 13, Münster, Germany
- <sup>eq</sup> Humane Technology Lab., Università Cattolica del Sacro Cuore, Milan, Italy
- <sup>er</sup> Auburn University, Auburn, AL, United States
- <sup>es</sup> Neuropsychiatric Institute, The Prince of Wales Hospital, Sydney, Australia
- <sup>et</sup> Psychological Process Research Team, Guardian Robot Project, RIKEN, 2-2-2 Hikaridai, Seika-cho, Soraku-gun, Kyoto, Japan
- <sup>eu</sup> Department of Psychology, University of Cambridge, Cambridge, United Kingdom
- <sup>ev</sup> School of Psychology, University of New South Wales, Sydney, Australia
- <sup>ew</sup> Department of Psychology (Clinical Psychology and Psychotherapy Research), PFH – Private University of Applied Sciences, Gottingen, Germany
- <sup>ex</sup> Knowledge Media Institute, The Open University, Milton Keynes MK7 6AA, United Kingdom
- <sup>ey</sup> Departments of Medicine and Psychiatry, Michigan State University, East Lansing, MI, United States
- <sup>ez</sup> Department of Biological Chemistry, Edmond and Lily Saifra Center of Brain Science and The Institute of Life Sciences, Hebrew University, Jerusalem, Israel
- <sup>fa</sup> Department of Biobehavioral Health, The Pennsylvania State University, State College, PA, United States
- <sup>fb</sup> New York University School of Medicine, New York, NY, United States
- <sup>fc</sup> Neuroscience of Cognition and Affection group, Lab of Medical Physics and Digital Innovation, School of Medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece
- <sup>fd</sup> International Psychoanalytic University, Berlin, Germany
- <sup>fe</sup> Departments of Psychiatry & Behavioral Health, Psychology, Obstetrics, Gynecology & Reproductive Medicine, and Program in Public Health, Renaissance School of Medicine at Stony Brook University, New York, United States
- <sup>ff</sup> Division of Child and Adolescent Psychiatry, Lausanne University Hospital (CHUV) and University of Lausanne, Lausanne, Switzerland
- <sup>fg</sup> Neuropsychiatry, Department of Neurosciences, Leuven Brain Institute, KU Leuven, Leuven, Belgium
- <sup>fh</sup> Translational Psychiatry, Department of Psychiatry and Psychotherapy, Universitätsmedizin der Johannes Gutenberg University Medical Center, Mainz, Germany
- <sup>fi</sup> Erasmus University Rotterdam, Rotterdam, the Netherlands
- <sup>fj</sup> University of Melbourne, Melbourne Neuropsychiatry Centre, Department of Psychiatry, 161 Barry Street, Carlton, VIC, Australia
- <sup>fk</sup> Division of Neurotherapeutics, Massachusetts General Hospital, Boston, MA, United States
- <sup>fl</sup> Department of Biological Psychology and Affective Science, Faculty of Human Sciences, University of Potsdam, Potsdam, Germany
- <sup>fm</sup> Department of Psychology, University of South Florida, Tampa, FL, United States
- <sup>fn</sup> Professor Emeritus of Biology and Environmental Studies, New York University, New York, NY, United States
- <sup>fo</sup> Department of Social Work and Human Services and the Department of Psychological Sciences, Center for Young Adult Addiction and Recovery, Kennesaw State University, Kennesaw, GA, United States
- <sup>fp</sup> Faculty of Health Sciences Brandenburg, University of Potsdam, Germany
- <sup>fq</sup> Elysium Neurological Services, Elysium Healthcare, The Avalon Centre, United Kingdom
- <sup>fr</sup> School of Behavioural and Health Sciences, Australian Catholic University, Sydney, NSW, Australia
- <sup>fs</sup> Central Queensland University, School of Health, Medical and Applied Sciences, Bruce Highway, Rockhampton, QLD, Australia
- <sup>ft</sup> Neuroqualia (NGO), Truro, Nova Scotia, Canada

## ARTICLE INFO

Keywords:  
Affect  
Framework  
Enactivism  
Allostasis  
Feeling  
Sensation  
Emotion  
Mood  
Wellbeing  
Valence  
Arousal  
Motivation  
Stress  
Self

## ABSTRACT

Over the last decades, theoretical perspectives in the interdisciplinary field of the affective sciences have proliferated rather than converged due to differing assumptions about what human affective phenomena are and how they work. These metaphysical and mechanistic assumptions, shaped by academic context and values, have dictated affective constructs and operationalizations. However, an assumption about the purpose of affective phenomena can guide us to a common set of metaphysical and mechanistic assumptions. In this capstone paper, we home in on a nested teleological principle for human affective phenomena in order to synthesize metaphysical and mechanistic assumptions. Under this framework, human affective phenomena can collectively be considered algorithms that either adjust based on the human comfort zone (*affective concerns*) or monitor those adaptive processes (*affective features*). This teleologically-grounded framework offers a principled agenda and launchpad for both organizing existing perspectives and generating new ones. Ultimately, we hope the Human Affectome brings us a step closer to not only an integrated understanding of human affective phenomena, but an integrated field for affective research.

## 1. Introduction

The affective sciences—the interdisciplinary study of affective phenomena, such as sensation, emotion, mood, and wellbeing—have their roots in neuroscience and psychology, but also intersect with philosophy, sociology, linguistics, anthropology, computer science, and economics (Ekman and Davidson, 1994; LeDoux, 1998; Panksepp, 2004; Davidson and Sutton, 1995; Damasio, 2005; Davidson et al., 2009; Kleinginna and Kleinginna, 1981; Sander and Scherer, 2014; Dagleish et al., 2009; Gendron and Barrett, 2009; Adolphs and Anderson, 2018; Gross and Barrett, 2013; Keltner and Lerner, 2010; Gordon, 1990; Solomon, 1978; Lutz and White, 1986; Mesquita and Frijda, 1992; Beatty, 2014, 2019; Armony and Vuilleumier, 2013; Solomon, 1993; Goldie,

2009; Deonna and Teroni, 2012; Scarantino, 2016; Picard, 2000; Hoque et al., 2011; Calvo et al., 2015; Dukes et al., 2021). This interdisciplinary field seeks to explain the mechanisms of affective phenomena by inferring affective constructs from observable data in order to predict future effects (Mill, 1856; Whewell, 1858; Machamer et al., 2000; Glennan, 2002, 2008; Azzouni, 2004; Bechtel and Abrahamsen, 2005; Chang, 2005; Morganti and Tahko, 2017; Ivanova and Farr, 2020; Levenstein et al., 2023; Hempel and Oppenheim, 1948; Hempel, 1970; Kauffman, 1970; Glennan, 1996), a scientific endeavor that has gained traction in the last few decades and secured the rise of affective research (Dukes et al., 2021). This growth, however, has been accompanied by a surge in theoretical divisions: divergent academic communities differ in their background assumptions on the **metaphysics** of affective

phenomena (i.e., what they are), (Marr, 2010; Danziger, 1997; Dayan and Abbott, 2005; Dixon, 2003, 2012; Solomon, 2008; Goldie, 2009; Deonna and Scherer, 2010; Izard, 2010a, 2010b; Gendron, 2010; Mulligan and Scherer, 2012; Barrett, 2012; Scarantino, 2012, 2016; Adolphs, 2017; Fox, 2018; Tappolet, 2022; Moors, 2022) which further distances their assumptions about the **mechanisms** of those phenomena (i.e., how affective phenomena arise) (Scherer, 2005; Bridgman, 1927; Chang, 2004; Levenstein et al., 2023). These assumptions *frame* the basic terms of a theory, such as each theory’s affective **constructs**, the scientific abstractions of affective phenomena that should be used (i.e., what should be studied), as well as their appropriate **operationalizations**, the methods of measuring those abstractions (i.e., how to observe them) (Hempel, 1952, 1970; Carnap and Gardner, 1966; Lewis, 1970, 1972). Even when assumptions are not explicitly disclosed, they are hidden in decision points at each stage of the scientific process meant to test that theory—from experimental design and methodology all the way to analysis and interpretation (Mill, 1856; Whewell, 1858; Azzouni, 2004; Chang, 2005; Morganti and Tahko, 2017; Ivanova and Farr, 2020; Scarantino, 2016; Fox, 2018). Thus, despite the field’s agreement that studying affective phenomena is important, discrepancies have yielded lasting theoretical debates, bodies of experimental work within separate frameworks have proliferated, and limited progress has been made in pruning or integrating existing frameworks with no clear consensus in sight (Kuhn, 1974, 2012; Box, 1976; Craver and Darden, 2013; Strevens, 2013; Levy and Bechtel, 2013; Woodward, 2014).

This persistence of theoretical splitting is in part due to empirical data being inadequate in arbitrating between sets of theoretical assumptions (Holton, 1975; Kuhn, 2012; Lakatos, 1978, 2014; Lowe, 2002; Notturmo and Popper, 2014; Ormerod, 2009; Popper, 1963;

Laudan, 1978; Godfrey-Smith, 2021). Such disagreements can only be settled by examining each camp’s take on **theoretical virtues** (i.e., what qualities make good framework and resulting theory), and comparing each theory’s underlying sets of assumptions (Galilei, 1953; Newton, 1999; Einstein, 1934; Achinstein, 1983; Duhem, 1982; Sober, 2015; Poincaré, 2022; Schindler, 2018; Keas, 2018; Ivanova and Farr, 2020). In addition, proponents of different theories with separate overarching frameworks differ in their assumptions about why certain affective phenomena are scientifically important—why their particular versions of the phenomena should be studied and why their methods of observation should be used (Bromberger, 1966; Achinstein, 1983; De Regt and Dieks, 2005; Kitcher, 2001; Brown, 2010; Dayan and Abbott, 2005; Kording et al., 2020; Levenstein et al., 2023). These **pragmatic** motivations tend to be prone to biases, such as which research tradition has been status quo in a proponent’s local context, which methods for observation are practical, which types of observational data are accessible, and which questions about affective phenomena are of interest to certain audiences (Ivanova and Farr, 2020; Duhem, 1982; Lowe, 2002; Ivanova, 2014, 2017; Paul, 2012; Ladyman, 2012; Latour and Woolgar, 2013; Achinstein, 1983; van Fraassen, 1980). Therefore, when evaluating sets of assumptions, collaboration across proponents of different camps and members of different disciplines can go a long way in shoring up these theoretical blind spots (Table 1) (Wray, 2002; Andersen and Wagenknecht, 2013; Callard and Fitzgerald, 2015; MacLeod, 2018).

Even if comprehensive collaboration on scientific incentives and theoretical virtues could be achieved, it would be unproductive to compare the metaphysical and mechanistic assumptions governing affective research without a premise of *why* affective phenomena exist in the first place—i.e., a **teleological** assumption (Deacon, 2011; Mayr,

**Table 1**

**Domains of Assumptions Shaping Scientific Frameworks and Resulting Theory.** This table summarizes domains of theoretical assumptions for scientific frameworks which shape the scientific theories resulting from them. As a case study, we highlight the framework of assumptions for Affect-as-Information Theory, to provide an exemplar in affective research. The first two rows correspond to domains of assumptions embedded in our individual contexts as affective researchers; the latter rows are the assumptions about affective phenomena themselves. Each unitalicized domain forms the basis of the *italicized* domain following it. Finally, the last row, indicated in **bold**, corresponds to the collective of all the domains of assumptions above it.

Domain of Assumptions (collectively, framework)	Description	Relationships between Domains of Assumptions	Shorthand	Exemplar in Affective Research <i>Affect-as-Information Theory</i> (Schwarz and Clore, 1983, 2003; Clore et al., 2001; Schwarz, 2012)
<b>Pragmatics</b>	assumed context-dependent motivation for the study of theoretical constructs	Shapes <b>metaphysics</b> and <b>mechanism</b> and, therefore, determines <b>construct</b> and <b>operationalization</b> .	why a <i>construct</i> should be studied and why a certain <i>operationalization</i> should be used to study it	Affect should be studied as information, by observing its effect on judgments, to situate subjective experience in decision-making.
<i>Theoretical virtues</i>	assumed desiderata for what makes good framework and theory (e.g., parsimony, elegance, simplicity)	shaped by aesthetic preferences; frames how theory that applies <b>construct</b> and <b>operationalization</b> is evaluated	why an <i>explanation</i> of a phenomenon is good	Characterizing affect as information provides parsimonious explanation for its influence on decision-making.
<b>Metaphysics</b>	assumed nature of phenomenon	shaped by <b>pragmatics</b>	<i>what the phenomenon</i> is	One set of studies testing affect-as-information theory examines mood as an influence on decision-making.
<i>Construct</i>	assumed abstraction of phenomenon	shaped by <b>pragmatics</b> , <b>metaphysics</b> , and (sometimes) <b>operationalization</b> ;	<i>what construct</i> is studied	Mood is construed as ranging from positive to negative.
<i>Mechanism</i>	assumed process of phenomenon	guided by <b>pragmatics</b> and <b>metaphysics</b>	<i>how phenomenon</i> arises	In the mechanism of mood functioning as information, positive valence biases positive judgment and negative valence biases negative judgment.
<i>Operationalization</i>	assumed measurement of abstracted phenomenon	guided by <b>pragmatics</b> , <b>construct</b> , and <b>mechanism</b>	<i>how construct</i> is observed	Overall positive to negative mood was manipulated by prompting recall of happy or sad events.
<i>Teleology</i>	assumed purpose of the phenomenon existing	determined by <b>pragmatics</b> ; motivates <b>metaphysics</b> and <b>mechanism</b>	<i>why phenomenon</i> exists	Affect-as-information theory suggests that mood functions as information in order to indicate benign or problematic environment.
<b>Framework (or paradigm)</b>	a set of the above domains of assumptions; terms used to articulate and organize testable theories	usually explicitly or implicitly consists of all of the above	all of the above	All of the above



1985; Levenstein et al., 2023). A framework grounded in a principle for the *purpose* of affective phenomena would allow us to (1) bridge across metaphysical and mechanistic assumptions behind different theories, (2) organize theories with respect to that teleological principle, and (3) evaluate theories in light of scientific motivations and theoretical virtues (Craver, 2007; Schindler, 2018; Keas, 2018; Levenstein, 2023). Therefore, to truly achieve an integrated understanding of affective phenomena, collaborative and interdisciplinary efforts should aim to integrate scholarly and theoretical values in order to synthesize a *common set of metaphysical and mechanistic assumptions grounded in teleological principle*—a **framework** with which to articulate and organize theories for conducting affective research as well as compare and integrate existing ones (Popper, 1963; Kuhn, 2012; Holton, 1975; Lakatos, 2014, 1978; Laudan, 1978; Lowe, 2002; Ormerod, 2009; Jabareen, 2009; Notturmo and Popper, 2014; Godfrey-Smith, 2021).

In this capstone paper, we conclude the special issue “Towards an Integrated Understanding of the Human Affectome” (Cromwell and Papadelis, 2022, this issue) by synthesizing the various assumptions ruling different affective fields and camps into a common teleologically-grounded set: the Human Affectome (Cromwell and Lowe, 2022, this issue). To get to this point, 173 researchers from 23 countries came together as a global, interdisciplinary taskforce to examine existing assumptions and approaches in the study of affective constructs. As a preliminary step, a team within this working group performed an exploratory computational linguistic analysis: identifying 3664 words for feelings, sorting them into feeling categories, and characterizing more specific senses for each word (Siddharthan et al., 2018). Guided by the themes that emerged from that initial exploration, twelve teams went on to produce the twelve reviews of this special issue. Each review summarized the state of current behavioral and neuroscientific research with special emphasis on theoretical concerns (this issue: Arias et al., 2020; Raber et al., 2019; Becker et al., 2019; Pace-Schott et al., 2019; Williams et al., 2020; Cromwell et al., 2020; Dolcos et al., 2020; Stefanova et al., 2020; Alia-Klein et al., 2020; Frewen et al., 2020; Alexander et al., 2021; Eslinger et al., 2021; Cromwell and Papadelis, 2022). Thus, the initial linguistic approach encouraged an exploratory, yet integrative approach in reviewing the sampling of theoretical perspectives across the affective domains. However, these themes have yet to be considered holistically by the taskforce from a top-down perspective: how can the metaphysical and mechanistic assumptions in the affective sciences be rooted in common teleological principles to motivate shared scientific constructs and operationalizations, and frame consequent testable theories? (Machamer et al., 2000; Craver, 2007; Bechtel, 2007, 2008, 2009, 2013; Bechtel and Richardson, 2010).

In what follows, we probe the question of purpose: *why are there affective phenomena?* We synthesize a common set of teleological principles to guide the metaphysical and mechanistic assumptions and, ultimately, motivate shared scientific constructs and operationalizations. What we offer here is not another theory, nor is it a history or review of the field—it is a scaffold of premises that accommodates existing theories by organizing them in terms of a common set of assumptions, and promotes the articulation of new theories. Thus, this synthesis can facilitate a better understanding of assumptions, differences, and possible cohesion among perspectives in the field. We hope that you, reader, whether you are an affective neuroscientist, philosopher of emotion, cognitive psychologist, computational psychiatrist, clinician, or another interested in affect, will take something away from this synthesis. We recommend not to treat this work as the ultimate answer to the long-lasting debates the field has been entrenched in, but as the beginning of the incremental untangling of assumptions in a principled way toward a new integrative paradigm. Practically speaking, we

encourage you to start with your own work—to situate your explanatory goals within the Human Affectome, relate them to other theories based on principles distilled by this synthesis, and articulate your future theories and accompanying hypotheses using these teleological terms. Ultimately, we hope that the wider community of affective sciences leverages this cohesive framework to generate and test more specific theories and hypotheses on the basis of its premises—so that in due course we will build a concrete, comprehensive, and, most importantly, principled set of affective constructs and operationalizations (analogous to Schuler et al., 1996, and Sporns et al., 2005). In this manner, this rich and sprawling field can come to an integrated understanding of human affective phenomena within which to situate past and future research.

## 2. Teleological Principle: *Why are there human affective phenomena?*

Among the affective sciences, we are united by our interest in phenomena that are subjectively felt, have neurobiological basis, influence decision-making and behavior, and can be expressed through implicit and explicit means (Darwin, 1965; James, 1890; Scherer, 1984; Leighton, 1985; Frijda, 1986; Clore and Ortony, 1988; Schwarz and Clore, 1988, 2007; Kleinginna and Kleinginna, 1981; Solomon, 1993; Ekman and Davidson, 1994; LeDoux, 1998; Panksepp, 2004; Pugmire, 1998; Davidson and Sutton, 1995; Cacioppo et al., 1999; Panksepp, 2004; Damasio, 2005; Davidson et al., 2009; Sander and Scherer, 2014; Dalgleish et al., 2009; Goldie, 2009; Deonna and Scherer, 2010; Keltner and Lerner, 2010; Hoque et al., 2011; LeDoux, 2012, 2015, 2023; Deonna and Teroni, 2012; Schwarz, 2012; Damasio and Carvalho, 2013; Gross and Barrett, 2013; Armony and Vuilleumier, 2013; Elpidorou and Freeman, 2014; Ekman, 2016; Scarantino, 2016; Deonna and Teroni, 2017; LeDoux and Brown, 2017; Adolphs and Anderson, 2018; Adolphs et al., 2019; Dukes et al., 2021). Our differing interpretations of those metaphysical and mechanistic assumptions, however, generate an expansive range of constructs and operationalizations, and resulting theories and hypotheses. Therefore, these assumptions require a teleological principle to be reduced and systematized. In this section, we will progress from the broadest purpose of an organism to the most specific principle in humans, in order to synthesize metaphysical and mechanistic assumptions for complete coverage of human affective phenomena: the Human Affectome.

### 2.1. To ensure viability

An organism can be considered a system or network of interconnected parts collectively and continuously (re)generating and distinguishing itself, with the ultimate purpose of autonomously ensuring its own persistent recreation and integrity (**autopoiesis**) (Jonas, 1973; Maturana and Varela, 1991; Varela et al., 1974, 2017; Varela, 1979; Weber and Varela, 2002; Di Paolo and Thompson, 2014). This involves recursively creating its own components, so that those components can both sustain the processes producing them as well as maintain their coordination such that, altogether, they are an organization distinct from an environment—that is, the organism. Each of these processes enables others within the system, such that they collectively support themselves and will disintegrate if even one is disrupted (Beer and Di Paolo, 2023). This dependence entails the entire neurobiological system staying within a narrow range of states, such as a specific set of glucose levels, temperature, pH, etc. (**homeostasis**) (Cannon, 1929; MacArthur, 1955). Therefore, the primary purpose of an organism is to ensure its own viability, where being an organism can be considered a collective inherent act of self-generating and self-distinguishing itself into

continuous being through error-correcting means (Wiener et al., 2019). This helps us understand what neurobiological processes are doing at large—but more importantly for our purposes, this is our launchpad for tracing the purpose of human affective phenomena (Damasio and Carvalho, 2013; Panksepp, 2004, 2005; Strigo and Craig, 2016).

## 2.2. To execute operations

Complex organisms execute many varied operations to ensure viability in the face of complex and changing environments. The capacity to discern more than just a handful of facets of the environment usually goes hand-in-hand with the capacity for many dimensions of action (Tooby and Cosmides, 1990, 2008; Cosmides and Tooby, 2000, 2013). This complexity poses more risks to viability, but also allows for flexibility when circumstances change. Such a complex organism cannot afford to let any one of the many elements push its system to the brink or it risks collapse (i.e., resulting in the organism dissolving, dying, ceasing to be). The complex organism does not remain idle but rather triumphs by doing the opposite: instead of remaining in a simplistic stable state, it moves between levels of relative stability (**attractor states**). When a perturbation to its ongoing organization approaches, the complex organism does not immediately address the breach, the way simpler life forms reset to more suitable states when an error is detected (Pereira, 2021). Instead, it acts in the direction of that breach so that, even if its actions temporarily make things worse, the organism will be on better footing in the future (Rosenblueth et al., 1943; Ruiz-Mirazo and Moreno, 2012; Boone and Piccinini, 2016; Williams and Colling, 2018; Fingelkurts and Fingelkurts, 2004). It preempts and prepares, choosing between different courses of action to anticipate and prevent a potentially fatal state brought on by the changing aspects of the environments before that point arrives (**allostasis**) (Sterling and Eyer, 1988; Carpenter, 2004; Cooper, 2008; McEwen and Wingfield, 2003; Sterling, 2012, 2020; Sterling and Laughlin, 2015; Schulkin and Sterling, 2019; Moors and Fischer, 2019).

For the complex organism, there are many, sometimes equally effective, ways to ensure viability, but all require operation. Some courses of action address metabolic intolerance more directly (e.g., raising food to one's mouth for consumption), while others require further intermediary steps (e.g., buying groceries) (Jonas, 2001). However, not all processes, especially in more intricate sequences, involve interacting with the external environment. Internal adjustments are what orchestrate the necessary shifts in approach to the environment—everything from attention to planning (**mental action**) (Kirsh and Maglio, 1994; Mele, 1997; Peacocke, 2006; Soteriou, 2013; Metzinger, 2017; Dolcos et al., 2020, this issue), serving as the bridge between the processes receiving inputs and those causing behavioral outputs, and enabling these two capacities to guide each other (**sensomotor**) (O'Regan and Noë, 2001; Di Paolo et al., 2017). Collectively, these processes move the organism around a new set of states wherein the organism is comfortable—each state as a position on one of many dimensions of anticipated deviation from viability, addressable in many actionable ways (Panksepp, 2010; Cromwell and Lowe, 2022, this issue). This 'comfort zone' guides the adaptive use of a repertoire of operations, whose individual actions consider future possibilities (Moors and Fischer, 2019; Cromwell et al., 2020, this issue). To navigate this comfort zone, an organism needs the capacity to monitor how it is faring with respect to the multidimensional, continuous, and fluctuating norm—an implicit form of self-evaluation. That evaluation allows the organism to consider its tools of internal and external processes in order to deploy them to safeguard viability. Sometimes, the organism's adaptive capabilities are surpassed in a way that strains its processes (Karastoreos and McEwen, 2011; Peters et al., 2017). Exceeding the comfort zone too often can result in pervasive damage to proactive processes (**allostatic load**) (McEwen, 1998, 2000). Therefore, beyond viability, the purpose of cognitive processes in complex organisms is to execute operations, which naturally involves managing them.

## 2.3. To enact relevance

Affective phenomena, to both academics and laypeople, can be felt (Chalmers, 1997; Craig, 2002; Frijda, 1986; Lambie and Marcel, 2002; Lange, 1885; Leighton, 1985; Nagel, 1974; Pugmire, 1998; Scherer, 1982b; Schwarz and Clore, 2007; James, 1890; Schwarz and Clore, 1988; Panksepp, 2008; Barrett, 2005; Barrett et al., 2007; Izard, 2010b; Deonna and Scherer, 2010; Schwarz, 2012; Damasio and Carvalho, 2013; Elpidorou and Freeman, 2014; Deonna and Teroni, 2017; LeDoux and Brown, 2017; Strigo and Craig, 2016; LeDoux and Hofmann, 2018; Adolphs et al., 2019; Paul et al., 2020; LeDoux, 2012, 2015, 2023; Szanto and Landweer, 2020; Álvarez-González, 2023; Davidson and Sutton, 1995; Cromwell and Lowe, 2022, this issue; Cromwell and Papadelis, 2022, this issue). We experience them over a duration of time (**episodes**) (Tye, 2003; Wollheim, 1999; Goldie, 2000; Locke, 1847; Levine, 1983; Hardin, 1988; Stein et al., 1993), how they feel has qualities (**qualia**) (Nagel, 1974; Chalmers, 1997; Silva, 2023), and they tend to mean something to us when we feel them, usually about how our concerns relate to objects, either physical or mental, such as things, people, and situations (**intentionality**) (Brentano, 2012; Tye, 2014; Deonna and Teroni, 2012). This aspect of meaning obliges us to consider not only the meaning of each individual affective experience, but also how different meanings of affective experiences relate to each other in an organized way (**phenomenology**) (Heidegger, 1967; Husserl and Dummett, 2001; Merleau-Ponty, 2011; Dreyfus, 1972; Sartre, 2022). A useful starting point for understanding why affective experiences exist would, therefore, be to ascertain how the structure in felt meaning relates to the entire system of neurobiological processes—including both those within the organism and those interacting with the environment (Horgan and Tienson, 2002; Strawson, 2004; Kriegel, 2014).

One major clue that the structure of affective experiences gives us is that they originate from a first-person perspective (**self**) (Descartes, 1644; Husserl, 2013; Kant, 1908; Searle, 1992; Shoemaker, 2003; Wittgenstein, 1958; James, 1890; Gallagher, 2000; Metzinger, 2003a, 2003b; Ochsner and Gross, 2005; Blanke and Metzinger, 2009, 2013; Christoff et al., 2011; Zahavi and Kriegel, 2015; Colombetti, 2011; Frewen et al., 2020, this issue). On the mechanistic side of things, this perspective seems to arise from the organism adeptly executing operations in order to ensure viability from a unified point of view (i.e., self). Being guided by a comfort zone means that all of the organism's considerations are driven by potential for action such that properties of the environment perceived and acted upon are features of action-worthiness (**affordances**) (Bourgin and Stewart, 2004; Stewart, 2010; Gibson, 1977; Teroni, 2007; Frijda, 1986). From the perspective of the organism, the world appears to it only in a manner relatable to its capacities (perceived surroundings or **umwelten**) (Uexküll, 2013; Sebeok, 2001; Chang, 2009; Feiten, 2020). If we want to be precise in studying affective mechanisms, we should not just look at the brain—we should consider the entire nervous system and the rest of the body (**embodied**) (Barsalou, 1999; Barsalou, 2003; Pfeifer and Bongard, 2006; Varela, 1997; Chemero, 2011; Gallagher and Zahavi, 2020; Fuchs, 2017). Among internal processes, the felt aspect of signals from our internal viscera is an important factor to consider given how often bodily sensations characterize affective experiences (**interoception**) (Craig, 2008; Sel, 2014; Critchley and Garfinkel, 2017; Tsakiris and Preester, 2018). However, if we fixate too much on what's going on inside, we miss the dynamic interplay between an organism and its environment (**embedded**) (Beer, 2014), which shapes the organism's adaptive capacities and gives it its perspective (**situated**) (Roth and Jornet, 2013; Walter, 2014; Dawson, 2014; Stephan and Walter, 2020). Having that central comfort zone in mind is what gives the organism the imperative to make sense of the world through perception, as well as affect the world through action to make sense of it (**sense-making**) (Di Paolo, 2005; Colombetti, 2010). Therefore, underpinned by their prospective concern for viability, and at the heart of the cognitive activity that defines them, complex organisms such as humans enact relevance for

themselves—by not only taking in what is relevant but also by purposefully creating relevance (**enactive**) (Colombetti and Thompson, 2008; Colombetti, 2014; Ward, 2017; Newen et al., 2018; Cromwell et al., 2020, this issue). When that activity is challenged, the organism's awareness of its own comfort zone is, from its perspective, prioritized as intense feeling to orient it to more adaptive options for action (**stress**) (Averill, 1973; McEwen, 1998, 2005; Koolhaas et al., 2011; McEwen and Akil, 2020). Thus, our teleological foundation of affective phenomena seems to require this organism's emergent capacity to find things meaningful based on their actionability.

#### 2.4. To entertain abstraction

Humans are not limited to affective processes that reflect our first-person needs of the current moment. While not fundamental to all affective phenomena, concerned foresight poses at least some detachment from the present and, therefore, enables a rudimentary form of abstraction (Neisser, 1963; Plutchik, 1982; Clore and Huntsinger, 2009; Plutchik and Kellerman, 2013). An object in the present context can be tied to some distant meaning, being associated with operations not presently executed. This form of practical symbolism is still grounded in proactive operation in the service of viability (Tenenbaum et al., 2011). This capacity for abstraction is often overlooked when painting a picture of affective phenomena. However, when it comes to humans in particular, this abstract capacity is essential as it enables us to reflect on our adaptive activities in general (especially when we are not concurrently exercising them) as well as enact relevance that is abstract. This equips us as humans with the capacity to consider adaptive operations while departing from our individual first-person perspective. We can imagine other origins of concerned perspective, starting with that of other individuals—inferring how they are oriented actionably toward the world (**theory of mind**) (Saxe, 2006; Brüne and Brüne-Cohrs, 2006; Mehriabian and Epstein, 1972; Smith, 2006; Cuff et al., 2016; Fotopoulou and Tsakiris, 2017). As a result, we can share an orientation toward the environment with others such that we can complement each other's operations. This shared perspective enhances our adaptivity, expanding our operational repertoires to include cooperation and collaboration (Dunbar, 1998; Lakin et al., 2003; De Jaegher and Di Paolo, 2007; Gray et al., 2007; Fischer and Manstead, 2008, 2016; Weisman et al., 2017; Nummenmaa et al., 2018; Williams, 2020; Tomasello, 2020, 2022). Beyond this social competence, we can conceive of origins of operations other than those driven by viability: anything, animate or inanimate, can seem like it has an effect. This explodes into possibilities of conceptualizing the significance of events, situations, ideas—over and above the collective activities of many individuals, that is, groups.

These expansions to abstraction do not only grant us the capacity to associate any process of animate or inanimate change with designated labels (**language**) (Wittgenstein, 1953; Itkonen, 1978; Pinker, 2010; Perniss and Vigliocco, 2014; Adolphs, 2017; Adolphs and Andler, 2018) but also give us the adaptive reason to do so. Labelling specific abstract activities in our operations greatly influences what operation is possible, determining where we are in our comfort zone (Whissell, 1989; Besnier, 1990; Barrett et al., 2007; Lindquist, 2021; Colombetti, 2009). Our communication is not merely an add-on to what we enact or an afterthought to what we feel. Expression of what we feel through bodily, vocal, or visual means carves the kind of relevance we are able to enact, consequently, constraining the feeling itself (Williams et al., 2020, this issue; Wharton et al., 2021; Wharton and de Saussure, 2023). The comfort zone is so inherent to us that we project that orientation of relevance to others, assigning perspective to both the animate and inanimate, to make events unfamiliar to us part of our world of relevance. This results in us assuming things have purpose or direction even when they don't, including people, objects, events, or even ideas, as long as they look like they do (**intentional stance**) (Dennett, 1989; Brooks, 1991; Villalobos and Ward, 2015; Hutto and Satne, 2015; Hutto and Myin, 2017; Csibra and Gergely, 2007). Although this projection can

seem futile, it allows us to articulate statements about not only our own concerns but also the hypothetical concerns of abstract objects (**propositional attitudes**) (Frege, 1948; Russell, 1905). This can be useful in that these articulations can match their targets in varying degrees of better or worse, making them more or less useful.

It's no surprise then that reality that is mapped poorly is difficult for us to operate in (**misrepresentation**) (Searle, 1983; Grice, 1957; Papineau, 1984; Millikan, 1987, 1989; Neander, 1995; Godfrey-Smith, 2006). In cases of psychopathology especially, we can be very off (Beck, 1971; Leventhal and Diefenbach, 1991; Cummins, 2010). This usually becomes obvious in faulty communication with others, or when our operations prove to be ineffective (Burge, 2010; Izard et al., 2008). Abstractions provide the means to articulate mental processes in verbal language, mathematical symbols, or code (**cognitive science**) (Stillings et al., 1995; Eckardt, 1995; Clark, 2000; Thagard, 2005), such as what is happening when individuals have trouble navigating the environment in light of their comfort zone, as they are mapping either or both poorly. We can articulate such maladaptive mechanisms and use these labels to predict future outcomes of those individuals' subjective operations (**computational psychiatry**) (Egan, 2018, 2020; Shin and Liberzon, 2010; Maia et al., 2017; Petzschner et al., 2017; Smith et al., 2021; Friston, 2023; Hitchcock et al., 2022; Hoemann et al., 2021). Taken together, there is much more associated with affective phenomena in humans than mere adaptive enaction of relevance. We cannot neglect our human capacity to entertain abstraction as it determines the versatility of our comfort zone.

Synthesizing the academic interests from different corners of the field, we have now built the teleological principle of human affective phenomena, illustrating how each purpose grounds the next. We began with root of purpose of a neurobiological organism—to ensure its viability. From there, we acknowledged the purpose of a complex organism—to execute operations in the service of its viability. We then explored the purpose of an organism's basic mental capacities—to enact its own relevance by executing operations for the sake of its viability. Finally, we discussed the purpose of conceptual capacity typical in humans—to entertain abstraction, when enacting relevance, by executing operations, to ensure our viability. To answer the question—*why are there human affective phenomena?*—using only one of these rationales seems incomplete: human affective phenomena collectively exist to serve these nested, intertwined purposes. Only together do these purposes account for all human affective phenomena. Therefore, guided by this teleological principle, we are now poised to articulate assumptions about what human affective phenomena are and how they work to construct our integrated framework: the Human Affectome.

### 3. The Human Affectome: What are human affective phenomena?

The term 'affect' has traditionally referred to the collective phenomena of feeling, sensation, emotion, mood, wellbeing, etc. Here, we use it to refer to the phenomena of a human organism affecting their environment and being affected by that environment, such that they are enacting their particular relevance in the world by executing operations with respect to viability. This intrinsic teleological foundation, synthesized from a comprehensive sampling of perspectives in the field of affect, can guide a principled set of metaphysical and mechanistic assumptions, resulting in an integrated framework for understanding human affective phenomena (Table 2).

Affective phenomena, being phenomena, are processes, both felt and mechanistic. While they are but a tangle among all the tightly interconnected dynamic processes of a human neurobiological system, we can carve up any set of those processes. When isolated, these processes can be described as algorithms, sequences of steps articulable in words, equations, or code that are executed for specific goals or to solve particular computational problems (Suppes, 1969; Cartwright, 1983; Marr, 2010; Pylyshyn, 1986; Rapaport, 2012; Vardi, 2012; Hill, 2016; Dennett, 2002; Chalmers, 2012; Egan, 2017, 2020). For our purposes,



Table 2

**Affective Concerns and Features.** This table describes two sets of algorithms among affective phenomena— affective concerns and features— providing examples and their theoretical rationale. Each phenomenon's computational problem is also specified, as well as algorithmic solutions existing in the field already.

Affective Phenomenon	Examples	Theoretical Rationale	Computational Problem	Existing Algorithmic Solutions
<b>AFFECTIVE CONCERNS</b> inference of objects as actionable and thus relevant, which is reflected in the felt implication of those objects	physiological, operational, global	<u>Intentionality</u> : feelings are about something (Frege, 1948; Russell, 1905; Dennett, 1989; Bedford, 1956; Brentano, 2012; de Sousa, 1990; Kenny, 2003; Leighton, 1985; Pitcher, 1965; Teroni, 2007; Deonna and Teroni, 2012; Clore and Huntsinger, 2009) <u>Embodiment and Enactivism</u> : all cognition is encoded as action (Varela et al., 2017; Colombetti and Thompson, 2008; Shargel and Prinz, 2017; Slaby and Wüschner, 2014; Hufendiek, 2015; Hutto, 2012) <u>Affordances</u> : the environment provides actionable meaning for the organism (Gibson, 1977) <u>Motivation Theories</u> : feeling states as motivational (Duffy, 1957; Frijda, 1986, 2017; Hommel et al., 2017)	how to infer relevance of objects	<u>Bayesian</u> : using observable (interoceptive or exteroceptive) sensory data to infer and update the non-observable meaning (hidden or latent conditional probabilistic states) of those sensory data (Barrett, 2017; Dayan et al., 1995; Doya, 2007; Friston et al., 2016; Knill and Pouget, 2004; Lee and Mumford, 2003; Neal, 2012; Seth, 2013; Seth and Friston, 2016; Smith et al., 2019; Wolpert et al., 1995; Palacios et al., 2020)
<b>Immediate to Distal</b> gradient of relevance according to the distance from metabolic impact that the actions demanded would have (i.e., complexity, timescale, abstractness)	physiological, operational	<u>Evolutionary and Biological Theories</u> : courses of action can be more immediate or more distal (Jonas, 2001)	how to organize needs with varying extents of actionability	<u>Bayesian</u> : hierarchical inference with varying levels of complexity, timescale, or abstractness; immediate concerns are hidden states inferred at a lowest level and distal concerns are those at the highest (Pezzulo et al., 2015; Pezzulo and Levin, 2016; Pezzulo et al., 2022)
<b>Physiological</b> concerns require the most immediate or concrete actions	nourishment (hunger), hydration (thirst), internal integrity (nauseous); <b>sensation</b>	<u>Interoception and Homeostasis</u> : internal state as indicative of homeostatic status (Craig, 2002, 2013; Pace-Schott et al., 2019, this issue)	how to address immediate needs	<u>Reinforcement Learning</u> : reflexive decision-making in reinforcement learning (i.e., model-free; van Swieten et al., 2021); pain as aversive prediction errors (Roy et al., 2014) <u>Bayesian</u> : fatigue as metacognitive inference (Stephan et al., 2016)
<b>Operational</b> concerns range from proximal to distal, wherein an organism has a feeling toward an object that, if acted upon, has proximal to eventual metabolic impact	safety (joy, happiness, exhilaration), danger (fear, worry, dread), obstruction (frustration, annoyance, anger), loss (disappointment, sadness, grief), epistemic (curiosity, intrigue, fascination), cooperation (care, love, belonging, trust, empathy), moral (pride, admiration, shame, moral disgust), aesthetic (awe, appreciation, beauty); <b>emotion</b>	<u>Evaluative or Action-Oriented Theories</u> : feelings or emotions are evaluation of readiness for action (Dewey, 1895; Frijda, 1986, 2017; King, 2009; Deonna et al., 2015; Deonna and Teroni, 2012, 2015; Scarantino, 2014, 2015; Simon, 1967; Tooby and Cosmides, 1990, 2008; Clore and Palmer, 2009; Seth, 2013; Oatley and Johnson-Laird, 2014; Bach and Dayan, 2017; Atzil and Gendron, 2017; Hommel et al., 2017; Hommel, 2019; Suri and Gross, 2022; Quadt et al., 2022; Del Giudice, 2021) <u>Basic and Discrete Appraisal Theories</u> : differentiating emotion types by respective evaluations (Kragel and LaBar, 2016; Adolphs, 2017; Ekman and Cordaro, 2011; Lazarus, 2001; Roseman and Smith, 2001; Izard, 2007; Levenson, 2011; Panksepp and Watt, 2011; Scherer et al., 2010) <u>Dimensional Appraisal Theory</u> : infinite combinations of concerns differentiate an infinite typology of emotions (Grandjean and Scherer, 2008; Scherer, 2009; Scherer and Moors, 2019; Lerner and Keltner, 2000, 2001) <u>Constitutive Appraisal Theory</u> : emotions are these evaluated concerns (Clore and Ortony, 2000, 2013; Ortony et al., 1988) <u>Constructionist Theories</u> : emotions are constructed from lower-level ingredients (Damasio, 2003; Russell, 2003; Barrett, 2017; LeDoux, 2012)	how to address proximal to distal needs	<u>Affective Computing, Reinforcement Learning, and Bayesian</u> : models for differentiating between emotions (Gratch and Marsella, 2004; Scherer et al., 2010; Broekens et al., 2013; Lee et al., 2021; Marsella and Gratch, 2009; Marsella et al., 2010; Poria et al., 2017; Bach and Dayan, 2017; Sennesh et al., 2022; Smith et al., 2019).

(continued on next page)

Table 2 (continued)

Affective Phenomenon	Examples	Theoretical Rationale	Computational Problem	Existing Algorithmic Solutions
<b>Global</b> summative adaptive states	trajectory, optimization	<u>Constructionist Theory</u> : summarizing overall organism state (LeDoux, 2012)	how to characterize own adaptive performance across time	See below.
<b>Trajectory</b> the direction of adaptation with regard to comfort zone	positive, negative; <b>mood</b>	<u>Philosophical Theories</u> : increased likelihood of positive/negative occurrences (Price, 2006; Railton, 2017)	how to characterize local direction of environment	<u>Reinforcement Learning</u> : momentum or trajectory of reward and punishment prediction errors (Eldar et al., 2016) <u>Bayesian</u> : mood as hyperpriors (Clark et al., 2018)
<b>Optimization</b> optimal match between the organism and the environment	low, high; <b>wellbeing</b>	<u>Life Satisfaction</u> : global evaluation of one's life (Schwarz and Strack, 1999; Strack et al., 1991; Diener and Ryan, 2009; Diener, 2009; Diener et al., 2009; LeDoux, 2012; Krueger and Schkade, 2008; Maddux, 2017; Oishi et al., 2020)	how to recognize best adaptive performance across an extensive period of time	<u>Bayesian</u> : maximizing momentary valence—using momentary judgments of adaptiveness to evaluate global optimality in adaptiveness (Smith et al., 2022; Miller et al., 2022) <u>Information Theory</u> : flow as mutual information (Melnikoff et al., 2022)
<b>AFFECTIVE FEATURES</b> momentary information on the adaptive process	valence, arousal	<u>Allostasis</u> : measures of predicted homeostatic need (Cannon, 1929; Cooper, 2008; Sterling and Eyer, 1988; Carpenter, 2004; McEwen and Wingfield, 2003; Sterling, 2012, 2020; Schulkin and Sterling, 2019; Sennesh et al., 2022)	how to characterize momentary status of adaptive process	See below.
<b>Valence</b> metric of evaluation of goodness or badness	positive, negative	<u>Core Affect</u> : valence as ubiquitous across all affective experience (Russell et al., 1989; Russell, 2003; Posner et al., 2005; Kuppens et al., 2013) <u>Philosophical Theory</u> : minimal metacognition in self-assessment of own adaptiveness (Van de Cruys, 2017)	how to characterize momentary suitability for organism's adaptivity	<u>Reinforcement Learning Implementation</u> : predicted rewards and punishments as 'happiness' (Rutledge et al., 2014) <u>Bayesian Implementation</u> : organism's predictive evaluation of its adaptiveness or preparedness for its environment (Hesp et al., 2021)
<b>Arousal</b> metric of activation of various systems	low, high	<u>Core Affect</u> : arousal as ubiquitous across all affective experience (Russell, 2003; Russell et al., 1989; Posner et al., 2005; Kuppens et al., 2013) <u>Wakeful, Sexual, Autonomic, Physical, and Affective Arousal Theories</u> : activation can occur within different systems at different levels (Duffy, 1957; Zuckerman, 1971; Pribram and McGuinness, 1975; Thayer, 1978; Robbins and Everitt, 1995; Robbins, 1997; Cahill and McGaugh, 1998; Jones, 2003; Eysenck, 2012; Satpute et al., 2019; Satpute et al., 2019; Neiss, 1988; Griffiths, 2013)	how to characterize momentary activation of system	<u>Vigor</u> : effort as an outcome of arousal (Niv et al., 2007)

the processes we are most interested in are grounded by the teleological principle above, so that we can identify types of problems among affective phenomena and articulate how affective mechanisms attempt to solve them.

All human affective phenomena are situated in both experience and mechanism from the perspective of the human organism. We distinguish between algorithms that address the relevance of a physical or mental object to the organism, and the algorithms that monitor that adaptation (Fig. 1). Thus, affective phenomena include the two sets of processes below:

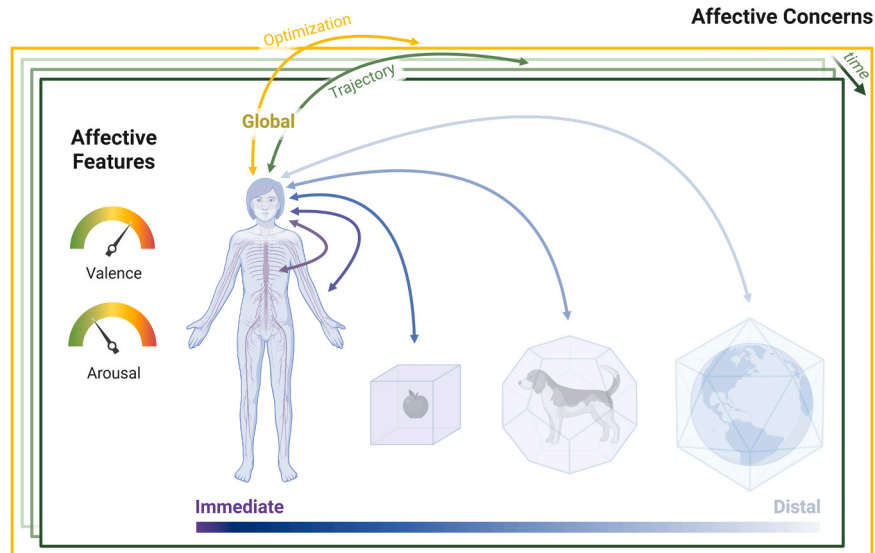
- (1) Algorithms reflecting *affective concerns* are processes that address the relevance of physical and mental objects, including things, people, and situations. These concerns signify what is of interest in affective experiences and are reflected in the felt actionability toward that object. These include concerns that have immediate to distal or global relevance to the organism. Several affective

concerns can be active at the same time to make up any present moment's total experience.

- (2) Algorithms reflecting *affective features* are processes that provide information on the adaptive process itself. They are the dimensional metrics of the organism's own performance in adaptation, integral to all affective concerns, and are reflected in qualitative aspects of affective experience. These include valence and arousal. These features are always present as they mark affective concerns, providing information on them.

### 3.1. Affective Concerns

These processes reflect concerns that address the relevance of physical or mental objects, including things, people, and situations, to the organism's viability. The organism is proactively oriented toward the object, which is reflected in the felt implications of those objects. The object is, therefore, meaningful to the organism in virtue of the



**Fig. 1. The Human Affectome.** This framework is guided by the teleological principle that the collection of human affective phenomena in their entirety can only be accounted for by the nested and intertwined purposes: to ensure viability, to execute operations, to enact relevance, and to entertain abstraction. The *bidirectional arrows* are used to indicate that the human is enacting—in both being affected by relevant aspects of their actionable world, and affecting that world in order to make it relevant. We characterize affective phenomena as algorithms that address the relevance of the environment and monitor that adaptation. We distinguish between processes that reflect affective concerns and those that reflect affective features. The algorithms that address **affective concerns** indicate the relevance of a physical or mental object by suggesting actions regarding that object. We can organize one set of these processes in a **hierarchy** according to the distance from metabolic impact that the actions demanded by the concerns would have. The most immediate concerns (**dark blue**) are also the most concrete, yet least complex in actionability (i.e., physiological concerns, such as consuming food to alleviate hunger). On the other end of the continuum, more distal concerns (**light blue**) are increasingly abstract and complicated in terms of actionability, wherein more causal steps are required to achieve homeostatic impact (i.e., operational concerns, such as running away from a dog to alleviate fear, flickering lights for right-of-way on the road to express irritation, or researching more on a topic to address interest). In addition, the set of algorithms addressing affective concerns that do not fall along this continuum of distance from metabolic impact instead summarize across affective concerns. These **global** concerns include **trajectory** (**green**), the direction that the environment is heading toward across time; **optimization** (**yellow**), the best match between the environment and organism's adaptive capacities across a given duration of time—the self-evaluations of aspects of the organism's own adaptive capacity that are persistent across time. Finally, algorithms expressing **affective features** provide momentary information on the status of the adaptive process in relation to the comfort zone. These include valence and arousal. Created using [Biorender.com](https://biorender.com).

organism's enactive orientation toward the object—the **affective concern** (Teroni, 2007; Frijda, 1986, 2017; Bedford, 1956; Kenny and Kenny, 2003; Pitcher, 1965; Leighton, 1985; de Sousa, 1990; Pham, 1998; King, 2009; Deonna et al., 2015; Deonna and Teroni, 2015; Varela et al., 1974; Gibson, 1977; Colombetti and Thompson, 2008; Di Paolo and Thompson, 2014; Shargel and Prinz, 2017; Slaby and Wüschner, 2014; Hufendiek, 2015; Hutto, 2012). As such, affective concerns can be clustered based on whether those operations address a potential breach in viability more or less directly, or as global summaries of those prospective operations. We can thus distinguish between different sets of mechanisms that address affective concerns:

- Algorithms that reflect **hierarchy** of immediate to distal concerns organize gradations of enactive relevance, according to the distance from metabolic impact that the actions demanded would have.
- Algorithms that reflect **global** concerns summarize across affective concerns in a comprehensive evaluation of adaptive performance across time, rather than being driven by a particular enactive relevance.

Many of these processes can be ongoing at the same time as well as rapidly changing moment to moment (Larsen and McGraw, 2014; Hoemann et al., 2017; Godfrey-Smith, 2020), collectively making up the human's profile of affective experience in a certain period of time.

### 3.1.1. Hierarchy

The algorithmic mechanisms that address a **hierarchy of immediate to distal concerns** reflect predictive actionability toward an object, its

relevance, along a gradient or scale of distance to metabolic impact. This gradient can correspond to the number of causal steps needed to address the affective concern, the timescale necessary to achieve homeostatic impact, or its concreteness to abstractness (Gilead et al., 2020; McEwen and Seaman, 1999; Pezzulo et al., 2015). In formal and computational terms, this can be construed as hierarchical depth (Pezzulo et al., 2021; Levin, 2019; Friston, 2020; Tschantz et al., 2022; Tomasello, 2022). Immediate concerns, such as physiological ones, are inferred at a lowest level (i.e., shortest timescale, fewest number of calculations, closest mappings to one-to-one between prediction and sensory data) in the hierarchy of actionability. Distal concerns, such as moral and other abstract concerns, are those at the highest (Scherer, 1982b). Below, we organize ranges of concerns along the continuum of actionable depth.

**3.1.1.1. Physiological.** Algorithms reflecting **physiological concerns** can be addressed by the most immediate or concrete actions required to maintain organismic balance. This set of concerns requires actions that immediately affect the internal environment of one's own body, therefore, dealing with the adaptive process in the most direct actionable manner. Physiological affective experience arises from interoceptive sensations, and typically reflects the integration of many interoceptive sources (Craig, 2002; Pace-Schott et al., 2019, this issue; Seth, 2013; Seth and Friston, 2016). In the English language, different feeling words along this dimension typically capture the intensity or degree of departure from the organism's comfort zone. Physiological affective states may pertain to nourishment (e.g., hungry or thirsty; Ombrato and Phillips, 2021), energy levels (e.g., rejuvenated; Podilchak, 1991; Caldwell, 2005; Iwasaki et al., 2005), and internal bodily concerns (e.g.,

sick; Quadt et al., 2018; pain; Coninx and Stilwell, 2021; Kiverstein et al., 2022), among others. Algorithms addressing physiological concerns seem to be what we tend to refer to as **sensation**.

**3.1.1.2. Operational.** Algorithms reflecting **operational concerns** are beyond immediate physiological needs as they demand the human organism to operate as a cohesive unit to interact with the environment in sophisticated sequences of actions (Frijda, 1986; LeDoux, 1989; Adolphs and Andler, 2018; Ekman and Cordaro, 2011; Lazarus, 2001; Roseman and Smith, 2001; Izard, 2007; Levenson, 2011; Panksepp and Watt, 2011; Poria et al., 2017; Scherer et al., 2010; Sander et al., 2003, 2005; Grandjean and Scherer, 2008; Scherer, 2009; Scherer and Moors, 2019; Clore and Ortony, 2000, 2013; Ortony et al., 1988; Russell, 2003; Barrett, 2017; Scarantino, 2014; Moors, 2022; Teroni, 2023). The meaning of an operational concern is such that addressing it won't impact metabolism in a few short steps. In fact, the hypothetical distance from metabolism means that there are many ways to address operational concerns. Given that these concerns demand complex sets of actions over extended periods of time, there are many possibilities for securing those future circumstances for the organism to remain viable. The more sophisticated the course of action, the more abstraction required from the present moment. In addition, while the first-person perspective of human organisms is always maintained, they may cast that perspective to other beings, inanimate objects, or even abstract concepts such that they may consider concerns that are not presently theirs or are imagined. In this way, operational concerns can vary in degree of complexity or abstractness along the higher levels of the hierarchy of distance from metabolic impact, ranging from more immediate and concrete (e.g., anger at a broken printer) or more distal and abstract (e.g., inspired by artwork). More strikingly, however, is the diversity of operational concerns—as they are as numerous as possible operations are for addressing the multidimensional spectrum of relevance to humans. Nevertheless, we offer some examples to demonstrate how potential operations toward objects tend to be clustered:

- **Safety Concerns:** suggest taking full advantage of an environment that enables and encourages exploration to expand one's action repertoire or play to simulate operations under low stakes (e.g., joy, happiness, exhilaration) (Fredrickson, 2001, 2005; Fredrickson and Joiner, 2002; Lopez and Snyder, 2011; Csikszentmihalyi, 2014)
- **Danger Concerns:** suggest avoiding potential threats that could cause harm such that viability is breached (e.g., fear, worry, dread) (Paterson and Neufeld, 1987; Levy and Schiller, 2021; LeDoux, 1996, LeDoux, 2022; Mobbs et al., 2019; Raber et al., 2019, this issue; Stefanova et al., 2020, this issue)
- **Obstruction Concerns:** suggest pushing through or against an object that hinders, obstacles, or violates one's adaptive capacity (e.g., frustration, annoyance, anger) (Britt and Janus, 1940; Kuppens et al., 2003; D'Mello and Graesser, 2012; Lench et al., 2016; Williams, 2017; Alia-Klein et al., 2020, this issue; Silva, 2021)
- **Loss Concerns:** suggest recognizing that a resource is lost and seeking new resource to replace it (e.g., disappointment, sadness, grief) (Draper, 1999; Freed and Mann, 2007; Zeelenberg et al., 2000; Chua et al., 2009; Horwitz and Wakefield, 2007; Lench et al., 2016; Averill, 1968; Bonanno and Kaltman, 2001; Archer, 1999; Shear and Shair, 2005; Kübler-Ross and Kessler, 2005; Parkes, 2013; Neimeyer et al., 2014; Fuchs, 2018; Bonanno, 2019; Arias et al., 2020, this issue; Tsikandilakis et al., 2023)
- **Epistemic Concerns:** suggest acquiring new knowledge to inform one's action repertoire or solving a gap in planned operations (e.g., curiosity, intrigue, fascination) (Ortony et al., 1988; Silvia, 2008; Vogl et al., 2020; Dolcos, 2020, this issue)
- **Cooperation Concerns:** suggest seeking out and sharing operations with other human beings for common goals (e.g., care, love, belonging, trust, empathy) (Eslinger et al., 2021, this issue; Heise,

1977; Isen, 1987; Leary, 2000; Schulkin, 2011; Forgas, 2001, 2012; van Hooft and Aureli, 1994; Atzil et al., 2018; Sznycer and Lukaszewski, 2019; Djerassi et al., 2021; Ho et al., 2022; Zoltowski et al., 2022; Migeot et al., 2023; Chemero, 2016; Fischer and Manstead, 2008, 2016; Lin et al., 2023)

- **Moral Concerns:** suggest influencing potentially cooperative others via praise or punishment to adhere to the standards of operations for one's comfort zone (e.g., pride, admiration, shame, moral disgust) (Haidt, 2003; Tangney et al., 2007; Gray and Wegner, 2011; Deonna et al., 2012)
- **Aesthetic Concerns:** suggest slowing down to take in fit between the environment's actionable features and one's own action repertoire (e.g., awe, appreciation, beauty) (Brouwer et al., 2017; Desmet and Schifferstein, 2008; Hogan, 2011, 2017; Juslin, 2013; Kaneko et al., 2018; Marković, 2012; Mastandrea et al., 2019; Menninghaus et al., 2019; Scherer and Coutinho, 2013; Silvia, 2005; Van de Cruys et al., 2022; Van Dyck et al., 2017a; Vessel et al., 2012)

It seems that what the field often refers to as **emotion** maps well onto algorithms reflecting operational concerns (Simon, 1967; Tooby and Cosmides, 1990, 2008; Clore and Palmer, 2009; Seth, 2013; Oatley and Johnson-Laird, 2014; Scarantino, 2014; Bach and Dayan, 2017; Atzil and Gendron, 2017; Hommel et al., 2017; Hommel, 2019; Al-Shawaf and Lewis, 2020; Al-Shawaf and Shackelford, 2024; Del Giudice, 2021; Suri and Gross, 2022; Quadt et al., 2022). This should be no surprise considering the term's etymology, which is inherently tied to movement and action (Dixon, 2003, 2012).

### 3.1.2. Global

Given that the hierarchical affective concerns above are comprised of separate process occurring at different timepoints and for different durations, other concerns are required to make sense of them combined or more globally. Algorithms reflecting **global concerns** are not driven by any particular level of enactive relevance, but instead summarize across hierarchical concerns in comprehensive evaluation at a higher time-scale. These global concerns are not about particular objects but are rather directed at summations of concerns about particular objects to inform an overall state (LeDoux, 2012). Although integration across hierarchical concerns can be analyzed in a number of different ways, there are two orders of global concerns that are the most obvious and have been studied well in the field: trajectory and optimization.

**3.1.2.1. Trajectory.** Algorithms reflecting **trajectory concerns** summarize hierarchical concerns by reflecting their global direction with regard to the organism's comfort zone (Schwarz and Clore, 1996; Eldar et al., 2016). These processes take into account whether the slope of adaptation is trending in a positive or negative direction. This means that affective experiences reflecting trajectory concerns often feel like they are not directed at anything in particular or they are directed at everything—as the specificity of relevance is lost in the summary of trajectory (Deonna and Teroni, 2012; Kind, 2013; Bollnow and Boelhaue, 2009; Frijda, 1993; Gendolla, 2000; Crane, 1998; Goldie, 2000; Seager, 1999; Solomon, 1993; de Sousa, 1990; Mendelovici, 2013; Tye, 1995; Arregui, 1996; Kriegel, 2019; Gendolla et al., 2005; Gendolla and Krüsken, 2001). Processes reflecting trajectory concerns usually last for longer periods of time than the short-lived hierarchical concerns. The affective construct that fits this characterization is **mood**. When one is in a good mood, one can describe its relevant environment as heading in a good direction (Morris and Schnurr, 1989; Price, 2006; Pessiglione et al., 2023).

**3.1.2.2. Optimization.** Algorithms of **optimization concerns** summarize hierarchical concerns by reflecting their global performance at a high temporal scale, indicating the extent to which the human organism has achieved their best match between their adaptive capacities and the



environment's actionable features, across an extended duration of time (Schwarz and Strack, 1999; Strack et al., 1991; Diener and Ryan, 2009; Diener, 2009; Diener et al., 2009; LeDoux, 2012; Krueger and Schkade, 2008; Maddux, 2017; Oishi et al., 2020). These processes assess how the organism is faring overall in their quest for the maintenance of their comfort zone, suggesting wholesale changes to future operations. This usually means that the organism has been able to consistently occupy its comfort zone despite engaging in various operations (De Neve et al., 2013; Lyubomirsky et al., 2005; Eid, 2008; Brown et al., 2020). These algorithms seem to be what the field often refers to as **wellbeing**, including affective experiences of life satisfaction, authenticity, fulfillment, and self-actualization (Alexander et al., 2021, this issue; Arias et al., 2020, this issue; Schwarz and Strack, 1999; Diener et al., 2013; Krueger and Schkade, 2008; Maddux, 2017; Oishi et al., 2020).

### 3.2. Affective Features

These processes reflect the momentary information on the adaptive process itself. Algorithms reflecting **affective features** monitor several standards inherent to the adaptive process:

- Algorithms that reflect *valence* provide information on how well or poorly the human organism is doing with respect to the comfort zone.
- Algorithms that reflect *arousal* provide information on how much resources should be put to various systems.

Unlike affective concerns, which highlight the object of interest as actionably relevant during an affective experience, affective features are reflected in the qualitative aspects of the experience itself. In addition, each can have multiple dimensions as opposed to being constrained to single scalars with two extremes.

#### 3.2.1. Valence

Across affective concerns, algorithms reflecting **valence** arise in the hedonic quality of affective experience, often described as pleasure and displeasure, marking how adaptation is faring with respect to the concern at the heart of the affective phenomenon (Becker et al., 2019, this issue). This characteristic of affective phenomena can be construed to have multiple dimensions, such as when both positive and negative valence seem to be present (e.g., nostalgia) (Colombetti, 2005; Keltner and Lerner, 2010; Viinikainen et al., 2010; Batcho, 2013; Vazard, 2022). There are more recent formal accounts of the mechanism of valence—some from the perspective of the environment being good, while others of the view that it is the evaluation of the environment being good (e.g., Rutledge et al., 2014; Joffily and Coricelli, 2013; Hesp et al., 2021)—but it is largely agreed upon that valence is an intrinsic characteristic of affective phenomena, momentarily describing adaptivity (Charland, 2005; Berridge and Kringlebach, 2008; Van de Cruys, 2017; Trofimova, 2018).

#### 3.2.2. Arousal

Across affective concerns, algorithms reflecting **arousal** assess the quality of intensity in affective experience, often described as low to high, marking the extent of excitation, activation, or mobilization of processes serving a particular concern (Duffy, 1957; Anderson and Adolphs, 2014; Clore et al., 2021). Given that many processes can be implicated in an affective concern, there are many dimensions of arousal (e.g., wakefulness, emotional arousal, sexual arousal, physical activity, attention) (Duffy, 1957; Zuckerman, 1971; Pribram and McGuinness, 1975; Thayer, 1978; Robbins and Everitt, 1995; Robbins, 1997; Cahill and McGaugh, 1998; Jones, 2003; Eysenck, 2012; Satpute et al., 2019; Dolcos et al., 2020, this issue). Although intermediate arousal across time can be an indication of effective adaptivity, these systems can have varying degrees of arousal at any one time (e.g., sexual arousal during fatigue) (Neiss, 1988; Griffiths, 2013).

Taken together, given the rapid change of a dynamic human neurobiological system, these algorithms rarely, if ever, reflect a neutral valence or arousal state, even in periods of high optimization. These two features are usually related but remain orthogonal due to operations that can involve opposing positions on their various spectra (Kuppens et al., 2013, 2017; Yik et al., 2023). These features are ever-present, marking every affective experience and evaluating every hierarchical affective concern. In addition, these are the sources of information used by algorithms of global concerns, responsible for summarizing across the dynamic momentary ones. Finally, these affective features are often what is referred to in the field as 'affect', perhaps because they are most inherently tied to the organism's comfort zone (Russell, 2003; Posner et al., 2005; Barrett and Satpute, 2019). We, however, distinguish them as the affective gauges, while concerns are the focus of affective phenomena.

The feature of **motivation** has also been suggested as part of affect, often citing dimensions of approach and avoidance (Lang and Bradley, 2008). However, within this framework, given the central role of our teleological principle, it seems that affective phenomena can be more cohesively organized if motivation is taken as an inherent aspect (Klinger, 1975; Nelkin, 1989; Rosenthal, 1991; Di Paolo, 2005; Colombetti, 2014; Cromwell et al., 2020, this issue). Given our teleological principle, an organism has algorithms reflecting affective concerns that address actionability, and thus relevance, of the environment through this enaction. Therefore, affective phenomena inherently involve motivation in that actionability is at the heart of relevance. As such, motivation folds into the inherent enacting of relevance necessary for this framework's teleological foundation, whereas valence and arousal can be found as distinct capacities in the human organism's adaptive purpose.

### 4. Conclusions: How can we study human affective phenomena?

This capstone paper builds a teleological principle to guide the construction of an integrative framework for human affective phenomena, a set of assumptions about what they are and how they work. To account for the entire collection of affective phenomena in humans, we can consider them as arising to entertain abstraction, when enacting relevance, by executing operations, to ensure viability. Based on this principle, affective phenomena can be considered processes that adjust based on the human's comfort zone (*affective concerns*) and monitor their adaptive process (*affective features*). Affective concerns, include a hierarchy of relevance ranging from courses of action with more immediate metabolic impact to those with more distal impact. They also include global concerns that summarize momentary affective concerns on the hierarchy at a higher timescale, such as tracking their trajectory and optimization with respect to the comfort zone. These global concerns use the momentary information that characterize all affective concerns provided by affective features—algorithms that monitor the adaptive process. These include multidimensional metrics of valence, how well or poorly the human organism performs in light of their comfort zone, and arousal, how much resource should be mobilized per necessary system for action. All affective phenomena are experientially and mechanistically organized from the perspective of the human organism, where affective concerns are the focus of the affective experiences and affective features mark them all as qualities of the experiences. This cohesive framework is offered to be used as a synthesized set of metaphysical and mechanistic assumptions organized around a teleological principle that is based on a comprehensive sampling of existing theoretical perspectives on affective phenomena (Table 2).

It is important to note that this is *not* intended as a semantic taxonomy of affective phenomena and their definitions, but rather as an ontology for how human affective phenomena might follow from a common principle and be related to each other (Fodor, 1998; Egan, 2017, 2020). To truly fold the richness of valid scholarly interests into an encyclopedia of semantic constructs in the field would require a full

research program's worth of time and work, spanning years, or even decades. This endeavor is also *not* meant to be another falsifiable theory for generating testable hypotheses. What we offer here instead is a principled multidisciplinary theoretical launchpad for many threads of inquiry and a *scaffold* for hosting specific theories and hypotheses differentiated from or situated among the tenets of this framework (Popper, 1963; Kuhn, 2012; Holton, 1975; Lakatos, 2014, 1978; Laudan, 1978; Godfrey-Smith, 2009; Ormerod, 2009; Jabareen, 2009; Notturmo and Popper, 2014).

We hope this framework provides a template for an organized research agenda for the affective sciences moving forward, following similar endeavors in neighboring fields: the *Human Genome*, organizing the complete set of human genetic information (Schuler et al., 1996), and the *Human Connectome*, organizing all networks of connectivity in the human brain (Sporns et al., 2005). By the same token, we dub this framework the **Human Affectome**, where the suffix '-ome' means "all the constituents of, considered collectively or in total" (Oxford English Dictionary, 2023), so that it can be used by the field to organize the collection of algorithms across human affective phenomena. We aim for this framework to encourage the interdisciplinary field of the affective sciences to identify concrete algorithms in order to test specific theories and hypotheses about affective phenomena. This will be an exercise in characterizing and organizing human affective phenomena based on the teleological principle, ultimately, applying this framework to build out the Human Affectome in a principled and comprehensive manner.

For each member of the field, the initial approach we advocate is to triangulate your explanatory goals among these assumptions in order to compare them to others in the field on the basis of the teleological principle described here. Paired with the perspectives incorporated into the teleological synthesis (Table 2), we offer an inverse, preliminary mapping of examples of the field's existing theoretical accounts onto this framework (Table 3). We also suggest ways the existing theoretical constructs in the field can be situated within this framework (Table 4). We hope these resources can help efforts to regenerate existing theories and hypotheses as well as put forth new ones in terms of the teleologically-principled algorithms here. In this way, different disciplines, subdisciplines, and individual researchers can understand their differing context-dependent interests, disclose their assumptions, and work toward integrating their frameworks in a non-adversarial manner (Dijkstra, 1965; Mitchell, 2003, 2012; Bechtel, 2009; Tabery, 2014; Tabery et al., 2014).

For the time being, we highlight a few avenues of guidance implicit in this paper:

Firstly, assuming affective phenomena to be *mechanistic* is not unique to empirical approaches. Beyond the sciences, affective phenomena are acknowledged as processes of change that not only shape the nature of the humanities but are a major part of the content among the humanities (Brouwer et al., 2017; Desmet and Schifferstein, 2008; Hogan, 2011, 2017; Juslin, 2013; Kaneko et al., 2018; Mastandrea et al., 2019; Menninghaus et al., 2019; Scherer and Coutinho, 2013; Silvia, 2005; Van Dyck et al., 2017a). On the other hand, among the sciences, this mechanistic assumption need not result in methodological factions (Lange, 1885; Scherer, 1982a; Schwarz and Clore, Averill et al., 1983, 1994; Frijda, 1994; Keltner and Gross, 1999; Cacioppo et al., 1999; Mill, 1856; Whewell, 1858; Machamer et al., 2000; Glennan, 2002, 2008; Azzouni, 2004; Bechtel and Abrahamsen, 2005; Chang, 2005; Morganti and Tahko, 2017; Ivanova and Farr, 2020; Levenstein et al., 2023). The classical cognitivist approach—that affective mechanisms transform inputs into outputs or are otherwise processes between stimulus and response—accords with our felt experience and has underpinned efforts to localize affective processes to specific brain regions (Haugeland,

1978, 1997; Marr, 2010; Kanwisher, 2010; Cromwell and Papadelis, 2022, this issue). This is not incompatible with more distributed and dynamic perspectives—that these processes are interactions between nodes of a neural network that change in configuration over time (**connectionism**) (Fodor and Pylyshyn, 1988; Bechtel and Abrahamsen, 1991; Clark, 1989)—which invite the articulation of those processes of change in formal terms with differential equations (**dynamical systems theory**) (Horgan and Tienson, 1996; Thelen and Smith, 1994; Port and Van Gelder, 1995; Clark, 1998; Boone and Piccinini, 2016). These views can be reconciled by considering the classical linear and localizable processes as emergent from distributed and dynamic neural activity (Friston and Price, 2001a, 2001b; De Wolf and Holvoet, 2005).

Secondly, we do not present an explicit formal or computational model precisely to encourage the multiple empirical interpretations of this framework by articulating the algorithms for your own hypotheses. We will caution that selecting a *modeling framework* introduces assumptions as well. For example, some frameworks that invoke the concept of **reward** tend to assume relevance and action to be separate (**reinforcement learning**) (Kaelbling et al., 1996; Wiering and Van Otterlo, 2012; Sequeira et al., 2011; Moerland et al., 2018; Grahek et al., 2020; Levine, 2018; Sutton and Barto, 2018), while others view relevance as probabilistic (**Bayesian inference**), going as far as building relevance from action (**active inference**) (Friston et al., 2017; Attias, 2003; Botvinick and Toussaint, 2012; Knill and Pouget, 2004; Friston and Kiebel, 2009; Allen and Friston, 2018; Friston et al., 2013; Ramstead et al., 2020; Sajid et al., 2021; Clark, 2013, 2015, 1997; Parr et al., 2022; Kiverstein et al., 2022; Smith et al., 2019, 2022; Millidge et al., 2020; Miłkowski and Litwin, 2022; Di Paolo et al., 2022; Nave, 2023). Notwithstanding accounts that mix these methods, none to our knowledge have successfully built algorithms of affective phenomena up from the earliest principle of an organism, although the groundwork is being laid (Prokopenko et al., 2009; Fernández et al., 2014; Ringstrom, 2022; Heylighen and Busseniers, 2023; Hodson et al., 2023; Broekens et al., 2013; Cunningham et al., 2013; Scherer et al., 2010; Marsella and Gratch, 2009; Marsella et al., 2010, 2016; Calvo et al., 2015; Poria et al., 2017; Emanuel and Eldar, 2023).

Thirdly, we do not make a strong claim about consciousness (Berridge and Winkelman, 2003; Winkelman and Berridge, 2004; Hatzi-moysis, 2007; Lacewing, 2007; de Waal, 2011; Carmel and Sprevak, 2014; Díaz, 2023; Reuter, forthcoming). We do assume, however, that the affective experiences discussed here are feelings and, therefore, are felt in the broadest sense (i.e., qualitatively organized by a unified perspective). As such, a *first-person perspective* from oneself—an assumption in the Human Affectome—should be taken seriously. One approach that has gained traction in the cognitive sciences is one that investigates the correlations between the structure of experience and the organization of neurocomputational mechanism (**neuro-phenomenology**) (Gallagher, 1997; Van Gelder, 2022; Varela, 1996; Thompson et al., 2005). This can be done through rigorous comparison of subjective report and case studies with neuroimaging and behavioral measures (Weiskrantz, 1997; Dehaene et al., 2003; Koch and Tsuchiya, 2007; Rosenthal, 2019; Cunningham, 1977; Scarantino, 2017; Wharton and de Saussure, 2023). Especially when it comes to psychopathology, investigation into aberrations in the capacity to maintain a perceived and actionable comfort zone is paramount—and methodologies to perform such studies are on the rise (Metzinger, 2003a, 2003b, 2013; Möller et al., 2021). For example, given the fundamental role that actionability plays in this framework, research into an integrated sense of agency (Georgieff and Jeannerod, 1998; Horgan et al., 2003; Engbert et al., 2008; Gallagher, 2000; Hohwy, 2007; de Haan and de Bruin, 2010; David, 2012; Synofzik et al., 2008, 2013; Roessler and Eilan,

Table 3

**Situating Existing Theoretical Accounts within the Human Affectome.** This table summarizes explanatory goals of existing theoretical accounts of affective phenomena with their chosen methodologies and situates them within the algorithmic organization of the Human Affectome. For each entry of theoretical account in the table below, references to relevant theoretical accounts are **bolded** and references to the Human Affectome are *italicized*. References included here supplement citations in the main body of the text.

Theoretical Accounts	Explanatory Goal	Methodology	Situated within The Human Affectome
<b>Affective computing</b>	matching, recognizing, or simulating affective phenomena often using multidimensional data ( <b>Picard, 2000; Gratch and Marsella, 2004; Poria et al., 2017</b> )	computational modeling; machine learning	Can be used to articulate affective algorithms. <i>To entertain abstraction, Operational concerns.</i>
<b>Appraisal</b>	1. the commonality of relations between evaluations and emotions across populations ( <b>discrete appraisal theories; Lazarus, 2001; Roseman and Smith, 2001</b> ) 2. the variability in relations between emotions and combinations of evaluations across populations ( <b>dimensional appraisal theories; Grandjean and Scherer, 2008; Scherer, 2009; Scherer and Moors, 2019; Lerner and Keltner, 2000, 2001</b> ) 3. evaluations as distinguishing between what constitutes different emotion types, rather than causing them ( <b>OCC model; Ortony et al., 1988</b> )	subjective report (fixed options); behavioral paradigms; physiological measures; affective computing subjective report (dimensional responses); behavioral paradigms; physiological measures; affective computing computational modeling and formalism	The actionable orientation with which the human organism evaluates an object as relevant. <i>Affective Concerns.</i>
<b>Autopoiesis</b>	See <b>enactive: autopoietic.</b>		
<b>Basic emotion</b>	the commonality of physiological, neural, and behavioral indicators of types of emotion across populations	subjective report (fixed options); behavioral paradigms; physiological measures; neuroimaging	Emotions can be grouped by their cluster of operational concerns but are not necessarily biologically determined. <i>Operational concerns.</i>
<b>Bayesian inference</b>	1. predictive inference of explanation for sensory data ( <b>Bayesian brain hypothesis or predictive coding</b> ) <i>1a.</i> predictive inference of explanation for sensory data based on principle of minimizing free energy by considering action ( <b>active inference</b> )	behavioral paradigms; computational modeling and formalism; neuroimaging	Objects are evaluated by their meaning. <i>Affective Concerns.</i> Objects are evaluated by their actionable meaning. <i>Affective Concerns.</i>
<b>Cognitive science</b>	interdisciplinary field studying the mind	behavioral paradigms; computational modeling and formalism; neuroimaging	<i>Entertaining abstraction</i> allows us to engage in cognitive science, but we can also question whether cognition and affect are indeed separate. <i>Conclusions.</i>
<b>Computational psychiatry</b>	the individual computational mechanisms at play in different people with psychiatric disorders	behavioral paradigms; computational modeling and formalism; neuroimaging	Mechanisms in psychiatric disorders can be construed as algorithms of adaptivity gone awry. See <b>representation: misrepresentation.</b> <i>To entertain abstraction.</i>
<b>Connectionism</b>	the distributed activity across nodes of a neural network (see <b>attractor states</b> in Table 4 and <b>dynamical systems</b> )	computational modeling and formalism	An organism's processes unfold across many nodes. <i>To ensure viability.</i>
<b>Constructionist</b>	1. the presence of felt bodily changes during emotional experience ( <b>somatic marker hypothesis</b> ) ( <b>Damasio, 1996</b> ) 2. the dimensional commonalities across all emotional experiences ( <b>core affect</b> ) ( <b>Russell, 2003; Russell et al., 1989; Posner et al., 2005; Kuppens et al., 2013</b> ) 3. the variability in subjective reports of emotional experience ( <b>theory of constructed emotion</b> ) ( <b>Barrett, 2017</b> )	subjective report; behavioral paradigms; physiological measures; neuroimaging subjective report (dimensional responses); behavioral paradigms; physiological measures; neuroimaging subjective report (free labeling); behavioral paradigms; physiological measures; neuroimaging	Emotions being felt reflections of algorithms addressing operational concerns, which can be inferences of lower-level affective concerns. <i>Operational concerns.</i>
<b>Dynamical systems</b>	the dynamics of distributed activity across time (see <b>attractor states</b> in Table 4)	computational modeling and formalism	An organism's processes unfold across time as a complex system. <i>To ensure viability.</i>
<b>Embedded</b>	interactions between organism and environment shape organism's capacities (see <b>situated</b> )	conceptual analysis	The human organism must interact with the environment to enact its relevance. <i>To enact relevance.</i>
<b>Embodied</b>	mental processes involve whole body, not just brain and nervous system	subjective report; behavioral paradigms; physiological measures; neuroimaging; conceptual analysis	All processes in an organism are contributing to enacting relevance. <i>To enact relevance.</i>
<b>Enactive</b>	1. everything an organism does, including cognition, is active—specifically, as interactions with its environment  <i>1a.</i> to be an organism is to self-generate and self-distinguish ( <b>autopoietic</b> ) <i>1b.</i> the organism both makes sense of the world and makes the world make sense ( <b>sense-making</b> )	computational modeling and formalism; conceptual analysis conceptual analysis	The <i>Human Affectome</i> is guided, in part, by the <i>Teleological Principle</i> that human organisms enact relevance. All affective phenomena are enactive. (Emotions, as references to <i>operational concerns</i> , can therefore also be considered enactive.) <i>To ensure viability.</i>  <i>To enact relevance.</i>

(continued on next page)

Table 3 (continued)

Theoretical Accounts	Explanatory Goal	Methodology	Situated within The Human Affectome
	2. how perception and action can guide each other ( <b>sensorimotor</b> )	subjective report; behavioral paradigms; physiological measures; neuroimaging;	<i>To enact relevance.</i>
	3. enaction allows us to do away with representation ( <b>radical</b> )	conceptual analysis	The <i>Human Affectome</i> does not assume a strong claim on representation, but representations can be used to describe algorithms. <i>To enact relevance, To entertain abstraction.</i>
<b>Evolutionary</b>	affective phenomena can be explained based on aspects that developed via natural selection (Izard, 1978; Nesse, 1990; Porges, 1997; Panksepp, 1998; LeDoux, 2012; Al-Shawaf et al., 2016).	behavioral paradigms; neuroimaging; conceptual analysis	The <i>Human Affectome</i> does not take up an explicit evolutionary perspective, despite the assumption that part of the purpose of affective phenomena is <i>to ensure viability</i> . All else, such as metabolism, reproduction, and evolution, arise from necessarily being a unity in the first place (Varela et al., 1974; Maturana, 1980)
<b>Extended</b>	the mind extends further than the body to objects used in a relevantly similar and reliable way (Clark and Chalmers, 1998)	conceptual analysis	The <i>Human Affectome</i> does not assume an extended mind, but merely highlights the interactions between human organism and environment. <i>To enact relevance.</i>
<b>Goal-directed theories</b>	integration of <b>dimensional appraisal and constructionist</b> theories of emotion (Moors, 2017a; 2017b)	conceptual analysis	Emotion types grounded by clusters of goal-orientedness or action tendency. <i>Operational concerns.</i> See <b>goal</b> in Table 4.
<b>Homeostasis</b>	how organism remains within viable states despite environmental change	behavioral paradigms; physiological measures; neuroimaging; conceptual analysis	This is entailed by <b>autopoiesis</b> . <i>To ensure viability.</i>
<b>Human Affectome</b>	what affective phenomena are and how they work based on why they exist	conceptual analysis	Entire framework of the <i>Human Affectome</i> .
<b>Intentionality</b>	the aspect of a mental state being about something  projecting intentionality onto something whose behavior seems to have it ( <b>intentional stance</b> )	conceptual analysis; phenomenological analysis	Objects are relevant to an organism based on its actionable orientation toward them; allows distinction between affective types based on clusters of affective concerns. <i>Affective Concerns.</i> We can use the intentional stance to articulate processes, whether the source has intentionality or not. <i>To entertain abstraction.</i>
<b>Moral emotions</b>	emotions that concern beliefs about violation	behavioral paradigms; conceptual analysis	Moral emotions as affective experiences grounded by algorithms addressing a moral subset of operational concerns. <i>Operational concerns.</i>
<b>Motivational theories</b>	1. the drive to act in emotion ( <b>action tendency</b> ; Frijda, 1986); see <b>appraisal</b> . 2. the evaluation in emotion in light of the drive to act ( <b>felt bodily attitude</b> ; Deonna and Teroni, 2012) 3. the drive to act as well as emotional actions ( <b>motivational theory of emotions</b> ; Scarantino, 2014)	conceptual analysis; behavioral paradigms; physiological measures; neuroimaging	The actionability implied by an object in an affective phenomenon. <i>To enact relevance, Affective Concerns.</i>
<b>Phenomenology</b>	the rich structure in the meaning of experience	conceptual analysis	This rich structure accompanies the organization of felt actionability implied by objects in affective phenomena. <i>To enact relevance.</i>
<b>Reinforcement learning</b>	1. learned behavior based on reward  1a. momentary affect as a function of reward  1b. mood as a momentum of reward	behavioral paradigms; computational modeling	Reward as intrinsic rather than in the environment. <i>To enact relevance.</i> Valence as metric of evaluation of goodness or badness. <i>Valence.</i> Mood as trajectory. <i>Trajectory concerns.</i>
<b>Representation</b>	1. mental content; can be written as <b>propositional attitudes</b>  1a. mental content can be unjustified ( <b>misrepresentation</b> )  2. providing sufficient coverage of the interests of members within a group; in this case, of the affective field (see <b>pragmatic</b> in Table 1)	conceptual analysis	We human organisms can seem as if we have representations, but this framework does not make a strong claim on representationalism. See <b>intentionality: intentional stance</b> . If meaning is captured by actionability, then unjustified meaning is associated with maladaptivity. <i>To entertain abstraction.</i> The <i>Human Affectome</i> provides a sampling of Western perspectives, but lacks in coverage of Eastern or non-analytic approaches. <i>Conclusions.</i>

(continued on next page)



Table 3 (continued)

Theoretical Accounts	Explanatory Goal	Methodology	Situated within The Human Affectome
<b>Situated</b>	the mind is shaped by environment in the interactions that are possible; see <b>embedded</b> ; can be applied to affective phenomena ( <b>situated affectivity</b> ; Griffiths and Scarantino, 2005; Colombetti, 2010; Piredda, 2020; Stephan and Walter, 2020)	conceptual analysis	The human organism's capacities are shaped by possible interactions with the environment. <i>To enact relevance.</i>
<b>Unconscious emotions</b>	1. the behavior of organisms whose mental state we cannot access  2. conscious feelings that the organism is not aware of on a higher-order, reflective level	behavioral paradigms; physiological measures, neuroimaging; computational modeling  conceptual analysis	The systematicity in feeling can be inferred to explain behavior, assuming that system is rational. See <b>intentionality</b> . <i>To enact relevance.</i>  Emotions, as affective experiences, are feelings that are minimally felt, but do not require reflection or reporting to be felt. <i>To enact relevance.</i>

2003; Pacherie, 2008; Gallagher, 2012; Moore, 2016; Haggard, 2017; Braun et al., 2018) as well as sense of control over intended outcomes (Pacherie, 2007; Rotter, 1966; Lachman and Weaver, 1998; Bandura, 1977, 2006; Na et al., 2023) in relation to affective phenomena can be expanded.

Moreover, we should not shut out language and thought as non-affective phenomena. Indeed, both communication and thinking have felt aspect themselves (Siewert, 2012; Siewert, 1998; Pitt, 2004; Bayne et al., 2014; Kind, 2001; Tulving, 1987; Roediger, 1990; Teroni, 2017; Gardiner and Java, 2019; Wharton et al., 2021). Instead, we should emphasize these *abstract* activities as active constructs in our picture of affective phenomena, such as by considering them determinants of relevance and, thus, generating activities of subjective report and communication as dynamic processes in themselves (Wharton and de Saussure, 2023; Satpute et al., 2020; Ryan et al., 2023; Gohm and Clore, 2000; Robinson and Clore, 2002; Barrett, 2004; Cowen and Keltner, 2017; Russell, 1980; Watson et al., 1988; Bradley and Lang, 1994; Boehner et al., 2007; Wilhelm and Grossman, 2010; Betella and Verschure, 2016; Shiffman et al., 2008; Csikszentmihalyi and Larson, 2014; Kuppens et al., 2022; Betz et al., 2019; Satpute and Lindquist, 2021; Ericsson and Simon, 1993; Wilson, 1994; Schwarz, 1999; Dehaene et al., 2003; Mauss and Robinson, 2009; Barrett et al., 2011; Lindquist et al., 2015; Harmon-Jones et al., 2016; Rosenthal, 2019; Li et al., 2023; Teoh et al., 2023). In addition, we should acknowledge that we academics, as humans ourselves, are performing the very same activity of abstraction and—if we choose not to investigate ourselves as affect-ridden researchers—should at least acknowledge and disclose the assumptions from our pragmatic context and theoretical virtues (e.g., Scarantino, 2016). All in all, we should take seriously the question whether cognition is truly separate from affect (Wharton and de Saussure, 2023; Lyons, 2005; Adolphs and Damasio, 2001; Duncan and Barrett, 2007; Okon-Singer et al., 2015; Zajonc et al., 1982, 2014; Bower et al., 1997; Isen, 1984; Hoffman, 1986; LeDoux, 1989; Izard, 1992; Ochsner and Phelps, 2007; Forgas, 2000; Storbeck and Clore, 2007).

Relatedly, as interdisciplinary and integrative as this framework is, only Western academic perspectives have been considered, while *Eastern* ones as well as *Indigenous* perspectives have not been breached. This is a significant drawback as Western academia tends to take a metaphysically categorical approach to affect, considering it separate from cognition, while this is not necessarily the case among Eastern and Indigenous psychologies and philosophies (e.g., Mercado, 1994; Reyes, 2015; Rošker, 2021; Sundararajan, 2015; Tuske, 2021; Zhou et al., 2021; Yik, 2010; Pernau, 2021; Briggs, 2010; Choi et al., 2007; Crivelli et al., 2016; Beatty, 2014, 2019; Allard, 2022; Michaels and Wulf, 2020; Pak, 2021; Yik et al., 2023). Further research and collaboration among those

from different cultures of academia as well as beyond is highly encouraged.

In addition, areas of academic and industry perspectives in affective research beyond philosophy and science have not been touched upon, such as design and architecture (Desmet, 2003; Desmet et al., 2021; Hassenzahl and Tractinsky, 2006; Norman, 2002, 2013; Fokkinga and Desmet, 2022). These sectors pose fertile collaboration in studying affective phenomena in new ways—especially given the growing scientific interest in the embodiment of affect.

Finally, although this framework exclusively covers humans—obliging us to incorporate abstraction, language, and self-report—its core tenets can apply to non-human animals as well. This could involve a nested teleological principle focusing on ensuring viability, executing operations, and enacting relevance, while motivating a more limited set of affective concerns and features. Converging on such teleologically grounded affective phenomena in this way could promote translation and collaboration across levels of investigation in the context of non-human animal affective research.

In conclusion, assumptions ruling academic research into affective explananda have been tangled and discussed in disparate pockets of inquiry—each field, subfield, and researcher, with their own explanatory motives. In this capstone paper of the special issue “Towards an Integrated Understanding of the Human Affectome”, we present the Human Affectome—a set of metaphysical and mechanistic assumptions guided by a common teleological principle based on a synthesis of interdisciplinary perspectives—in order to motivate a comprehensive and organized research agenda that differentiates the theoretical aspects of this integrative framework into specific theories and hypotheses. As we mentioned in the *Introduction*, we hope that you have taken something away, no matter how small the message and no matter what background you have in affect, from this endeavor and are inspired to bridge our rich and sprawling field further. We hope that we are one step closer to not only an integrated understanding of human affective phenomena, but an integrated field for affective research.

#### Author Sequencing

Daniela Schiller and Alessandra N. C. Yu both contributed equally as co-first authors. Nelly Alia-Klein, Susanne Becker, Howard C. Cromwell, Florin Dolcos, Paul J. Eslinger, Paul Frewen, Andrew H. Kemp, Edward F. Pace-Schott, Jacob Raber, Rebecca L. Silton, Elka Stefanova, and Justin H. G. Williams were all team leaders in this project. They contributed equally and are listed alphabetically, and they are ahead of all the remaining authors who all contributed equally and who are also listed alphabetically. Finally, Leroy Lowe led the entire collaboration.

Table 4

**Situating Existing Theoretical Constructs within the Human Affectome.** This table summarizes meaning—and senses of meaning—of existing theoretical constructs of affective phenomena, situating them within the algorithmic organization of the Human Affectome. Within the entries below, references to relevant theoretical accounts are **bolded**; references to other theoretical constructs within this table are **bolded and italicized**; and references to the Human Affectome are *italicized*. References included here supplement citations in the main body of the text.

Theoretical Construct	Sense	Situated Within Human Affectome
<b>Affect</b>	<ol style="list-style-type: none"> <li>all affective phenomena</li> <li>aspects that characterize affective phenomena</li> <li>valence and arousal (<b>core affect</b>; Russell, 2003; Russell et al., 1989; Posner et al., 2005; Kuppens et al., 2013); sometimes also dominance (Mehrabian and Russell, 1974; Bakker et al., 2014)</li> </ol>	<p><i>Affectome</i>: all of the specified constituents of an organism's system of algorithms for affective phenomena, considered collectively or in total. <i>The Human Affectome</i>.</p> <p>Affective features: the dimensional metrics of the organism's own performance in predictive adaptation, integral to all affective concerns, and reflected in qualitative aspects of affective experience. See <b>valence</b> and <b>arousal</b>. <i>Affective Features</i>.</p> <p>See <b>valence</b> and <b>arousal</b>. <i>Affective Features</i>.</p> <p>Dominance can be seen as the manner in which the human organism is poised to act upon the world (see <b>appraisal</b> in Table 3); <i>Affective Concerns</i>. It can also be seen as the sense of agency the agent has or sense of control over intended outcomes or <b>goal</b>; <i>Conclusions</i>.</p>
<b>Affordance</b>	actionability features of objects in the environment	<i>To execute operations, Affective Concerns.</i>
<b>Allotasis</b>	predictive process to maintain stability despite change	Dynamic regulation and navigation within a complex and changing environment in order to anticipate the approach of a fatal state before it approaches, i.e., to safeguard homeostasis. See <b>homeostasis</b> . <i>To execute operations.</i>
<b>Allostatic load</b>	chronic burden on allotasis	The repeated surpassing of an organism's adaptive capabilities in anticipating its own needs due to a persistently difficult environment, usually consisting of persistent acute stress, resulting in chronic stress (i.e., bearing allostatic load). See <b>allotasis</b> and <b>stress</b> . <i>To execute operations.</i>
<b>Algorithm</b>	description of process	Sequences of steps executed for the sake of a goal. <i>The Human Affectome.</i>
<b>Arousal</b>	an aspect of affective experience	The metric of excitation, activation, or energy mobilization within different systems indicating the urgency to act; reflected in the aspect of intensity of an affective experience; measured as magnitude from low to high for each kind of arousal based on the system of interest or as a whole (e.g., wakefulness, emotional arousal, sexual arousal, physical activity, attention, etc.). <i>Affective Feature: Arousal.</i>
<b>Attractor states</b>	configurations that a complex system is attracted to (see <b>connectionism</b> and <b>dynamical systems</b> in Table 3)	<i>To ensure viability</i> and in <i>executing operations</i> , a complex organism will hover around states of relative stability.
<b>Comfort zone</b>	set of states	Range of comfortable states which an organism seeks to sustain. See <b>allotasis</b> . <i>To execute operations.</i>
<b>Consciousness</b>	<ol style="list-style-type: none"> <li>qualitative state</li> <li>phenomenology</li> <li>higher-order, reflective experience</li> </ol>	<p>See <b>feeling</b>. <i>To enact relevance.</i></p> <p>See <b>feeling: phenomenology</b>. <i>To enact relevance.</i></p> <p>See <b>metacognition</b>. <i>To entertain abstraction.</i></p>
<b>Emotion</b>	a type of affective experience	Affective experiences grounded in algorithms that reflect <i>operational concerns</i> , implications of an object's actionability in terms of sophisticated sequences of actions.
<b>Episodes</b>	duration of time	Affective experiences are episodes of experience. <i>To enact relevance.</i>
<b>Expression</b>	articulation of affective phenomenon through implicit or explicit means	Human organisms express affective phenomena to communicate with others as part of their adaptive operations. <i>To entertain abstraction.</i>
<b>Feeling</b>	<ol style="list-style-type: none"> <li>affective experiences</li> <li>aspect of experience (felt)</li> <li>experience</li> <li>metacognitive awareness</li> </ol>	<p>First-person, conscious mental states with qualitative character that is experienced which reflect affective algorithms. <i>To enact relevance.</i></p> <p>Raw qualitative aspect that marks all experience. See <b>qualia</b>. <i>To enact relevance.</i></p> <p>Having a what it's like and rich structure. See <b>qualia</b> and <b>phenomenology</b>. <i>To enact relevance.</i></p> <p>Higher-order, reflective conscious awareness of being in an affective state; can sometimes be verbalized in subjective report. See <b>subjective report</b>. <i>To entertain abstraction, Conclusions.</i></p>
<b>Goal</b>	<ol style="list-style-type: none"> <li>final state that explains development (Aristotle, 1999)</li> <li>purpose that explains certain capacities or characteristics (Mayr, 1998, 1985; Cartwright, 1986; Schlosser, 1998; McLaughlin, 2000; Ward et al., 2017)</li> <li>hypothetical end result that explains explicit deliberation, decision, and planning</li> </ol>	<p>As a dynamic, complex system, the human organism is not seeking, whether implicitly or explicitly, a final state. It can be considered a self-producing and self-distinguishing act. See <b>enactive: autopoiesis</b> in Table 3. <i>To ensure viability.</i></p> <p>A <i>Teleological Principle</i>, an assumption about what purpose explains capacities and characteristics associated with affective phenomena, can ground other assumptions in the field. See <b>teleology</b> in Table 1 and <b>goal-directed</b> in Table 3.</p> <p>Human organisms can explicitly aim for goals as individual agents or among a group in a collaborative context. See <b>metacognition</b> and <b>theory of mind</b>. <i>To entertain abstraction.</i></p>

(continued on next page)

Table 4 (continued)

Theoretical Construct	Sense	Situated Within Human Affectome
<b>Interoception</b>	the afferent signaling, central neural, and perceptual representation of the internal (physiological) state of the body	Interoception is among the internal processes in organism's adaptivity. <i>To enact relevance.</i>
<b>Language</b>	designating and using symbols to communicate abstract meaning	Human organisms can associate labels with abstracted operations. <i>To entertain abstraction, Conclusions.</i>
<b>Mental action</b>	actions can be taken internally without interaction with the outside world	The organism uses mental actions to orchestrate operations. <i>To execute operations.</i>
<b>Metacognition</b>	1. reflective consciousness 2. reported confidence 3. parameter of precision	Higher-order processing of oneself that is necessary for organisms to be able to subjectively report on their feelings but is not necessary for feeling itself. See <b>subjective report</b> . <i>To entertain abstraction, Conclusions.</i> A measurement of subjective report about how confident a participant is about their responses, which is used as a parameter of precision in understanding that participant's algorithms. See <b>metacognition: 3. Conclusions.</b> A parameter used in algorithm which reflects an evaluation of weighting of a lower-level parameter, e.g., sensation, valence. See <b>sensation and valence</b> . <i>To entertain abstraction, Valence, Conclusions.</i>
<b>Mood</b>	a type of affective experience	An affective experience reflecting the direction or momentum of positive or negative outcomes in the environment. <i>Trajectory concerns.</i>
<b>Motivation</b>	an aspect of being actionably oriented toward the world	The entire <i>Human Affectome</i> is motivational. Not among <i>Affective Features</i> .
<b>Qualia</b>	quality, or 'what it's like', of conscious experience	Affective experiences have qualities that mark them— <i>Affective Features</i> . <i>To enact relevance.</i>
<b>Reward</b>	inherent relevance of an object, learned with experience	See <b>reinforcement learning</b> in <a href="#">Table 3</a> .
<b>Self</b>	1. perspective from which conscious experience is organized 2. metacognitive reflection of self as an object	All affective phenomena are organized from the perspective of a self. <i>To enact relevance.</i> Human organism can reflect abstractly upon itself. See <b>metacognition: 1. To entertain abstraction</b> .
<b>Sensation</b>	a type of affective experience	An affective experience grounded in algorithms reflecting <i>physiological concerns</i> .
<b>Stress</b>	a type of affective experience	Acute or chronic state of intense affective experience which can lead to <b>allostatic load</b> if persistent. <i>To execute operations.</i>
<b>Subjective report (self-report)</b>	behavioral operationalization	Verbalized account of one's feelings, which requires reflective, higher-order metacognition; an empirical measurement used to gain insight into the systematicity of feeling, but not required for feeling itself. See <b>metacognition. Conclusions.</b>
<b>Theory of mind</b>	the capacity to infer the mental state of others	Human organisms can project their adaptive perspective to others in order to cooperate or to abstract about non-agentive objects. See <b>intentionality: intentional stance</b> in <a href="#">Table 3</a> . <i>To entertain abstraction.</i>
<b>Umwelten</b>	the way the world appears to an organism based on its adaptive capacities	The world appears to the human organism in a manner based on their adaptive capacities. <i>To enact relevance.</i>
<b>Valence</b>	an aspect of affective experience	The metric of how good or bad something is evaluated with relation to affective concerns indicating how suited the human organism is; reflected in the aspect of pleasure or displeasure of an affective experience; measured as low to high positive or negative fit. <i>Affective Feature: Valence.</i>
<b>Wellbeing</b>	1. life satisfaction 2. mood 3. momentary affective state	An affective experience reflecting the optimal match between the organism's adaptive capabilities and the environment's demands. <i>Optimization concerns.</i> See <b>mood. Trajectory concerns.</b> See <b>valence. Valence, Optimization.</b>

### Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used GPT-4 for edits. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

### Data Availability

No data was used for the research described in the article.

### Acknowledgements

We are especially grateful to the support provided by Professor Jaak Panksepp in the early stages of this project prior to his passing on the 18th April 2017. We extend special thanks to Dr. Denis Tarasov, Chief Software Architect at Meanotek AI, for his early efforts to help us understand the full range of feeling words that could be retrieved using a big data approach. In addition, we would like to give a special thanks to Drs. Ralph Adolphs, Roger Clem, Antonio Damasio, Roeland Heerema, Joseph LeDoux, Ifat Levy, James H. McIntyre, Seth Pollak, Disa Sauter, Norbert Schwarz, Fabrice Teroni, Dave Ward, and Tim Wharton, for

their guidance and feedback. A. Ibanez was supported by grants from Takeda; CW2680521; CONICET; FONCYT-PICT (2017-1818, 2017-1820); ANID/FONDECYT Regular (1210195, 1210176, 1220995); ANID/FONDAP (15150012); ANID/PIA/ANILLOS ACT210096; and the Multi-Partner Consortium to Expand Dementia Research in Latin America (ReDLat), funded by the National Institutes of Aging of the National Institutes of Health under award number R01AG057234, an Alzheimer's Association grant (SG-20-725707-ReDLat), the Rainwater Foundation, and the Global Brain Health Institute. A. Lawrence was supported by the Scottish Government Strategic Research Programme (Theme 2) and by the BBSRC Institute Strategic Programme to the Roslin Institute (ISP3; Theme 2). A.H. Kemp acknowledges support from a CHERISH-DE international mobility fellowship that supported his contributions to the Human Affectome Project. He was also supported by research funding for patient and public benefit awarded by Health and Care Research Wales (RfPPB-18-1502). B. Derntl was supported by the German Research Foundation (DFG, DE2319/6-1, DE2319/9-1). C.A. Lowry was supported by the National Institute of Mental Health [R21MH116263], the National Center for Complementary and Integrative Health [R01AT010005 and R41AT011390], the Colorado Office of Economic Development and International Trade (OEDIT) Advanced Industries Accelerator Program [CTGG1-2020-3064] and the Department of the Navy, Office of Naval Research Multidisciplinary University Research Initiative (MURI) Award [N00014-15-1-2809]. C.D. Ladoum framework was funded by the National Institute of Mental Health [R01MH099007, R01MH103241, R01MH101096]. C.H.Y. Fu acknowledges support from MRC grant (G0802594). D. Ellingsen was supported by the Norwegian Research Council/Marie Skłodowska-Curie Actions [FRICON/COFUND-240553/F20]. D. Schiller is supported by NIH grants [R01MH122611], [R01MH123069], and The Misophonia Research Fund. E. Stefanova was supported by Ministry of Education Science, and Technological Development, Republic of Serbia (Project No. 175090), Alzheimer Association grant for Promoting Diversity. E. Stern and C. Brown are supported by National Institute of Mental Health (NIMH) R01 MH111794, R33 MH107589, and R01 MH126981 awarded to ERS. E.D. Musser was supported by the National Institutes of Mental Health [R03MH110812-02, K23MH117280]. E.F. Pace-Schott was supported by MH109638, MH115279. F. Dolcos acknowledges support received from a Helen Corley Petit Scholarship in Liberal Arts and Sciences, an Emanuel Donchin Professorial Scholarship in Psychology, and an Arnold O. Beckman Award from the University of Illinois, during his contribution to this article. G. Northoff acknowledges that this work was funded by PSI and CIHR as well as the European Human Brain project. G. Pinna is supported in part by the United States U. S. Department of Defense Grant W81XWH-15-1-0521. G. Riva and P. Cipresso were funded by the Italian MIUR research project "Unlocking the memory of the body: Virtual Reality in Anorexia Nervosa" (201597WTTM) and by the Italian Ministry of Health research project "High-end and Low-End Virtual Reality Systems for the Rehabilitation of Frailty in the Elderly" (PE-2013-0235594). J. Gatt was supported by a NHMRC Project Grant (APP1122816). J. Raber was supported in part by the United States Department of Defense Grant W81XWH-17-1-0193, NIH RF1 AG059088, R21 ES027943, R21 AG065914, R01 NS080866, RF1 AG058273, R01 HL140182, R21 CA223461, U19 AT010829, and by NASA NSCOR NNX15AK13G to M.Weil (OHSU subcontract to J. Raber) and NASA NASA 80NSSC19K0498 -P00001 to J. Baker (subcontract to J. Raber). J. Williams and C. Huggins were supported by the Northwood Trust. J.E. Swain was supported by the Research Foundation for the State University of New York (SUNY), the National Institutes of Health (NIH)/National Institute on Drug Abuse (NIDA) R01 DA047336 and R01 DA047094, and the Peter F. McManus Charitable Trust. L. Booij was supported by a career award from the Fonds de Recherche du Québec –

Santé. L. M. Bylsma was supported by MH118218, MH104325, MH101750 and a NARSAD Young Investigator Award from the Brain and Behavior Research Foundation (BBRF) and Vital Projects Fund, Inc. M. Bensafi was supported by the French-German ANR/DFG SHS FRAL program [MEROD Project, ANR-15-FRAL-0002]. M. Joffily was supported by the LABEX CORTEX of the University of Lyon [ANR-11-LABX-0042] and the program Investissements d'Avenir of the French National Research Agency (ANR) [ANR-11-IDEX-007]. M.Owolabi was supported by SIREN (U54HG007479), SIBS Genomics (R01NS107900), SIBS Gen Gen (R01NS107900-02S1), ARISES (R01NS115944-01), H3Africa CVD Supplement (3U24HG009780-03S5), CaNVAS (1R01NS114045-01), Sub-Saharan Africa Conference on Stroke (SSACS) 1R13NS115395-01A1 and Training Africans to Lead and Execute Neurological Trials & Studies (TALENTS) D43TW012030 from the NIH. M. Owolabi and K. Kusi-Mensah would like to thank the following medical students of the Kwame Nkrumah University of Science and Technology, Kumasi- Ghana, class of 2019 for volunteering their time to work on the classification of affect words in English: Gladys Akrofi, Loretta Agyare, Felix Allotey and Edwin Akomaning. M. Polyakova was supported by the International Max Planck Research School (IMPRS) NeuroCom by the Max Planck Society. M.-F. Marin was supported by an award from the Fonds de recherche du Québec – Santé (FRQS). M.L. Schroeter was supported by the German Research Foundation (DFG; SCHR 774/5-1), by the German Consortium for Frontotemporal Lobar Degeneration, funded by the German Federal Ministry of Education and Research (BMBF; FKZ 01GI1007A), by the Parkinson's Disease Foundation (PDFIRG-1307), the Michael J Fox Foundation (MJFF-11362), by LIFE –Leipzig Research Center for Civilization Diseases, Universität Leipzig, and by the eHealthSax Initiative of the Sächsische Aufbaubank (SAB). M. Weymar was supported by the German Research Foundation (DFG; WE 4801/3-1, WE 4801/6-1). N. Abe was supported by JSPS KAKENHI Grant Number 17H06054 and 19H00628. O. Gosseseries and S. Laureys are research associate and research director at FRS-FNRS respectively and acknowledge support from the Human Brain Project SGA3 (No. 945539). P. Eslinger was supported by NIH/NIEHS R01 ES019672 and the Alzheimer's Therapeutic Research Institute/USC/NIA. P. Frewen was supported by the Canadian Institutes for Health Research, Canadian Department of National Defense, and Veteran's Affairs Canada. P.S. Sachdev was supported by an Investigator Grant from the National Health and Medical Research Council of Australia. R. Alexander was supported by an Australian Government Research Training Program Domestic Scholarship. R.C.K Chan was supported by the National Natural Foundation of China [81571317], National Key Research and Development Programme [2016YFC0906402], and the Beijing Municipal Science & Technology Commission [Z16110000216138]. R.C.K Chan and Y. Wang were supported by the CAS Key Laboratory of Mental Health, Institute of Psychology. R. Nusslock was supported by the National Institute of Mental Health [MH100117; MH077908] and the National Institute on Drug Abuse [DA051361]. R. Palermo and M. Willis were supported by the Australian Research Council (ARC) Centre of Excellence for Cognition and its Disorders (CE110001021). S. Boutros was supported by National Science Foundation GVPRS0014D9, NIA T32 AG055378, and F31 AG067269. S. Krach was supported by the German Research Foundation (DFG KR 3803/9-1; KR 3803/11-1). S.Schweizer was supported by the Wellcome Trust, Sir Henry Wellcome Fellowship, 209127/Z/17/Z. S. Urben was supported by Swiss National Science Foundation (SPARK# CRSK-3\_190490). S.G. Hofmann receives financial support by the Alexander von Humboldt Foundation (as part of the Alexander von Humboldt Professur) and the Hessische Ministerium für Wissenschaft und Kunst (as part of the LOEWE Spitzenprofessur). He also receives compensation for his work as editor from SpringerNature and royalties



and payments for his work from various publishers. T. Aue was supported by the Swiss National Science Foundation (grants PP00P1\_150492 and PP00P1\_183709). T.E. Van Rheeën was supported by a National Health and Medical Research Council (NHMRC) Early Career Fellowship (1088785) and a Dame Kate Campbell Fellowship from the University of Melbourne. T. Jovanovic was supported by the National Institute of Mental Health (R01MH111682, R01MH100122, R01MH110364). T.Olino was supported by the National Institute of Mental Health [R01MH107495]. Y. Wang was supported by the National Natural Foundation of China [31871114].

## References

- Achinstein, P., 1983. *The nature of explanation*. Oxford University Press, USA.
- Adolphs, R., 2017. How should neuroscience study emotions? By distinguishing emotion states, concepts, and experiences. *Soc. Cogn. Affect. Neurosci.* 12 (1), 24–31.
- Adolphs, R., Damasio, A.R., 2001. The interaction of affect and cognition: a neurobiological perspective. In *Handbook of affect and social cognition*. Lawrence Erlbaum Associates Publishers, pp. 27–49.
- Adolphs, R., Anderson, D.J., 2018. The neuroscience of emotion: a new synthesis. In *The Neuroscience of Emotion*. Princeton University Press. <https://doi.org/10.23943/9781400889914>.
- Adolphs, R., Andler, D., 2018. Investigating emotions as functional states distinct from feelings. *Emot. Rev.: J. Int. Soc. Res. Emot.* 10 (3), 191–201. <https://doi.org/10.1177/1754073918765662>.
- Adolphs, R., Mlodinow, L., Barrett, L.F., 2019. What is an emotion? *Curr. Biol.* 29 (20), R1060–R1064. <https://doi.org/10.1016/j.cub.2019.09.008>.
- Alexander, R., Aragón, O.R., Bookwala, J., Cherbuin, N., Gatt, J.M., Kahrilas, I.J., Kästner, N., Lawrence, A., Lowe, L., Morrison, R.G., Mueller, S.C., Nusslock, R., Papadelis, C., Polnaszek, K.L., Helene Richter, S., Silton, R.L., Styliadis, C., 2021. The neuroscience of positive emotions and affect: Implications for cultivating happiness and wellbeing (this issue). *Neurosci. Biobehav. Rev.* 121, 220–249. <https://doi.org/10.1016/j.neubiorev.2020.12.002>.
- Alia-Klein, N., Gan, G., Gilam, G., Bezek, J., Bruno, A., Denson, T.F., Hendler, T., Lowe, L., Mariotti, V., Muscatello, M.R., Palumbo, S., Pellegrini, S., Pietrini, P., Rizzo, A., Verona, E., 2020. The feeling of anger: From brain networks to linguistic expressions (this issue). *Neurosci. Biobehav. Rev.* 108, 480–497. <https://doi.org/10.1016/j.neubiorev.2019.12.002>.
- Allard, O. (2022). *Anthropology of Emotion*. Oxford Bibliographies. DOI: [10.1093/OBO/9780199766567-0161](https://doi.org/10.1093/OBO/9780199766567-0161).
- Allen, M., Friston, K.J., 2018. From cognitivism to autopoiesis: Towards a computational framework for the embodied mind. *Synthese* 195 (6), 2459–2482. <https://doi.org/10.1007/s11229-016-1288-5>.
- Al-Shawaf, L., Lewis, D.M.G., 2020. Evolutionary psychology and the emotions. In: Zeigler-Hill, V., Shackelford, T.K. (Eds.), *Encyclopedia of Personality and Individual Differences*. Springer International Publishing, pp. 1452–1461. [https://doi.org/10.1007/978-3-319-24612-3\\_516](https://doi.org/10.1007/978-3-319-24612-3_516).
- Al-Shawaf, L., Shackelford, T.K., 2024. *The Oxford Handbook of Evolution and the Emotions*. Oxford University Press, New York.
- Al-Shawaf, L., Conroy-Beam, D., Asao, K., Buss, D.M., 2016. Human emotions: An evolutionary psychological perspective. *Emotion Review* 8 (2), 173–186.
- Álvarez-González, A., 2023. Emotional phenomenology: a new puzzle. *Phenomenol. Cogn. Sci.* <https://doi.org/10.1007/s11097-023-09887-1>.
- Andersen, H., Wagenknecht, S., 2013. Epistemic dependence in interdisciplinary groups. *Synthese* 190 (11), 1881–1898. <https://doi.org/10.1007/s11229-012-0172-1>.
- Anderson, D.J., Adolphs, R., 2014. A framework for studying emotions across Species. *Cell* 157 (1), 187–200. <https://doi.org/10.1016/j.cell.2014.03.003>.
- Archer, J., 1999. The nature of grief: The evolution and psychology of reactions to loss, 317. Taylor & Francis/Routledge, p. xiii. <https://doi.org/10.4324/97802033360651>.
- Arias, J.A., Williams, C., Raghvani, R., Aghajani, M., Baez, S., Belzung, C., Booij, L., Busatto, G., Chiarella, J., Fu, C.H., Ibanez, A., Liddell, B.J., Lowe, L., Penninx, B.W.J.H., Rosa, P., Kemp, A.H., 2020. The neuroscience of sadness: a multidisciplinary synthesis and collaborative review (this issue). *Neurosci. Biobehav. Rev.* 111, 199–228. <https://doi.org/10.1016/j.neubiorev.2020.01.006>.
- Aristotle, 1999. *Physics*. Oxford University Press.
- Armony, J., Vuilleumier, P., 2013. *The Cambridge Handbook of Human Affective Neuroscience*. Cambridge University Press.
- Arregui, J.V., 1996. On the intentionality of moods: phenomenology and linguistic analysis. *Am. Cathol. Philos. Q.* 70 (3), 397–411. <https://doi.org/10.5840/acpq199670337>.
- Attias, H., 2003. Planning by probabilistic inference. *Int. Workshop Artif. Intell. Stat.* 9–16.
- Atzil, S., Gendron, M., 2017. Bio-behavioral synchrony promotes the development of conceptualized emotions. *Curr. Opin. Psychol.* 17, 162–169. <https://doi.org/10.1016/j.copsyc.2017.07.009>.
- Atzil, S., Gao, W., Fradkin, I., Barrett, L.F., 2018. Growing a social brain. *Article 9 Nat. Hum. Behav.* 2 (9). <https://doi.org/10.1038/s41562-018-0384-6>.
- Averill, J.R., 1968. Grief: Its nature and significance. *Psychol. Bull.* 70 (6, Pt.1), 721–748. <https://doi.org/10.1037/h0026824>.
- Averill, J.R., 1973. Personal control over aversive stimuli and its relationship to stress. *Psychol. Bull.* 80 (4), 286–303. <https://doi.org/10.1037/h0034845>.
- Averill, J.R., Clore, G.L., Frijda, N.H., Levenson, R.W., Scherer, K.R., Clark, L.A., Watson, D., Ekman, P., Davidson, R.J., 1994. What is the function of emotions? In *The nature of emotion: Fundamental questions*. Oxford University Press, pp. 97–177.
- Azzouni, J., 2004. Theory, observation and scientific realism. *Br. J. Philos. Sci.* 55 (3), 371–392. <https://doi.org/10.1093/bjps/55.3.371>.
- Bach, D.R., Dayan, P., 2017. Algorithms for survival: a comparative perspective on emotions. *Article 5 Nat. Rev. Neurosci.* 18 (5). <https://doi.org/10.1038/nrn.2017.35>.
- Bakker, I., van der Voort, T., Vink, P., de Boon, J., 2014. Pleasure, arousal, dominance: mehriban and russell revisited. *Curr. Psychol.* 33 (3), 405–421. <https://doi.org/10.1007/s12144-014-9219-4>.
- Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. *Psychol. Rev.* 84 (2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>.
- Bandura, A., 2006. Toward a psychology of human agency. *Perspect. Psychol. Sci.* 1 (2), 164–180. <https://doi.org/10.1111/j.1745-6916.2006.00011.x>.
- Barrett, L.F., 2004. Feelings or words? Understanding the content in self-report ratings of experienced emotion. *J. Personal. Soc. Psychol.* 87 (2), 266–281. <https://doi.org/10.1037/0022-3514.87.2.266>.
- Barrett, L.F., 2005. Feeling is perceiving: core affect and conceptualization in the experience of emotion. In *Emotion and consciousness*. The Guilford Press, pp. 255–284.
- Barrett, L.F., 2012. Emotions are real. *Emotion* 12 (3), 413–429. <https://doi.org/10.1037/a0027555>.
- Barrett, L.F., 2017. The theory of constructed emotion: an active inference account of interoception and categorization. *Soc. Cogn. Affect. Neurosci.* 12 (1), 1–23. <https://doi.org/10.1093/scan/nsw154>.
- Barrett, L.F., Satpute, A.B., 2019. Historical pitfalls and new directions in the neuroscience of emotion. *Neurosci. Lett.* 693, 9–18. <https://doi.org/10.1016/j.neulet.2017.07.045>.
- Barrett, L.F., Lindquist, K.A., Gendron, M., 2007. Language as context for the perception of emotion. *Trends Cogn. Sci.* 11 (8), 327–332. <https://doi.org/10.1016/j.tics.2007.06.003>.
- Barrett, L.F., Mesquita, B., Gendron, M., 2011. Context in emotion perception. *Curr. Dir. Psychol. Sci.* 20 (5), 286–290. <https://doi.org/10.1177/0963721411422522>.
- Barrett, L.F., Mesquita, B., Ochsner, K.N., Gross, J.J., 2007. The experience of emotion. *Annu. Rev. Psychol.* 58 (1), 373–403. <https://doi.org/10.1146/annurev.psych.58.110405.085709>.
- Barsalou, L.W., 1999. Perceptual symbol systems. *Behav. Brain Sci.* 22 (4), 577–660. <https://doi.org/10.1017/S0140525X99002149>.
- Barsalou, L.W., 2003. Situated simulation in the human conceptual system. *Lang. Cogn. Process.* 18 (5–6), 513–562. <https://doi.org/10.1080/01690960344000026>.
- Batcho, K.I., 2013. Nostalgia: the bittersweet history of a psychological concept. *Hist. Psychol.* 16 (3), 165–176. <https://doi.org/10.1037/a0032427>.
- Bayne, T., Montague, M., Bayne, T., Montague, M. (Eds.), 2014. *Cognitive Phenomenology*. Oxford University Press.
- Beatty, A., 2014. *Anthropology and emotion*. *J. R. Anthropol. Inst.* 20 (3), 545–563.
- Beatty, A., 2019. *Emotional Worlds: Beyond an Anthropology of Emotion*. Cambridge University Press. <https://doi.org/10.1017/9781139108096>.
- Bechtel, W., 2007. *Mental mechanisms: Philosophical perspectives on cognitive neuroscience*. Psychology Press.
- Bechtel, W., 2008. Mechanisms in cognitive psychology: What are the operations? *Philosophy of Science* 75 (5), 983–994.
- Bechtel, W., 2009. Looking down, around, and up: mechanistic explanation in psychology. *Philos. Psychol.* 22 (5), 543–564.
- Bechtel, W., 2013. *Philosophy of Science: An Overview for Cognitive Science*. Psychology Press. <https://doi.org/10.4324/9781315802084>.
- Bechtel, W., & Abrahamsen, A. (1991). *Connectionism and the mind: An introduction to parallel processing in networks* (pp. xiv, 349). Basil Blackwell.
- Bechtel, W., Abrahamsen, A., 2005. Explanation: a mechanist alternative. *Stud. Hist. Philos. Sci. Part C: Stud. Hist. Philos. Biol. Biomed. Sci.* 36 (2), 421–441. <https://doi.org/10.1016/j.shpsc.2005.03.010>.
- Bechtel, W., Richardson, R.C., 2010. *Discovering complexity: decomposition and localization as strategies in scientific research*. MIT press.
- Beck, A.T., 1971. Cognition, affect, and psychopathology. *Arch. Gen. Psychiatry* 24 (6), 495–500. <https://doi.org/10.1001/archpsyc.1971.01750120011002>.
- Becker, S., Bräscher, A.-K., Bannister, S., Bensafi, M., Calma-Birling, D., Chan, R.C.K., Eerola, T., Ellingsen, D.-M., Ferdenzi, C., Hanson, J.L., Joffily, M., Lidhar, N.K., Lowe, L.J., Martin, L.J., Musser, E.D., Noll-Hussong, M., Olino, T.M., Pintos Lobo, R., Wang, Y., 2019. The role of hedonics in the Human Affectome (this issue). *Neurosci. Biobehav. Rev.* 102, 221–241. <https://doi.org/10.1016/j.neubiorev.2019.05.003>.
- Bedford, E., 1956. Emotions. *Proc. Aristot. Soc.* 57, 281–304.
- Beer, R.D., 2014. Dynamical systems and embedded cognition. In: Frankish, K., Ramsey, W.M. (Eds.), *The Cambridge Handbook of Artificial Intelligence*. Cambridge University Press, pp. 128–148. <https://doi.org/10.1017/CBO9781139046855.009>.
- Beer, R.D., Di Paolo, E.A., 2023. The theoretical foundations of enaction: Precariousness. *Biosystems* 223, 104823. <https://doi.org/10.1016/j.biosystems.2022.104823>.

- Berridge, K., Winkielman, P., 2003. What is an unconscious emotion? (The case for unconscious "liking"). *Cogn. Emot.* 17 (2), 181–211. <https://doi.org/10.1080/02699930302289>.
- Berridge, K.C., Kringelbach, M.L., 2008. Affective neuroscience of pleasure: reward in humans and animals. *Psychopharmacology* 199, 457–480.
- Besnier, N., 1990. Language and affect. *Annu. Rev. Anthropol.* 19 (1), 419–451. <https://doi.org/10.1146/annurev.an.19.100190.002223>.
- Betella, A., Verschure, P.F.M.J., 2016. The affective slider: a digital self-assessment scale for the measurement of human emotions. *PLoS One* 11 (2), e0148037. <https://doi.org/10.1371/journal.pone.0148037>.
- Betz, N., Hoemann, K., Barrett, L.F., 2019. Words are a context for mental inference. *Emot. (Wash., D. C.)* 19 (8), 1463–1477. <https://doi.org/10.1037/emo0000510>.
- Blanke, O., Metzinger, T., 2009. Full-body illusions and minimal phenomenal selfhood. *Trends Cogn. Sci.* 13 (1), 7–13. <https://doi.org/10.1016/j.tics.2008.10.003>.
- Boehner, K., DePaula, R., Dourish, P., Sengers, P., 2007. How emotion is made and measured. *Int. J. Hum. Comput. Stud.* 65 (4), 275–291. <https://doi.org/10.1016/j.ijhcs.2006.11.016>.
- Bollnow, O.F., Boelhaue, U., 2009. *Das Wesen der Stimmungen*. Königshausen & Neumann.
- Bonanno, G.A., 2019. *The Other Side of Sadness: What the New Science of Bereavement Tells Us About Life After Loss*. Hachette UK.
- Bonanno, G.A., Kaltman, S., 2001. The varieties of grief experience. *Clin. Psychol. Rev.* 21 (5), 705–734. [https://doi.org/10.1016/s0272-7358\(00\)00062-3](https://doi.org/10.1016/s0272-7358(00)00062-3).
- Boone, W., Piccinini, G., 2016. The cognitive neuroscience revolution. *Synthese* 193 (5), 1509–1534. <https://doi.org/10.1007/s11229-015-0783-4>.
- Botvinick, M., Toussaint, M., 2012. Planning as inference. *Trends Cogn. Sci.* 16 (10), 485–488. <https://doi.org/10.1016/j.tics.2012.08.006>.
- Bourging, P., Stewart, J., 2004. Autopoiesis and cognition. *Artif. Life* 10 (3), 327–345. <https://doi.org/10.1162/1064546041255557>.
- Bower, G.H., Sahgal, A., Routh, D.A., Broadbent, D.E., 1997. Affect and cognition. *Philos. Trans. R. Soc. Lond. B, Biol. Sci.* 302 (1110), 387–402. <https://doi.org/10.1098/rstb.1993.0062>.
- Box, G.E., 1976. Science and statistics. *J. Am. Stat. Assoc.* 71 (356), 791–799.
- Bradley, M.M., Lang, P.J., 1994. Measuring emotion: the self-assessment manikin and the semantic differential. *J. Behav. Ther. Exp. Psychiatry* 25 (1), 49–59. [https://doi.org/10.1016/0005-7916\(94\)90063-9](https://doi.org/10.1016/0005-7916(94)90063-9).
- Braun, N., Debener, S., Spychala, N., Bongartz, E., Sörös, P., Müller, H.H.O., Philippen, A., 2018. The Senses of Agency and Ownership: A Review. *Front. Psychol.* 9. <https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00535>.
- Brentano, F., 2012. *Psychology from an Empirical Standpoint*. Routledge.
- Bridgman, P.W., 1927. *The logic of modern physics*, Vol. 3. Macmillan.
- Briggs, J., 2010. *Emotions have many faces: Inuit lessons*. Wiley Blackwell, p. 67.
- Britt, S.H., Janus, S.Q., 1940. Criteria of frustration. *Psychol. Rev.* 47 (5), 451–470. <https://doi.org/10.1037/h0061381>.
- Broekens, J., Bosse, T., Marsella, S.C., 2013. Challenges in computational modeling of affective processes. *IEEE Trans. Affect. Comput.* 4 (3), 242–245. <https://doi.org/10.1109/T-AFFC.2013.23>.
- Bromberger, S., 1966. *Why-Questions*. In: Robert, G.C. (Ed.), *Mind and Cosmos – Essays in Contemporary Science and Philosophy*. University of Pittsburgh Press, pp. 86–111.
- Brooks, R.A., 1991. New Approaches to Robotics. *Science* 253 (5025), 1227–1232. <https://doi.org/10.1126/science.253.5025.1227>.
- Brouwer, A.-M., Hogervorst, M.A., Grootjen, M., van Erp, J.B.F., Zandstra, E.H., 2017. Neurophysiological responses during cooking food associated with different emotions. *Food Qual. Prefer.* 62, 307–316. <https://doi.org/10.1016/j.foodqual.2017.03.005>.
- Brown, C.L., Van Doren, N., Ford, B.Q., Mauss, I.B., Sze, J.W., Levenson, R.W., 2020. Coherence between subjective experience and physiology in emotion: Individual differences and implications for well-being. *Emotion* 20 (5), 818–829. <https://doi.org/10.1037/emo0000579>.
- Brown, M.J., 2010. *Genuine problems and the significance of science*. *Contemp. Pragmatism* 7 (2), 131.
- Brüne, M., Brüne-Cohrs, U., 2006. Theory of mind—evolution, ontogeny, brain mechanisms and psychopathology. *Neurosci. Biobehav. Rev.* 30 (4), 437–455. <https://doi.org/10.1016/j.neubiorev.2005.08.001>.
- Burge, T., 2010. *Origins of Objectivity*. OUP, Oxford.
- Cacioppo, J.T., Gardner, W.L., Berntson, G.G., 1999. The affect system has parallel and integrative processing components: Form follows function. *J. Personal. Soc. Psychol.* 76 (5), 839–855. <https://doi.org/10.1037/0022-3514.76.5.839>.
- Cahill, L., McGaugh, J.L., 1998. Mechanisms of emotional arousal and lasting declarative memory. *Trends Neurosci.* 21 (7), 294–299. [https://doi.org/10.1016/S0166-2236\(97\)01214-9](https://doi.org/10.1016/S0166-2236(97)01214-9).
- Caldwell, L.L., 2005. Leisure and health: why is leisure therapeutic. *Br. J. Guid. Couns.* 33 (1), 7–26. <https://doi.org/10.1080/03069880412331335939>.
- Callard, F., Fitzgerald, D., 2015. *Rethinking interdisciplinarity across the social sciences and neurosciences*. Springer Nature.
- Calvo, R.A., D'Mello, S., Gratch, J.M., Kappas, A., 2015. *The Oxford Handbook of Affective Computing*. Oxford University Press.
- Cannon, W.B., 1929. Organization for physiological homeostasis. *Physiol. Rev.* 9 (3), 399–431. <https://doi.org/10.1152/physrev.1929.9.3.399>.
- Carmel, D., Sprevak, M., 2014. *What is consciousness? In Philosophy and the Sciences For Everyone*. Routledge. <https://www.research.ed.ac.uk/en/publications/what-is-consciousness>.
- Carnap, R., Gardner, M., 1966. *Philos. Found. Phys.: Introd. Philos. Sci.*
- Carpenter, R.H.S., 2004. Homeostasis: a plea for a unified approach. *Adv. Physiol. Educ.* 28 (4), 180–187. <https://doi.org/10.1152/advan.00012.2004>.
- Cartwright, N., 1983. *How the Laws of Physics Lie*. OUP, Oxford.
- Cartwright, N., 1986. Two Kinds of Teleological Explanation. In: Donagan, A., Perovich, A.N., Wedin, M.V. (Eds.), *Human Nature and Natural Knowledge: Essays Presented to Marjorie Grene on the Occasion of Her Seventy-Fifth Birthday*. Springer, Netherlands, pp. 201–210. [https://doi.org/10.1007/978-94-009-5349-9\\_10](https://doi.org/10.1007/978-94-009-5349-9_10).
- Chalmers, D.J., 1997. *The Conscious Mind: In Search of a Fundamental Theory*. OUP USA.
- Chalmers, D.J., 2012. The Varieties of Computation: A Reply. *J. Cogn. Sci.* 13 (3), 211–248. <https://doi.org/10.17791/JCS.2012.13.3.211>.
- Chang, H., 2004. *Inventing temperature: Measurement and scientific progress*. Oxford University Press.
- Chang, H., 2005. A case for old-fashioned observability, and a reconstructed constructive empiricism. *Philos. Sci.* 72 (5), 876–887. <https://doi.org/10.1086/508116>.
- Chang, R.S., 2009. *Relating to Environments: A New Look at Umwelt*. IAP.
- Charland, L.C., 2005. The heat of emotion: valence and the demarcation problem. *J. Conscious. Stud.* 12 (8–9), 82–102.
- Chemero, A., 2011. *Radical Embodied Cognitive Science*. MIT Press.
- Chemero, A., 2016. Sensorimotor empathy. *Journal of Consciousness Studies* 23 (5–6), 138–152.
- Choi, S.-C., Han, G., Kim, C.-W., 2007. Analysis of cultural emotion: Understanding of indigenous psychology for universal implications. In *The Cambridge handbook of sociocultural psychology*. Cambridge University Press, pp. 318–342. <https://doi.org/10.1017/CBO9780511611162.018>.
- Christoff, K., Cosmelli, D., Legrand, D., Thompson, E., 2011. Specifying the self for cognitive neuroscience. *Trends Cogn. Sci.* 15 (3), 104–112. <https://doi.org/10.1016/j.tics.2011.01.001>.
- Chua, H.F., Gonzalez, R., Taylor, S.F., Welsh, R.C., Liberzon, I., 2009. Decision-related loss: regret and disappointment. *NeuroImage* 47 (4), 2031–2040. <https://doi.org/10.1016/j.neuroimage.2009.06.006>.
- Clark, A., 1989. *Microcognition: Philosophy, Cognitive Science, and Parallel Distributed Processing*. MIT Press.
- Clark, A., 1997. The dynamical challenge. *Cogn. Sci.* 21 (4), 461–481. [https://doi.org/10.1016/S0364-0213\(99\)80030-5](https://doi.org/10.1016/S0364-0213(99)80030-5).
- Clark, A., 1998. *Being There: Putting Brain, Body, and World Together Again*. MIT Press.
- Clark, A., 2000. *Mindware: An introduction to the philosophy of cognitive science* (pp. xiii, 210). Oxford University Press.
- Clark, A., 2013. Whatver next? Predictive brains, situated agents, and the future of cognitive science. *Behav. Brain Sci.* 36 (3), 181–204. <https://doi.org/10.1017/S0140525X12000477>.
- Clark, A., 2015. *Surfing Uncertainty: Prediction, Action, and the Embodied Mind*. Oxford University Press.
- Clark, A., Chalmers, D., 1998. *The Extended Mind*. *Analysis* 58 (1), 7–19.
- Clark, J.E., Watson, S., Friston, K.J., 2018. What is mood? A computational perspective. *Psychol. Med.* 48 (14), 2277–2284. <https://doi.org/10.1017/S0033291718000430>.
- Clare, G.L., Ortony, A., 1988. The semantics of the affective lexicon. In: Hamilton, V., Bower, G.H., Frijda, N.H. (Eds.), *Cognitive Perspectives on Emotion and Motivation*. Springer, Netherlands, pp. 367–397. [https://doi.org/10.1007/978-94-009-2792-6\\_15](https://doi.org/10.1007/978-94-009-2792-6_15).
- Clare, G.L., Ortony, A., 2000. Cognition in Emotion: Always, Sometimes, or Never. In: Lane, R.D.R., Nadel, L., Ahern, G.L., Allen, J., Kaszniak, A.W. (Eds.), *Cognitive Neuroscience of Emotion*. Oxford University Press, pp. 24–61.
- Clare, G.L., Huntsinger, J.R., 2009. How the object of affect guides its impact. *Emot. Rev.* 1 (1), 39–54. <https://doi.org/10.1177/175407390809185>.
- Clare, G.L., Palmer, J., 2009. Affective guidance of intelligent agents: How emotion controls cognition. *Cogn. Syst. Res.* 10 (1), 21–30. <https://doi.org/10.1016/j.cogsys.2008.03.002>.
- Clare, G.L., Ortony, A., 2013. Psychological construction in the OCC model of emotion. *Emot. Rev.* 5 (4), 335–343. <https://doi.org/10.1177/1754073913489751>.
- Clare, G.L., Gasper, K., Garvin, E., 2001. *Affect as information*. In: *Handbook of affect and social cognition*. Lawrence Erlbaum Associates Publishers, pp. 121–144.
- Clare, G.L., Proffitt, D.R., Zadra, J.R., 2021. Feeling, seeing, and liking: how bodily resources inform perception and emotion. In: Robinson, M.D., Thomas, L.E. (Eds.), *Handbook of Embodied Psychology: Thinking, Feeling, and Acting*. Springer International Publishing, pp. 43–64. [https://doi.org/10.1007/978-3-030-78471-3\\_3](https://doi.org/10.1007/978-3-030-78471-3_3).
- Colombetti, G., 2005. Appraising valence. *J. Conscious. Stud.* 12 (8–9), 103–126.
- Colombetti, G., 2009. What language does to feelings. *J. Conscious. Stud.* 16 (9), 4–26.
- Colombetti, G., 2010. Enaction, sense-making, and emotion. In: Stewart, J., Gapenne, O., Di Paolo, E.A. (Eds.), *Enaction: Toward a New Paradigm for Cognitive Science*. The MIT Press, pp. 145–164. <https://doi.org/10.7551/mitpress/9780262014601.003.0006>.
- Colombetti, G., 2011. Varieties of pre-reflective self-awareness: foreground and background bodily feelings in emotion experience. *Inquiry* 54, 293–313. <https://doi.org/10.1080/0020174X.2011.575003>.
- Colombetti, G., 2014. *The Feeling Body: Affective Science Meets the Enactive Mind*. MIT Press.
- Colombetti, G., Thompson, E., 2008. *The Feeling Body: Towards an Enactive Approach to Emotion*. In: Overton, W.F., Müller, U., Newman, J.L. (Eds.), *Developmental Perspectives on Embodiment and Consciousness*. Erlbaum.
- Coninx, S., Stilwell, P., 2021. Pain and the field of affordances: an enactive approach to acute and chronic pain. *Synthese* 199 (3), 7835–7863. <https://doi.org/10.1007/s11229-021-03142-3>.
- Cooper, S.J., 2008. From Claude Bernard to Walter Cannon. emergence of the concept of homeostasis. *Appetite* 51 (3), 419–427. <https://doi.org/10.1016/j.appet.2008.06.005>.
- Tooby, J., Cosmides, L., 2008. *The evolutionary psychology of the emotions and their relationship to internal regulatory variables*. In: *Handbook of Emotions*, 3rd Ed. The Guilford Press, New York, NY, US, pp. 114–137.

- Cosmides, L., Tooby, J., 2013. Evolutionary Psychology: New Perspectives on Cognition and Motivation. *Annual Review of Psychology* 64 (1), 201–229. <https://doi.org/10.1146/annurev.psych.121208.131628>.
- Cowen, A.S., & Keltner, D. (2017). Self-report captures 27 distinct categories of emotion bridged by continuous gradients. *Proceedings of the National Academy of Sciences*, 114(38), E7900–E7909. <https://doi.org/10.1073/pnas.1702247114>.
- Craig, A.D., 2002. How do you feel? Interoception: the sense of the physiological condition of the body. *Article 8 Nat. Rev. Neurosci.* 3 (8). <https://doi.org/10.1038/nrn894>.
- Craig, A.D. (B.), 2008. Interoception and emotion: A neuroanatomical perspective. In *Handbook of emotions*, 3rd ed. The Guilford Press, New York, NY, USA, pp. 272–292.
- Craig, A.D., 2013. Chapter 9—Cooling, pain, and other feelings from the body in relation to the autonomic nervous system. In: Buijs, R.M., Swaab, D.F. (Eds.), *Handbook of Clinical Neurology*, Vol. 117. Elsevier, pp. 103–109. <https://doi.org/10.1016/B978-0-444-53491-0.00009-2>.
- Crane, T., 1998. Intentionality as the mark of the mental. *R. Inst. Philos. Suppl.* 43, 229–251. <https://doi.org/10.1017/S1358246100004380>.
- Craver, C.F., 2007. *Explaining the Brain: Mechanisms and the Mosaic Unity of Neuroscience*. Clarendon Press.
- Craver, C.F., Darden, L., 2013. *In search of mechanisms: discoveries across the life sciences*. University of Chicago Press.
- Critchley, H.D., Garfinkel, S.N., 2017. Interoception and emotion. *Curr. Opin. Psychol.* 17, 7–14. <https://doi.org/10.1016/j.copsyc.2017.04.020>.
- Crivelli, C., Jarillo, S., Russell, J.A., Fernández-Dols, J.-M., 2016. Reading emotions from faces in two indigenous societies. *J. Exp. Psychol.: Gen.* 145 (7), 830–843. <https://doi.org/10.1037/xge0000172>.
- Cromwell, H.C., Lowe, L.J., 2022. The human affectome project: a dedication to Jaak Panksepp (this issue). *Neurosci. Biobehav. Rev.* 138, 104693. <https://doi.org/10.1016/j.neubiorev.2022.104693>.
- Cromwell, H.C., Papadelis, C., 2022. Mapping the brain basis of feelings, emotions and much more: a special issue focused on ‘The Human Affectome (this issue)’. *Neurosci. Biobehav. Rev.* 137, 104672. <https://doi.org/10.1016/j.neubiorev.2022.104672>.
- Cromwell, H.C., Abe, N., Barrett, K.C., Caldwell-Harris, C., Gendolla, G.H.E., Koncz, R., Sachdev, P.S., 2020. Mapping the interconnected neural systems underlying motivation and emotion: a key step toward understanding the human affectome (this issue). *Neurosci. Biobehav. Rev.* 113, 204–226. <https://doi.org/10.1016/j.neubiorev.2020.02.032>.
- Csibra, G., Gergely, G., 2007. ‘Obsessed with goals’: Functions and mechanisms of teleological interpretation of actions in humans. *Acta Psychol.* 124 (1), 60–78. <https://doi.org/10.1016/j.actpsy.2006.09.007>.
- Csikszentmihalyi, M., 2014. *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi*. Springer, Netherlands. <https://doi.org/10.1007/978-94-017-9088-8>.
- Csikszentmihalyi, M., Larson, R., 2014. Validity and Reliability of the Experience-Sampling Method. In: Csikszentmihalyi, M. (Ed.), *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi*. Springer, Netherlands, pp. 35–54. [https://doi.org/10.1007/978-94-017-9088-8\\_3](https://doi.org/10.1007/978-94-017-9088-8_3).
- Cuff, B.M.P., Brown, S.J., Taylor, L., Howat, D.J., 2016. Empathy: a review of the concept. *Emot. Rev.* 8 (2), 144–153. <https://doi.org/10.1177/1754073914558466>.
- Cummins, R.A., 2010. Subjective wellbeing, homeostatically protected mood and depression: a synthesis. *J. Happiness Stud.* 11 (1), 1–17. <https://doi.org/10.1007/s10902-009-9167-0>.
- Cunningham, M.R., 1977. Personality and the structure of the nonverbal communication of emotion. *J. Personal.* 45 (4), 564–584. <https://doi.org/10.1111/j.1467-6494.1977.tb00172.x>.
- Cunningham, W.A., Dunfield, K.A., Stillman, P.E., 2013. Emotional states from affective dynamics. *Emot. Rev.* 5 (4), 344–355. <https://doi.org/10.1177/1754073913489749>.
- D’Mello, S., Graesser, A., 2012. Dynamics of affective states during complex learning. *Learn. Instr.* 22 (2), 145–157. <https://doi.org/10.1016/j.learninstruc.2011.10.001>.
- Dalgleish, T., Dunn, B.D., & Mobbs, D. (2009). *Affective Neuroscience: Past, Present, and Future*. *Emotion Review*, 1(4), 355–368. <https://doi.org/10.1177/1754073909338307e>.
- Damasio, A., 2003. Feelings of emotion and the self. *Annals of the New York Academy of Sciences* 1001 (1), 253–261.
- Damasio, A., 2005. *Descartes’ Error: Emotion, Reason, and the Human Brain* (Reprint edition). Penguin Books.
- Damasio, A., Carvalho, G.B., 2013. The nature of feelings: evolutionary and neurobiological origins. *Article 2 Nat. Rev. Neurosci.* 14 (2). <https://doi.org/10.1038/nrn3403>.
- Damasio, A.R., 1996. The somatic marker hypothesis and the possible functions of the prefrontal cortex. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 351 (1346), 1413–1420.
- Danziger, K., 1997. Naming the mind: how psychology found its language. *Namin. Mind* 1–224.
- Darwin, C., 1965. *The Expression of the Emotions in Man and Animals*. University of Chicago Press. <https://press.uchicago.edu/ucp/books/book/chicago/E/bo24666926.html>.
- David, N., 2012. New frontiers in the neuroscience of the sense of agency. *Front. Hum. Neurosci.* 6. <https://www.frontiersin.org/articles/10.3389/fnhum.2012.00161>.
- Davidson, R.J., Sutton, S.K., 1995. Affective neuroscience: the emergence of a discipline. *Curr. Opin. Neurobiol.* 5 (2), 217–224. [https://doi.org/10.1016/0959-4388\(95\)80029-8](https://doi.org/10.1016/0959-4388(95)80029-8).
- Davidson, R.J., Sherer, K.R., Goldsmith, H.H., 2009. *Handbook of Affective Sciences*. Oxford University Press.
- Dawson, M., 2014. Embedded and situated cognition. In *The Routledge Handbook of Embodied Cognition*. Routledge.
- Dayan, P., Abbott, L.F., 2005. *Theoretical neuroscience: computational and mathematical modeling of neural systems*. MIT press.
- Dayan, P., Hinton, G.E., Neal, R.M., Zemel, R.S., 1995. The helmholtz machine. *Neural Comput.* 7 (5), 889–904. <https://doi.org/10.1162/neco.1995.7.5.889>.
- de Haan, S., de Bruin, L., 2010. Reconstructing the minimal self, or how to make sense of agency and ownership. *Phenomenol. Cogn. Sci.* 9 (3), 373–396. <https://doi.org/10.1007/s11097-009-9148-0>.
- De Jaegher, H., Di Paolo, E., 2007. Participatory sense-making: an enactive approach to social cognition. *Phenomenol. Cogn. Sci.* 6 (4), 485–507. <https://doi.org/10.1007/s11097-007-9076-9>.
- De Neve, J.-E., Diener, E., Tay, L., & Xuereb, C. (2013). The Objective Benefits of Subjective Well-Being (SSRN Scholarly Paper 2306651). <https://papers.ssrn.com/abstract=2306651>.
- De Regt, H.W., Dieks, D., 2005. A contextual approach to scientific understanding. *Synthese* 144, 137–170.
- de Sousa, R., 1990. *The Rationality of Emotion*. MIT Press.
- de Waal, F.B.M., 2011. What is an animal emotion. *Ann. N. Y. Acad. Sci.* 1224 (1), 191–206. <https://doi.org/10.1111/j.1749-6632.2010.05912.x>.
- De Wolf, T., Holvoet, T., 2005. Emergence versus self-organisation: different concepts but promising when combined. In: Brueckner, S.A., Di Marzo Serugendo, G., Karageorgos, A., Nagpal, R. (Eds.), *Engineering Self-Organising Systems*. Springer, pp. 1–15. [https://doi.org/10.1007/11494676\\_1](https://doi.org/10.1007/11494676_1).
- Deacon, T.W., 2011. *Incomplete nature: How mind emerged from matter*. WW Norton & Company.
- Dehaene, S., Sergent, C., Changeux, J.-P., 2003. A neuronal network model linking subjective reports and objective physiological data during conscious perception. *Proc. Natl. Acad. Sci.* 100 (14), 8520–8525. <https://doi.org/10.1073/pnas.1332574100>.
- Dennett, D.C., 1989. *The Intentional Stance*. MIT Press.
- Dennett, D.C., 2002. *Content and Consciousness*. Routledge.
- Deonna, J., Teroni, F., 2012. *The Emotions: A Philosophical Introduction*. Routledge.
- Deonna, J., Tappolet, C., Teroni, F., 2015. Emotion, philosophical issues about. *WIREs Cogn. Sci.* 6 (3), 193–207. <https://doi.org/10.1002/wcs.1342>.
- Deonna, J.A., Scherer, K.R., 2010. The case of the disappearing intentional object: constraints on a definition of emotion. *Emot. Rev.* 2 (1), 44–52.
- Deonna, J.A., Teroni, F., 2015. Emotions as Attitudes. *Dialectica* 69 (3), 293–311. <https://doi.org/10.1111/1746-8361.12116>.
- Deonna, J.A., Teroni, F., 2017. Getting bodily feelings into emotional experience in the right way. *Emot. Rev.* 9 (1), 55–63. <https://doi.org/10.1177/1754073916639666>.
- Deonna, J.A., Rodogno, R., Teroni, F., 2012. *In Defense of Shame: The Faces of an Emotion*. Oxford University Press, USA.
- Descartes, R., 1644. *Principia philosophiae*. Ludovicum Elzevirium.
- Desmet, P., 2003. Measuring Emotion: Development and Application of an Instrument to Measure Emotional Responses to Products. In: Blythe, M.A., Overbeeke, K., Monk, A. F., Wright, P.C. (Eds.), *Funology*, Vol. 3. Springer Netherlands, pp. 111–123. [https://doi.org/10.1007/1-4020-2967-5\\_12](https://doi.org/10.1007/1-4020-2967-5_12).
- Desmet, P.M.A., Schifferstein, H.N.J., 2008. Sources of positive and negative emotions in food experience. *Appetite* 50 (2), 290–301. <https://doi.org/10.1016/j.appet.2007.08.003>.
- Desmet, P.M.A., Fokkinga, S.F., Ozkaramanli, D., Yoon, J., 2021. Chapter 20—Emotion-driven product design. In: Meiselman, H.L. (Ed.), *Emotion Measurement, Second edition*, Woodhead Publishing, pp. 645–670. <https://doi.org/10.1016/B978-0-12-821124-3.00020-X>.
- Dewey, J., 1895. The theory of emotion. *Psychol. Rev.* 2 (1), 13–32. <https://doi.org/10.1037/h0070927>.
- Di Paolo, E., Thompson, E., 2014. The enactive approach. In *The Routledge handbook of embodied cognition*. Routledge/Taylor & Francis Group, pp. 68–78.
- Di Paolo, E., Thompson, E., Beer, R., 2022. Laying down a forking path: Tensions between enaction and the free energy principle. *Philos. Mind Sci.* 3. <https://doi.org/10.33735/phimisci.2022.9187>.
- Di Paolo, E.A., 2005. Autopoiesis, adaptivity, teleology, agency. *Phenomenol. Cogn. Sci.* 4 (4), 429–452. <https://doi.org/10.1007/s11097-005-9002-y>.
- Diaz, R., 2023. Experimental Philosophy of Emotion. In: Bauer, A.M., Kornmesser, S. (Eds.), *Compact Compendium of Experimental Philosophy*. De Gruyter. <https://philarchive.org/rec/DAZEPO>.
- Diener, E. (Ed.), 2009. *The Science of Well-Being*, Vol. 37. Springer Netherlands. <https://doi.org/10.1007/978-90-481-2350-6>.
- Diener, E., Ryan, K., 2009. Subjective well-being: a general overview. *South Afr. J. Psychol.* 39 (4), 391–406. <https://doi.org/10.1177/008124630903900402>.
- Diener, E., Oishi, S., Lucas, R.E., 2009. Subjective well-being: The science of happiness and life satisfaction. In *Oxford handbook of positive psychology*, 2nd ed., Oxford University Press, pp. 187–194.
- Diener, E., Inglehart, R., Tay, L., 2013. Theory and validity of life satisfaction scales. *Soc. Indic. Res.* 112 (3), 497–527. <https://doi.org/10.1007/s11205-012-0076-y>.
- Dijkstra, E.W., 2002. Cooperating sequential processes, in: *The Origin of Concurrent Programming: From Semaphores to Remote Procedure Calls*. Springer-Verlag, Berlin, Heidelberg, pp. 65–138.
- Dixon, T., 2003. From passions to emotions: the creation of a secular psychological category. Cambridge University Press.
- Dixon, T., 2012. ‘Emotion’: The history of a keyword in crisis. *Emot. Rev.* 4 (4), 338–344.
- Djerassi, M., Ophir, S., Atzil, S., 2021. What is social about autism? The role of allostasis-driven learning. *Article 10 Brain Sci.* 11 (10). <https://doi.org/10.3390/brainsci11101269>.



- Dolcos, F., Katsumi, Y., Moore, M., Berggren, N., De Gelder, B., Derakshan, N., Hamm, A. O., Koster, E.H.W., Ladouceur, C.D., Okon-Singer, H., Pegna, A.J., Richter, T., Schweizer, S., Van Den Stock, J., Ventura-Bort, C., Weymar, M., Dolcos, S., 2020. Neural correlates of emotion-attention interactions: From perception, learning, and memory to social cognition, individual differences, and training interventions (this issue). *Neurosci. Biobehav. Rev.* 108, 559–601. <https://doi.org/10.1016/j.neubiorev.2019.08.017>.
- Doya, K., 2007. *Bayesian Brain: Probabilistic Approaches to Neural Coding*. MIT Press.
- Draper, K., 1999. Disappointment, sadness, and death. *Philos. Rev.* 108 (3), 387–414. <https://doi.org/10.2307/2998466>.
- Dreyfus, H.L., 1972. *What Computers Can't Do: A Critique of Artificial Reason*. Harper & Row.
- Duffy, E., 1957. The psychological significance of the concept of "arousal" or "activation". *Psychol. Rev.* 64 (5), 265–275. <https://doi.org/10.1037/h0048837>.
- Duhem, P., Wiener, P.P., Vuillemin, J., 1982. *The Aim and Structure of Physical Theory*. Princeton University Press. <https://doi.org/10.2307/j.ctv1nj34vm>.
- Dukes, D., Abrams, K., Adolphs, R., Ahmed, M.E., Beatty, A., Berridge, K.C., Broomhall, S., Brosch, T., Campos, J.J., Clay, Z., Clément, F., Cunningham, W.A., Damasio, A., Damasio, H., D'Arms, J., Davidson, J.W., de Gelder, B., Deonna, J., de Sousa, R., Sander, D., 2021. The rise of affectivism. *Article 7 Nat. Hum. Behav.* 5 (7). <https://doi.org/10.1038/s41562-021-01130-8>.
- Dunbar, R., 1998. *Grooming, Gossip, and the Evolution of Language*. Harvard University Press.
- Duncan, S., Barrett, L.F., 2007. Affect is a form of cognition: a neurobiological analysis. *Cogn. Emot.* 21 (6), 1184–1211. <https://doi.org/10.1080/02699930701437931>.
- Eckardt, B.V., 1995. *What is Cognitive Science?* MIT Press.
- Egan, F., 2017. *Function-theoretic explanation and the search for neural mechanisms*, in: *Explanation and Integration in Mind and Brain Science*. Oxford University Press, New York, NY, US, pp. 145–163.
- Egan, F., 2020. A Deflationary Account of Mental Representation. In: Smortchkova, J., Dolega, K., Schlicht, T. (Eds.), *What Are Mental Representations?* Oxford University Press, pp. 26–53. <https://doi.org/10.1093/oso/9780190686673.003.0002>.
- Eid, M. (Ed.), 2008. *The science of subjective well-being*. Guilford Press.
- Einstein, A., 1934. On the method of theoretical physics. *Philos. Sci.* 1 (2), 163–169.
- Ekman, P., 2016. What scientists who study emotion agree about. *Perspect. Psychol. Sci.* 11 (1), 31–34. <https://doi.org/10.1177/1745691615596992>.
- Ekman, P., Davidson, R.J. (Eds.), 1994. *The nature of emotion: Fundamental questions*, 496. Oxford University Press, p. xiv.
- Ekman, P., Cordaro, D., 2011. What is meant by calling emotions basic. *Emot. Rev.* 3 (4), 364–370. <https://doi.org/10.1177/1754073911410740>.
- Eldar, E., Rutledge, R.B., Dolan, R.J., Niv, Y., 2016. Mood as representation of momentum. *Trends in cognitive sciences* 20 (1), 15–24.
- Elpidorou, A., Freeman, L., 2014. The phenomenology and science of emotions: an introduction. *Phenomenol. Cogn. Sci.* 13 (4), 507–511. <https://doi.org/10.1007/s11097-014-9402-y>.
- Emanuel, A., Eldar, E., 2023. Emotions as computations. *Neurosci. Biobehav. Rev.* 144, 104977. <https://doi.org/10.1016/j.neubiorev.2022.104977>.
- Engbert, K., Wohlshläger, A., Haggard, P., 2008. Who is causing what? The sense of agency is relational and efferent-triggered. *Cognition* 107 (2), 693–704. <https://doi.org/10.1016/j.cognition.2007.07.021>.
- Ericsson, K.A., Simon, H.A., 1993. *Protocol Analysis: Verbal Reports as Data*. The MIT Press. <https://doi.org/10.7551/mitpress/5657.001.0001>.
- Eslinger, P.J., Anders, S., Ballarini, T., Boutros, S., Krach, S., Mayer, A.V., Moll, J., Newton, T.L., Schroeter, M.L., De Oliveira-Souza, R., Raber, J., Sullivan, G.B., Swain, J.E., Lowe, L., Zahn, R., 2021. The neuroscience of social feelings: mechanisms of adaptive social functioning (this issue). *Neurosci. Biobehav. Rev.* 128, 592–620. <https://doi.org/10.1016/j.neubiorev.2021.05.028>.
- Eysenck, M., 2012. *Attention and Arousal: Cognition and Performance*. Springer Science & Business Media.
- Feiten, T.E., 2020. Mind after uexküll: a foray into the worlds of ecological psychologists and enactivists. *Front. Psychol.* 11. <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00480>.
- Fernández, N., Maldonado, C., Gershenson, C., 2014. Information measures of complexity, emergence, self-organization, homeostasis, and autopoiesis. In: Prokopenko, M. (Ed.), *Guided Self-Organization: Inception*. Springer, pp. 19–51. [https://doi.org/10.1007/978-3-642-53734-9\\_2](https://doi.org/10.1007/978-3-642-53734-9_2).
- Fingelkurts, A.A., Fingelkurts, A., 2004. Making complexity simpler: multivariability and metastability in the brain. *Int. J. Neurosci.* 114 (7), 843–862. <https://doi.org/10.1080/00207450490450046>.
- Fischer, A.H., Manstead, A.S.R., 2008. Social functions of emotion. In *Handbook of emotions*, 3rd ed., The Guilford Press, pp. 456–468.
- Fischer, A.H., Manstead, A.S., 2016. Social functions of emotion and emotion regulation. *Handbook of emotions* 4, 424–439.
- Fodor, J.A., 1998. *Concepts: Where Cognitive Science Went Wrong*. Oxford University Press.
- Fodor, J.A., Pylyshyn, Z.W., 1988. Connectionism and cognitive architecture: A critical analysis. *Cognition* 28 (1), 3–71. [https://doi.org/10.1016/0010-0277\(88\)90031-5](https://doi.org/10.1016/0010-0277(88)90031-5).
- Fokkinga, S.F., Desmet, P.M.A., 2022. *Emot. Typology*. *Emot. Typology*. <https://emotontypology.com>.
- Forgas, J.P. (Ed.), 2000. *Feeling and thinking: The role of affect in social cognition*, 421. Cambridge University Press, p. xvi.
- Forgas, J.P. (Ed.), 2001. *Handbook of affect and social cognition*, 457. Lawrence Erlbaum Associates Publishers, p. xviii.
- Forgas, J.P., 2012. *Handbook of Affect and Social Cognition*. Psychology Press.
- Fotopoulou, A., Tsakiris, M., 2017. Mentalizing homeostasis: the social origins of interoceptive inference. *Neuropsychanalysis* 19 (1), 3–28. <https://doi.org/10.1080/15294145.2017.1294031>.
- Fox, E., 2018. Perspectives from affective science on understanding the nature of emotion. *Brain Neurosci. Adv.* 2, 2398212818812628.
- Fredrickson, B.L., 2001. The role of positive emotions in positive psychology. *Am. Psychol.* 56 (3), 218–226.
- Fredrickson, B.L., 2005. The broaden-and-build theory of positive emotions. In *The science of well-being*. Oxford University Press, pp. 217–238. <https://doi.org/10.1093/acprof:oso/9780198567523.003.0008>.
- Fredrickson, B.L., Joiner, T., 2002. Positive emotions trigger upward spirals toward emotional well-being. *Psychological science* 13 (2), 172–175.
- Freed, P.J., Mann, J.J., 2007. Sadness and loss: toward a neurobiopsychosocial model. *Am. J. Psychiatry* 164 (1), 28–34. <https://doi.org/10.1176/ajp.2007.164.1.28>.
- Frege, G., 1948. Sense and reference. *Philos. Rev.* 57 (3), 209–230. <https://doi.org/10.2307/2181485>.
- Frewen, P., Schroeter, M.L., Riva, G., Cipresso, P., Fairfield, B., Padulo, C., Kemp, A.H., Palaniyappan, L., Owolabi, M., Kusi-Mensah, K., Polyakova, M., Fehertoi, N., D'Andrea, W., Lowe, L., Northoff, G., 2020. Neuroimaging the consciousness of self: Review, and conceptual-methodological framework (this issue). *Neurosci. Biobehav. Rev.* 112, 164–212. <https://doi.org/10.1016/j.neubiorev.2020.01.023>.
- Frijda, N.H., 1986. *The Emotions*. Cambridge University Press.
- Frijda, N.H., 1993. Moods, emotion episodes, and emotions. In *Handbook of emotions*. The Guilford Press, pp. 381–403.
- Frijda, N.H., 2017. *The Laws of Emotion*. Psychology Press. <https://doi.org/10.4324/9781315086071>.
- Frijda, Nico H. 1994. "Emotions are Functional, Most of the Time." In *The Nature of Emotion: Fundamental Questions*, edited by Paul Ekman and Richard J. Davidson, 112–122. Oxford: Oxford University Press.
- Friston, K., 2020. Representation and agency. *Behav. Brain Sci.* 43, e134. <https://doi.org/10.1017/S0140525X19002929>.
- Friston, K., 2023. Computational psychiatry: from synapses to sentence. *Article 1 Mol. Psychiatry* 28 (1). <https://doi.org/10.1038/s41380-022-01743-z>.
- Friston, K., Kiebel, S., 2009. Predictive coding under the free-energy principle. *Philos. Trans. R. Soc. B: Biol. Sci.* 364 (1521), 1211–1221. <https://doi.org/10.1098/rstb.2008.0300>.
- Friston, K., FitzGerald, T., Rigoli, F., Schwartenbeck, P., Pezzulo, G., 2017. Active Inference: A Process Theory. *Neural Computation* 29 (1), 1–49. [https://doi.org/10.1162/NECO\\_a\\_00912](https://doi.org/10.1162/NECO_a_00912).
- Friston, K., Schwartenbeck, P., Fitzgerald, T., Moutoussis, M., Behrens, T., Dolan, R., 2013. The anatomy of choice: active inference and agency. *Front. Hum. Neurosci.* 7. <https://www.frontiersin.org/articles/10.3389/fnhum.2013.00598>.
- Friston, K., FitzGerald, T., Rigoli, F., Schwartenbeck, P., O'Doherty, J., Pezzulo, G., 2016. Active inference and learning. *Neurosci. Biobehav. Rev.* 68, 862–879. <https://doi.org/10.1016/j.neubiorev.2016.06.022>.
- Friston, K.J., Price, C.J., 2001a. Dynamic representations and generative models of brain function. *Brain Res. Bull.* 54 (3), 275–285. [https://doi.org/10.1016/S0361-9230\(00\)00436-6](https://doi.org/10.1016/S0361-9230(00)00436-6).
- Friston, K.J., Price, C.J., 2001b. Generative models, brain function and neuroimaging. *Scand. J. Psychol.* 42 (3), 167–177. <https://doi.org/10.1111/1467-9450.00228>.
- Fuchs, T., 2017. *Ecology of the Brain: The phenomenology and biology of the embodied mind*. Oxford University Press.
- Fuchs, T., 2018. Presence in absence. The ambiguous phenomenology of grief. *Phenomenology and the Cognitive Sciences* 17 (1), 43–63. <https://doi.org/10.1007/s11097-017-9506-2>.
- Galilei, G., 1953. *Dialogue Concerning the Two Chief World Systems, Ptolemaic and Copernican, Second Revised edition*. University of California Press.
- Gallagher, S., 1997. Mutual enlightenment: Recent phenomenology in cognitive science. *J. Conscious. Stud.* 4, 195–214.
- Gallagher, S., 2000. Philosophical conceptions of the self: Implications for cognitive science. *Trends Cogn. Sci.* 4 (1), 14–21. [https://doi.org/10.1016/S1364-6613\(99\)01417-5](https://doi.org/10.1016/S1364-6613(99)01417-5).
- Gallagher, S., 2012. Multiple aspects in the sense of agency. *N. Ideas Psychol.* 30 (1), 15–31. <https://doi.org/10.1016/j.newideapsych.2010.03.003>.
- Gallagher, S., Zahavi, D., 2020. *The Phenomenological Mind*, 3rd ed. Routledge, London. <https://doi.org/10.4324/9780429319792>.
- Gardiner, J.M., Java, R.I., 2019. Recognising and remembering. In *Theories of memory*. Psychology Press, pp. 163–188.
- Gendolla, G.H.E., 2000. On the impact of mood on behavior: an integrative theory and a review. *Rev. Gen. Psychol.* 4 (4), 378–408. <https://doi.org/10.1037/1089-2680.4.4.378>.
- Gendolla, G.H.E., Krüsken, J., 2001. Mood state and cardiovascular response in active coping with an affect-regulative challenge. *Int. J. Psychophysiol.* 41 (2), 169–180. [https://doi.org/10.1016/S0167-8760\(01\)00130-1](https://doi.org/10.1016/S0167-8760(01)00130-1).
- Gendolla, G.H.E., Abele, A.E., Andrei, A., Spurk, D., Richter, M., 2005. Negative mood, self-focused attention, and the experience of physical symptoms: the joint impact hypothesis. *Emotion* 5 (2), 131–144. <https://doi.org/10.1037/1528-3542.5.2.131>.
- Gendron, M., 2010. Defining emotion: a brief history. *Emot. Rev.* 2 (4), 371–372.
- Gendron, M., Barrett, L.F., 2009. Reconstructing the past: a century of ideas about emotion in psychology. *Emot. Rev.* 1 (4), 316–339.
- Georgieff, N., Jeannerod, M., 1998. Beyond Consciousness of External Reality: A "Who" System for Consciousness of Action and Self-Consciousness. *Consciousness and Cognition* 7 (3), 465–477. <https://doi.org/10.1006/ccog.1998.0367>.
- Gibson, J.J., 1977. *The Theory of Affordances*, in: *The People, Place, and Space Reader*. Routledge, pp. 56–60.



- Gilead, M., Trope, Y., Liberman, N., 2020. Above and beyond the concrete: the diverse representational substrates of the predictive brain. *Behav. Brain Sci.* 43, e121 <https://doi.org/10.1017/S0140525X19002000>.
- Glennan, S., 2002. Rethinking mechanistic explanation. *Philos. Sci.* 69 (S3), S342–S353. <https://doi.org/10.1086/341857>.
- Glennan, S., 2008. Mechanisms. In *The Routledge Companion to Philosophy of Science*. Routledge.
- Glennan, S.S., 1996. Mechanisms and the nature of causation. *Erkenntnis* 44 (1), 49–71.
- Godfrey-Smith, P., 2006. Mental Representation, Naturalism, and Teleosemantics. In *Teleosemantics*. Clarendon Press., <https://philpapers.org/rec/GODMRN-2>.
- Godfrey-Smith, P., 2020. Gradualism and the evolution of experience. *Philos. Top.* 48 (1), 201–220.
- Godfrey-Smith, P., 2021. *Theory and Reality: An Introduction to the Philosophy of Science*, Second Edition. University of Chicago Press. <https://press.uchicago.edu/ucp/books/book/chicago/T/bo37447570.html>.
- Gohm, C.L., Clore, G.L., 2000. Individual differences in emotional experience: mapping available scales to processes. *Personal. Soc. Psychol. Bull.* 26 (6), 679–697. <https://doi.org/10.1177/0146167200268004>.
- Goldie, P., 2000. *The Emotions: A Philosophical Exploration*. Clarendon Press.
- Goldie, P., 2009. *The Oxford Handbook of Philosophy of Emotion*. OUP Oxford.
- Gordon, S.L., 1990. *The Sociology of Sentiments and Emotion*. In *Social Psychology*. Routledge.
- Grahek, I., Musslick, S., Shenhav, A., 2020. A computational perspective on the roles of affect in cognitive control. *Int. J. Psychophysiol.* 151, 25–34. <https://doi.org/10.1016/j.ijpsycho.2020.02.001>.
- Grandjean, D., Scherer, K.R., 2008. Unpacking the cognitive architecture of emotion processes. *Emotion* 8 (3), 341–351. <https://doi.org/10.1037/1528-3542.8.3.341>.
- Gratch, J., Marsella, S., 2004. A domain-independent framework for modeling emotion. *Cogn. Syst. Res.* 5 (4), 269–306. <https://doi.org/10.1016/j.cogsys.2004.02.002>.
- Gray, K., Wegner, D.M., 2011. Dimensions of moral emotions. *Emot. Rev.* 3 (3), 258–260. <https://doi.org/10.1177/1754073911402388>.
- Gray, H.M., Gray, K., Wegner, D.M., 2007. Dimensions of Mind Perception. *Science* 315, 619. <https://doi.org/10.1126/science.1134475>.
- Grice, H.P., 1957. Meaning. *Philos. Rev.* 66 (3), 377–388. <https://doi.org/10.2307/2182440>.
- Griffiths, P.E., 2013. Current emotion research in philosophy. *Emot. Rev.* 5 (2), 215–222. <https://doi.org/10.1177/1754073912468299>.
- Griffiths, P.E., Scarantino, A., 2005. Emotions in the Wild: The Situated Perspective on Emotion. In: Robbins, P., Aydede, M. (Eds.), *The Cambridge Handbook of Situated Cognition*. Cambridge University Press. <https://philpapers.org/rec/GRIEIT>.
- Gross, J.J., Barrett, L.F., 2013. The emerging field of affective science. *Emotion* 13 (6), 997–998. <https://doi.org/10.1037/a0034512>.
- Haggard, P., 2017. Sense of agency in the human brain. *Nat. Rev. Neurosci.*, 18(4), Artic. 4. <https://doi.org/10.1038/nrn.2017.14>.
- Haidt, J., 2003. The moral emotions. In *Handbook of affective sciences*. Oxford University Press, pp. 852–870.
- Hardin, C.L., 1988. *Color for Philosophers: Unweaving the Rainbow*. Hackett Publishing.
- Harmon-Jones, C., Bastian, B., Harmon-Jones, E., 2016. The discrete emotions questionnaire: a new tool for measuring state self-reported emotions. *PLoS One* 11 (8), e0159915. <https://doi.org/10.1371/journal.pone.0159915>.
- Hassenzahl, M., Tractinsky, N., 2006. User experience—a research agenda. *Behav. Inf. Technol.* 25 (2), 91–97. <https://doi.org/10.1080/01449290500330331>.
- Hatzimoysis, A., 2007. The case against unconscious emotions. *Analysis* 67 (4), 292–299.
- Haugeland, J., 1978. The nature and plausibility of cognitivism. *Behav. Brain Sci.* 1 (2), 215–226. <https://doi.org/10.1017/S0140525X00074148>.
- Haugeland, J., 1997. *Mind Design II: Philosophy, Psychology, and Artificial Intelligence*. MIT Press.
- Heidegger, M., 1967. *Being and Time*. Blackwell.
- Heise, D.R., 1977. Social action as the control of affect. *Behav. Sci.* 22 (3), 163–177. <https://doi.org/10.1002/bs.3830220303>.
- Hempel, C.G., 1952. *Fundamentals of concept formation in empirical science*, Vol. II. No. 7. University of Chicago Press, Chicago, IL, USA.
- Hempel, C.G., Oppenheim, P., 1948. Studies in the logic of explanation. *Philos. Sci.* 15 (2), 135–175. <https://doi.org/10.1086/286983>.
- Hempel, C.G., 1970. *Aspects of Scientific Explanation: And Other Essays in the Philosophy of Science*. Free Press.
- Hesp, C., Smith, R., Parr, T., Allen, M., Friston, K.J., Ramstead, M.J.D., 2021. Deeply felt affect: the emergence of valence in deep active inference. *Neural Comput.* 33 (2), 398–446. [https://doi.org/10.1162/neco\\_a.01341](https://doi.org/10.1162/neco_a.01341).
- Heylighen, F., Busseniens, E., 2023. Modeling autopoiesis and cognition with reaction networks. *Biosystems* 230, 104937. <https://doi.org/10.1016/j.biosystems.2023.104937>.
- Hill, R.K., 2016. What an algorithm is. *Philos. Technol.* 29 (1), 35–59. <https://doi.org/10.1007/s13347-014-0184-5>.
- Hitchcock, P.F., Fried, E.L., Frank, M.J., 2022. Computational Psychiatry Needs Time and Context. *Annual Review of Psychology* 73, 243–270. <https://doi.org/10.1146/annurev-psych-021621-124910>.
- Ho, M.K., Saxe, R., Cushman, F., 2022. Planning with theory of mind. *Trends Cogn. Sci.* 26 (11), 959–971. <https://doi.org/10.1016/j.tics.2022.08.003>.
- Hodson, R., Bassett, B., van Hoof, C., Rosman, B., Solms, M., Shock, J.P., & Smith, R. (2023, August 15). Planning to Learn: A Novel Algorithm for Active Learning during Model-Based Planning. *ArXiv.Org*. <https://arxiv.org/abs/2308.08029v1>.
- Hoemann, K., Gendron, M., Barrett, L.F., 2017. Mixed emotions in the predictive brain. *Curr. Opin. Behav. Sci.* 15, 51–57. <https://doi.org/10.1016/j.cobeha.2017.05.013>.
- Hoemann, K., Nielson, C., Yuen, A., Gurera, J.W., Quigley, K.S., Barrett, L.F., 2021. Expertise in emotion: a scoping review and unifying framework for individual differences in the mental representation of emotional experience. *Psychol. Bull.* 147 (11), 1159–1183. <https://doi.org/10.1037/bul0000327>.
- Hoffman, M.L., 1986. Affect, cognition, and motivation. In *Handbook of motivation and cognition: Foundations of social behavior*. Guilford Press., pp. 244–280.
- Hogan, P., 2017. *Literature and Emotion*. Routledge. <https://doi.org/10.4324/9781315644639>.
- Hogan, P.C., 2011. *What literature teaches us about emotion*. Cambridge University Press, New York, NY, US. <https://doi.org/10.1017/CBO9780511976773>.
- Hohwy, J., 2007. The sense of self in the phenomenology of agency and perception. *Sense Self* 13 (1), 20.
- Holton, G., 1975. On the role of themata in scientific thought. *Science* 188 (4186), 328–334.
- Hommel, B., 2019. Affect and control: a conceptual clarification. *Int. J. Psychophysiol.* 144, 1–6. <https://doi.org/10.1016/j.ijpsycho.2019.07.006>.
- Hommel, B., Moors, A., Sander, D., Deonna, J., 2017. Emotion meets action: towards an integration of research and theory. *Emot. Rev.* 9 (4), 295–298. <https://doi.org/10.1177/1754073916689379>.
- Hoque, M., McDuff, D.J., Morency, L.-P., Picard, R.W., 2011. Machine learning for affective computing. In: D’Mello, S., Graesser, A., Schuller, B., Martin, J.-C. (Eds.), *Affective Computing and Intelligent Interaction*. Springer., p. 567. [https://doi.org/10.1007/978-3-642-24571-8\\_70](https://doi.org/10.1007/978-3-642-24571-8_70).
- Horgan, T., Tienson, J., 1996. *Connectionism and the Philosophy of Psychology*. MIT Press.
- Horgan, T., & Tienson, J. (2002). *The Intentionality of Phenomenology and the Phenomenology of Intentionality*. <https://philpapers.org/rec/HORTIO>.
- Horgan, T., Tienson, J., Graham, G., 2003. The phenomenology of first-person agency. In *Physicalism and mental causation: The metaphysics of mind and action*. Imprint Academic, pp. 323–340.
- Horwitz, A.V., Wakefield, J.C., 2007. *The Loss of Sadness: How Psychiatry Transformed Normal Sorrow into Depressive Disorder*. Oxford University Press.
- Hufendiek, R., 2015. *Embodied Emotions: A Naturalist Approach to a Normative Phenomenon*. Routledge.
- Husserl, E., Dummett, M., 2001. *Logical Investigations*. Routledge, London; New York.
- Husserl, E., 2013. *Cartesian Meditations: An Introduction to Phenomenology*. Springer Science & Business Media.
- Hutto, D.D., 2012. Truly enactive emotion. *Emot. Rev.* 4 (2), 176–181. <https://doi.org/10.1177/1754073911430134>.
- Hutto, D.D., Satne, G., 2015. The natural origins of content. *Philosophia* 43 (3), 521–536. <https://doi.org/10.1007/s11406-015-9644-0>.
- Hutto, D.D., Myin, E., 2017. *Evolving Enactivism: Basic Minds Meet Content*. MIT Press.
- Isen, A.M., 1984. Toward understanding the role of affect in cognition, in: *Handbook of Social Cognition*, Vol 3. Lawrence Erlbaum Associates Publishers, Mahwah, NJ, US, pp. 179–236.
- Isen, A.M., 1987. Positive affect, cognitive processes, and social behavior. In: *Advances in experimental social psychology*, Vol. 20. Academic Press, pp. 203–253.
- Itkonen, E., 1978. Grammatical Theory and Metascience: A critical investigation into the methodological and philosophical foundations of “autonomous” linguistics. John Benjamins Publishing.
- Ivanova, M., 2014. Is There a Place for Epistemic Virtues in Theory Choice? In: Fairweather, A. (Ed.), *Virtue Epistemology Naturalized: Bridges Between Virtue Epistemology and Philosophy of Science*. Springer International Publishing, pp. 207–226. [https://doi.org/10.1007/978-3-319-04672-3\\_13](https://doi.org/10.1007/978-3-319-04672-3_13).
- Ivanova, M., 2017. Aesthetic values in science. *Philos. Compass* 12 (10), e12433.
- Ivanova, M., Farr, M., 2020. *Methods in science and metaphysics. Routledge Handb. Metametaphysics*. Routledge.
- Iwasaki, Y., MacTavish, J., MacKay, K., 2005. Building on strengths and resilience: Leisure as a stress survival strategy. *Br. J. Guid. Couns.* 33 (1), 81–100. <https://doi.org/10.1080/03069880412331335894>.
- Izard, C., Stark, K., Trentacosta, C., Schultz, D., 2008. Beyond emotion regulation: emotion utilization and adaptive functioning. *Child Dev. Perspect.* 2 (3), 156–163. <https://doi.org/10.1111/j.1750-8606.2008.00058.x>.
- Izard, C.E., 1978. Emotions as motivations: An evolutionary-developmental perspective. *Nebraska Symposium on Motivation* 26, 163–200.
- Izard, C.E., 1992. Basic emotions, relations among emotions, and emotion-cognition relations. *Psychological Review* 99 (3), 561–565. <https://doi.org/10.1037/0033-295X.99.3.561>.
- Izard, C.E., 2007. Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspect. Psychol. Sci.* 2 (3), 260–280. <https://doi.org/10.1111/j.1745-6916.2007.00044.x>.
- Izard, C.E., 2010a. More meanings and more questions for the term “emotion”. *Emot. Rev.* 2 (4), 383–385.
- Izard, C.E., 2010b. The many meanings/aspects of emotion: definitions, functions, activation, and regulation. *Emot. Rev.* 2 (4), 363–370.
- Jabareen, Y., 2009. Building a conceptual framework: philosophy, definitions, and procedure. *Int. J. Qual. Methods* 8 (4), 49–62. <https://doi.org/10.1177/160940690900800406>.
- James, W., 1890. *The Principles of Psychology*. Dover Publications.
- Joffily, M., Coricelli, G., 2013. Emotional valence and the free-energy principle. *PLoS Comput. Biol.* 9 (6), e1003094 <https://doi.org/10.1371/journal.pcbi.1003094>.
- Jonas, H., 1973. *Organismus und Freiheit: Ansätze zu einer philosophischen Biologie*. Vandenhoeck & Ruprecht.
- Jonas, H., 2001. *The Phenomenon of Life: Toward a Philosophical Biology*. Northwestern University Press.
- Jones, B.E., 2003. Arousal systems. *Front. Biosci.: A J. Virtual Libr.* 8, s438–s451. <https://doi.org/10.2741/1074>.

- Juslin, P.N., 2013. From everyday emotions to aesthetic emotions: towards a unified theory of musical emotions. *Phys. Life Rev.* 10 (3), 235–266. <https://doi.org/10.1016/j.plrev.2013.05.008>.
- Kaelbling, L.P., Littman, M.L., Moore, A.W., 1996. Reinforcement learning: a survey. *J. Artif. Intell. Res.* 4, 237–285. <https://doi.org/10.1613/jair.301>.
- Kaneko, D., Toet, A., Brouwer, A.-M., Kallen, V., van Erp, J.B.F., 2018. Methods for Evaluating Emotions Evoked by Food Experiences: A Literature Review. *Front. Psychol.* 9. <https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00911>.
- Kant, I., 1781. Critique of pure reason. *Modern Classical Philosophers*. Houghton Mifflin (1908), Cambridge, MA, pp. 370–456.
- Kanwisher, N., 2010. Functional specificity in the human brain: a window into the functional architecture of the mind. *Proc. Natl. Acad. Sci.* 107 (25), 11163–11170. <https://doi.org/10.1073/pnas.1005062107>.
- Karatsoreos, I.N., McEwen, B.S., 2011. Psychobiological allostasis: resistance, resilience and vulnerability. *Trends Cogn. Sci.* 15 (12), 576–584. <https://doi.org/10.1016/j.tics.2011.10.005>.
- Kauffman, S.A., 1970. Articulation of parts explanation in biology and the rational search for them. *PSA: Proc. Bienn. Meet. Philos. Sci. Assoc.* 1970, 257–272.
- Keas, M.N., 2018. Systematizing the theoretical virtues. *Synthese* 195 (6), 2761–2793.
- Keltner, D., Gross, J.J., 1999. Functional accounts of emotions. *Cogn. Emot.* 13 (5), 467–480. <https://doi.org/10.1080/026999399379140>.
- Keltner, D., Lerner, J.S., 2010. Emotion, in: *Handbook of Social Psychology*, Vol. 1, 5th Ed. John Wiley & Sons, Inc., Hoboken, NJ, US, pp. 317–352. <https://doi.org/10.1002/9780470561119.socpsy001009>.
- Kenny, D.A., Kenny, A., 2003. Action, Emotion and Will. Routledge.
- Kind, A., 2001. Putting the image back in imagination. *Philos. Phenomenol. Res.* 62 (1), 85–109. <https://doi.org/10.2307/2653590>.
- Kind, A., 2013. The Case against Representationalism about Moods. In *Current Controversies in Philosophy of Mind*. Routledge.
- King, P., 2009. Emotions in Medieval Thought. In: Goldie, P. (Ed.), *The Oxford Handbook of Philosophy of Emotion* (p. 0). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199235018.003.0008>.
- Kirsh, D., Maglio, P., 1994. On distinguishing epistemic from pragmatic action. *Cogn. Sci.* 18 (4), 513–549. [https://doi.org/10.1016/0364-0213\(94\)90007-8](https://doi.org/10.1016/0364-0213(94)90007-8).
- Kitcher, P., 2001. Science, truth, and democracy. Oxford University Press.
- Kiverstein, J., Kirchhoff, M.D., Thacker, M., 2022. An embodied predictive processing theory of pain experience. *Review of Philosophy and Psychology* 13 (4), 973–998.
- Kleinginna, P.R., Kleinginna, A.M., 1981. A categorized list of emotion definitions, with suggestions for a consensual definition. *Motiv. Emot.* 5 (4), 345–379. <https://doi.org/10.1007/BF00992553>.
- Klinger, E., 1975. Consequences of commitment to and disengagement from incentives. *Psychol. Rev.* 82 (1), 1–25. <https://doi.org/10.1037/h0076171>.
- Knill, D.C., Pouget, A., 2004. The Bayesian brain: the role of uncertainty in neural coding and computation. *Trends Neurosci.* 27 (12), 712–719. <https://doi.org/10.1016/j.tins.2004.10.007>.
- Koch, C., Tsuchiya, N., 2007. Phenomenology without conscious access is a form of consciousness without top-down attention. *Behav. Brain Sci.* 30 (5–6), 509–510. <https://doi.org/10.1017/S0140525X07002907>.
- Koolhaas, J.M., Bartolomucci, A., Buwalda, B., de Boer, S.F., Flügg, G., Korte, S.M., Meerlo, P., Murison, R., Olivier, B., Palanza, P., Richter-Levin, G., Sgoifo, A., Steimer, T., Siedel, O., van Dijk, G., Wöhr, M., Fuchs, E., 2011. Stress revisited: a critical evaluation of the stress concept. *Neurosci. Biobehav. Rev.* 35 (5), 1291–1301. <https://doi.org/10.1016/j.neubiorev.2011.02.003>.
- Kording, K.P., Blohm, G., Schrater, P., Kay, K., 2020. *Appreciating the variety of goals in computational neuroscience* (arXiv:2002.03211). arXiv. <https://doi.org/10.48550/arXiv.2002.03211>.
- Kragel, P.A., LaBar, K.S., 2016. Decoding the nature of emotion in the brain. *Trends Cogn. Sci.* 20 (6), 444–455. <https://doi.org/10.1016/j.tics.2016.03.011>.
- Kriegel, U., 2014. *The Sources of Intentionality*, Reprint ed. Oxford University Press, Oxford.
- Kriegel, U., 2019. The Intentional Structure of Moods. *Philosophers' Imprint* 19, 1–19.
- Krueger, A.B., Schkade, D.A., 2008. The reliability of subjective well-being measures. *J. Public Econ* 92 (8), 1833–1845. <https://doi.org/10.1016/j.jpubeco.2007.12.015>.
- Kübler-Ross, E., Kessler, D., 2005. On Grief and Grieving: Finding the Meaning of Grief Through the Five Stages of Loss. Simon and Schuster.
- Kuhn, T.S., 1974. Second thoughts on paradigms. *Struct. Sci. Theor.* 2, 459–482.
- Kuhn, T.S., Hacking, I., 2012. *The Structure of Scientific Revolutions: 50th Anniversary*, 4th ed. University of Chicago Press, Chicago.
- Kuppens, P., Van Mechelen, I., Smits, D.J., De Boeck, P., 2003. The appraisal basis of anger: specificity, necessity and sufficiency of components. *Emotion* 3 (3), 254.
- Kuppens, P., Tuerlinckx, F., Russell, J.A., Barrett, L.F., 2013. The relation between valence and arousal in subjective experience. *Psychol. Bull.* 139 (4), 917–940. <https://doi.org/10.1037/a0030811>.
- Kuppens, P., Dejonckheere, E., Kalokerinos, E.K., Koval, P., 2022. Some recommendations on the use of daily life methods in affective science. *Affect. Sci.* 2 (2), 505–515. <https://doi.org/10.1007/s42761-022-00101-0>.
- Kuppens, P., Tuerlinckx, F., Yik, M., Koval, P., Coosemans, J., Zeng, K.J., Russell, J.A., 2017. The relation between valence and arousal in subjective experience varies with personality and culture. *J. Personal.* 85 (4), 530–542. <https://doi.org/10.1111/jopy.12258>.
- Lacewing, M., 2007. Do unconscious emotions involve unconscious feelings. *Philos. Psychol.* 20 (1), 81–104. <https://doi.org/10.1080/09515080601023402>.
- Lachman, M.E., Weaver, S.L., 1998. The sense of control as a moderator of social class differences in health and well-being. *J. Personal. Soc. Psychol.* 74 (3), 763–773. <https://doi.org/10.1037/0022-3514.74.3.763>.
- Ladyman, J., 2012. Science, metaphysics and method. *Philos. Stud.* 160, 31–51.
- Lakatos, I., 1978. Science and pseudoscience. *Philos. Pap.* 1, 1–7.
- Lakatos, I., 2014. Falsification and the methodology of scientific research programmes. In *Philosophy, Science, and History*. Routledge, pp. 89–94.
- Lakin, J.L., Jefferis, V.E., Cheng, C.M., Chartrand, T.L., 2003. The chameleon effect as social glue: evidence for the evolutionary significance of nonconscious mimicry. *J. Nonverbal Behav.* 27 (3), 145–162. <https://doi.org/10.1023/A:1025389814290>.
- Lambie, J.A., Marcel, A.J., 2002. Consciousness and the varieties of emotion experience: a theoretical framework. *Psychol. Rev.* 109 (2), 219–259. <https://doi.org/10.1037/0033-295X.109.2.219>.
- Lang, P.J., Bradley, M.M., 2008. Appetitive and defensive motivation is the substrate of emotion. In *Handbook of approach and avoidance motivation*. Psychology Press, pp. 51–65.
- Lange, C.G., 1885. Om sindsbevaegelser; et psyko-fysiologisk studie. Lund..
- Larsen, J.T., McGraw, A.P., 2014. The case for mixed emotions. *Soc. Personal. Psychol. Compass* 8 (6), 263–274. <https://doi.org/10.1111/spc3.12108>.
- Latour, B., Woolgar, S., 2013. *Laboratory Life: The Construction of Scientific Facts*. Princeton University Press.
- Laudan, L. (1978). *Progress and Its Problems: Towards a Theory of Scientific Growth*.
- Lazarus, R.S., 2001. Relational meaning and discrete emotions. In *Appraisal processes in emotion: Theory, methods, research*. Oxford University Press, pp. 37–67.
- Leary, M.R., 2000. Affect, cognition, and the social emotions. In *Feeling and thinking: The role of affect in social cognition*. Cambridge University Press, pp. 331–356.
- LeDoux, J., 1996. Emotional networks and motor control: a fearful view. *Prog. Brain Res.* 107, 437–446. [https://doi.org/10.1016/s0079-6123\(08\)61880-4](https://doi.org/10.1016/s0079-6123(08)61880-4).
- LeDoux, J., 2012. Rethinking the emotional brain. *Neuron* 73 (4), 653–676. <https://doi.org/10.1016/j.neuron.2012.02.004>.
- LeDoux, J., 2023. Deep history and beyond: a reply to commentators. *Philos. Psychol.* 36 (4), 756–766. <https://doi.org/10.1080/09515089.2022.2160312>.
- LeDoux, J.E., 1989. Cognitive-emotional interactions in the brain. *Cogn. Emot.* 3 (4), 267–289. <https://doi.org/10.1080/02699938908412709>.
- LeDoux, J.E., 1998. *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*. Simon and Schuster.
- LeDoux, J.E., 2015. Feelings: what are they & how does the brain make them? *Daedalus* 144 (1), 96–111. <https://doi.org/10.1162/DAED.a.00319>.
- LeDoux, J.E., 2022. As soon as there was life, there was danger: the deep history of survival behaviours and the shallower history of consciousness. *Philosophical Transactions of the Royal Society B* 377 (1844), 20210292.
- LeDoux, J.E., Brown, R., 2017. A higher-order theory of emotional consciousness. *Proc. Natl. Acad. Sci.* 114 (10). <https://doi.org/10.1073/pnas.1619316114>.
- LeDoux, J.E., Hofmann, S.G., 2018. The subjective experience of emotion: a fearful view. *Curr. Opin. Behav. Sci.* 19, 67–72. <https://doi.org/10.1016/j.cobeha.2017.09.011>.
- Lee, K.M., Ferreira-Santos, F., Satpute, A.B., 2021. Predictive processing models and affective neuroscience. *Neuroscience and Biobehavioral Reviews* 131, 211–228. <https://doi.org/10.1016/j.neubiorev.2021.09.009>.
- Lee, T.S., Mumford, D., 2003. Hierarchical Bayesian inference in the visual cortex. *JOSA A* 20 (7), 1434–1448. <https://doi.org/10.1364/JOSAA.20.001434>.
- Leighton, S.R., 1985. A new view of emotion. *Am. Philos. Q.* 22 (2), 133–141.
- Lench, H.C., Tibbett, T.P., Bench, S.W., 2016. Exploring the toolkit of emotion: what do sadness and anger do for us? *Soc. Personal. Psychol. Compass* 10 (1), 11–25. <https://doi.org/10.1111/spc3.12229>.
- Lerner, J.S., Keltner, D., 2000. Beyond valence: toward a model of emotion-specific influences on judgement and choice. *Cogn. Emot.* 14 (4), 473–493. <https://doi.org/10.1080/026999300402763>.
- Lerner, J.S., Keltner, D., 2001. Fear, anger, and risk. *J. Personal. Soc. Psychol.* 81 (1), 146–159. <https://doi.org/10.1037/0022-3514.81.1.146>.
- Levenson, R.W., 2011. Basic emotion questions. *Emot. Rev.* 3 (4), 379–386. <https://doi.org/10.1177/1754073911410743>.
- Levenstein, D., Alvarez, V.A., Amarasingham, A., Azab, H., Chen, Z.S., Gerkin, R.C., Hasenstaub, A., Iyer, R., Jolivet, R.B., Marzen, S., Monaco, J.D., Prinz, A.A., Quraishi, S., Santamaria, F., Shivkumar, S., Singh, M.F., Traub, R., Nadim, F., Rotstein, H.G., Redish, A.D., 2023. On the role of theory and modeling in neuroscience. *J. Neurosci.* 43 (7), 1074–1088. <https://doi.org/10.1523/JNEUROSCI.1179-22.2022>.
- Leventhal, H., Diefenbach, M., 1991. The Active Side of Illness Cognition. In: Skelton, J. A., Croyle, R.T. (Eds.), *Mental Representation in Health and Illness*. Springer, US, pp. 247–272. [https://doi.org/10.1007/978-1-4613-9074-9\\_11](https://doi.org/10.1007/978-1-4613-9074-9_11).
- Levin, M., 2019. The Computational Boundary of a “Self”: Developmental Bioelectricity Drives Multicellularity and Scale-Free Cognition. *Front. Psychol.* 10. <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02688>.
- Levine, J., 1983. Materialism and qualia: the explanatory gap. *Pac. Philos. Q.* 64 (4), 354–361. <https://doi.org/10.1111/j.1468-0114.1983.tb00207.x>.
- Levine, S., 2018. Reinforcement Learning and Control as Probabilistic Inference: Tutorial and Review (arXiv:1805.00909). arXiv. <https://doi.org/10.48550/arXiv.1805.00909>.
- Levy, A., Bechtel, W., 2013. Abstraction and the organization of mechanisms. *Philos. Sci.* 80 (2), 241–261.
- Levy, I., Schiller, D., 2021. Neural Computations of Threat. *Trends Cogn. Sci.* 25, 151–171. <https://doi.org/10.1016/j.tics.2020.11.007>.
- Lewis, D., 1970. How to define theoretical terms. *J. Philos.* 67 (13), 427–446.
- Lewis, D., 1972. Psychophysical and theoretical identifications. *Australas. J. Philos.* 50 (3), 249–258.
- Li, Z., Lu, H., Liu, D., Yu, A.N.C., Gendron, M., 2023. Emotional event perception is related to lexical complexity and emotion knowledge. *PsyArXiv*. <https://doi.org/10.31234/osf.io/vfsc4>.
- Lin, H., Coricelli, G., Feng, C., Luo, S., Young, S., 2023. Social Emotions and Their Influences. *Frontiers Media SA*.

- Lindquist, K.A., 2021. Language and emotion: introduction to the special issue. *Affect. Sci.* 2 (2), 91–98. <https://doi.org/10.1007/s42761-021-00049-7>.
- Lindquist, K.A., Satpute, A.B., Gendron, M., 2015. Does language do more than communicate emotion. *Curr. Dir. Psychol. Sci.* 24 (2), 99–108. <https://doi.org/10.1177/0963721414553440>.
- Locke, J., 1847. *An Essay Concerning Human Understanding*. Kay & Troutman.
- Lopez, S.J., & Snyder, C.R. (2011). *The Oxford Handbook of Positive Psychology*. OUP USA.
- Lowe, E.J., 2002. *A survey of metaphysics, (Vol. 15).* Oxford University Press, Oxford.
- Lutz, C., White, G.M., 1986. The Anthropology of Emotions. *Annual Review of Anthropology* 15 (1), 405–436. <https://doi.org/10.1146/annurev.an.15.100186.002201>.
- Lyons, W., 2005. *Philos. Cogn. Emot.* 21–44. <https://doi.org/10.1002/0470013494.ch2>.
- Lyubomirsky, S., Sheldon, K.M., Schkade, D., 2005. Pursuing happiness: the architecture of sustainable change. *Rev. Gen. Psychol.* 9 (2), 111–131. <https://doi.org/10.1037/1089-2680.9.2.111>.
- M. Del Giudice. 2021. The motivational architecture of emotions. *The Oxford Handbook of Evolution and the Emotions*. Oxford, p. 39.
- MacArthur, R., 1955. Fluctuations of animal populations and a measure of community stability. *Ecology* 36 (3), 533–536. <https://doi.org/10.2307/1929601>.
- Machamer, P., Darden, L., Craver, C.F., 2000. Thinking about mechanisms. *Philos. Sci.* 67 (1), 1–25. <https://doi.org/10.1086/392759>.
- MacLeod, M., 2018. What makes interdisciplinarity difficult? Some consequences of domain specificity in interdisciplinary practice. *Synthese* 195 (2), 697–720. <https://doi.org/10.1007/s11229-016-1236-4>.
- Maddux, J.E., 2017. *Subjective Well-Being and Life Satisfaction*. Routledge.
- Maia, T.V., Huys, Q.J.M., Frank, M.J., 2017. Theory-based computational psychiatry. *Biol. Psychiatry* 82 (6), 382–384. <https://doi.org/10.1016/j.biopsych.2017.07.016>.
- Markovic, S., 2012. Components of aesthetic experience: aesthetic fascination, aesthetic appraisal, and aesthetic emotion. *I-Percept.* 3 (1), 1–17. <https://doi.org/10.1068/i0450aap>.
- Marr, D., 2010. *Vision: a computational investigation into the human representation and processing of visual information*. The MIT Press, Cambridge, MA, USA.
- Marsella, S., Gratch, J., 2016. Computational models of emotion as psychological tools. In: Barrett, L.F., Lewis, M., Haviland-Jones, J.M. (Eds.), *Handbook of emotions*, 4th ed. Guilford Press, pp. 113–129.
- Marsella, S., Gratch, J., Petta, P., 2010. Computational models of emotion. A Blueprint for Affective Computing—A sourcebook and manual 11 (1), 21–46.
- Marsella, S.C., Gratch, J., 2009. EMA: A process model of appraisal dynamics. *Cognitive Systems Research* 10 (1), 70–90. <https://doi.org/10.1016/j.cogsys.2008.03.005>.
- Mastandrea, S., Fagioli, S., Biasi, V., 2019. Art and psychological well-being: linking the brain to the aesthetic emotion. *Front. Psychol.*, 10. <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.00739>.
- Maturana, H.R. (1980). Autopoiesis: reproduction, heredity and evolution. In *Autopoiesis, dissipative structures and spontaneous social orders, AAAS Selected Symposium 55 (AAAS National Annual Meeting, Houston TX, 3–8 January 1979)* (pp. 45–79). Westview Press.
- Maturana, H.R., Varela, F.J., 1991. *Autopoiesis and Cognition: The Realization of the Living*. Springer Science & Business Media.
- Mauss, I.B., Robinson, M.D., 2009. Measures of emotion: a review. *Cogn. Emot.* 23 (2), 209–237. <https://doi.org/10.1080/02699930802204677>.
- Mayr, E., 1985. Teleological and Teleonomic, a New Analysis. In: Cohen, R.S., Wartofsky, M.W. (Eds.), *A Portrait of Twenty-Five Years: Boston Colloquium for the Philosophy of Science 1960–1985*, Boston Studies in the Philosophy of Science. Springer, Netherlands, Dordrecht, pp. 133–159. [https://doi.org/10.1007/978-94-009-5345-1\\_10](https://doi.org/10.1007/978-94-009-5345-1_10).
- Mayr, E., 1998. The Multiple Meanings of “Teleological.”. *History and Philosophy of the Life Sciences* 20 (1), 35–40.
- McEwen, B.S., 1998. Stress, adaptation, and disease: allostasis and allostatic load. *Ann. N. Y. Acad. Sci.* 840 (1), 33–44. <https://doi.org/10.1111/j.1749-6632.1998.tb09546.x>.
- McEwen, B.S., 2000. Allostasis and allostatic load: implications for neuropsychopharmacology. *Neuropsychopharmacology* 22 (2), 108–124. [https://doi.org/10.1016/S0893-133X\(99\)00129-3](https://doi.org/10.1016/S0893-133X(99)00129-3).
- McEwen, B.S., 2005. Stressed or stressed out: what is the difference? *J. Psychiatry Neurosci.* 30 (5), 315–318.
- McEwen, B.S., Seeman, T., 1999. Protective and damaging effects of mediators of stress: elaborating and testing the concepts of allostasis and allostatic load. *Ann. N. Y. Acad. Sci.* 896 (1), 30–47. <https://doi.org/10.1111/j.1749-6632.1999.tb08103.x>.
- McEwen, B.S., Wingfield, J.C., 2003. The concept of allostasis in biology and biomedicine. *Horm. Behav.* 43 (1), 2–15. [https://doi.org/10.1016/S0018-506X\(02\)00024-7](https://doi.org/10.1016/S0018-506X(02)00024-7).
- McEwen, B.S., Akil, H., 2020. Revisiting the stress concept: implications for affective disorders. *J. Neurosci. Off. J. Soc. Neurosci.* 40 (1), 12–21. <https://doi.org/10.1523/JNEUROSCI.0733-19.2019>.
- McLaughlin, P., 2000. *What Functions Explain: Functional Explanation and Self-Reproducing Systems*. Cambridge University Press.
- Mehrabian, A., Epstein, N., 1972. A measure of emotional empathy. *J. Personal.* 40 (4), 525–543. <https://doi.org/10.1111/j.1467-6494.1972.tb00078.x>.
- Mehrabian, A., Russell, J.A., 1974. *An approach to environmental psychology* (pp. xii, 266). The MIT Press.
- Mele, A.R., 1997. Agency and Mental Action. *Philos. Perspect.* 11, 231–249.
- Melnikoff, D.E., Carlson, R.W., Stillman, P.E., 2022. A computational theory of the subjective experience of flow. *Article 1 Nat. Commun.* 13 (1). <https://doi.org/10.1038/s41467-022-29742-2>.
- Mendelovici, A., 2013. Pure Intentionalism about Moods and Emotions. In *Current Controversies in Philosophy of Mind*. Routledge.
- Menninghaus, W., Wagner, V., Wassiliwizky, E., Schindler, I., Hanich, J., Jacobsen, T., Koelsch, S., 2019. What are aesthetic emotions. *Psychol. Rev.* 126 (2), 171–195. <https://doi.org/10.1037/rev0000135>.
- Mercado, L.N., 1994. *The Filipino mind*. Council for Research in Values and Philosophy.
- Merleau-Ponty, M., 2011. *Phenomenology of Perception*. Routledge. <https://doi.org/10.4324/9780203720714>.
- Mesquita, B., Frijda, N.H., 1992. Cultural variations in emotions: A review. *Psychological Bulletin* 112 (2), 179–204. <https://doi.org/10.1037/0033-2909.112.2.179>.
- Metzinger, T., 2003a. *Being No One: The Self-Model Theory of Subjectivity*. MIT Press. <https://doi.org/10.7551/mitpress/1551.001.0001>.
- Metzinger, T., 2003b. Phenomenal transparency and cognitive self-reference. *Phenomenol. Cogn. Sci.* 2 (4), 353–393. <https://doi.org/10.1023/B:PHEN.0000007366.42918.eb>.
- Metzinger, T., 2013. Why are dreams interesting for philosophers? The example of minimal phenomenal selfhood, plus an agenda for future research. *Front. Psychol.* 4. <https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00746>.
- Metzinger, T., 2017. *Probl. Ment. Action*. <https://philpapers.org/rec/METTP0-14>.
- Michaels, A., Wulf, C., 2020. *Emotions in Rituals and Performances: South Asian and European Perspectives on Rituals and Performativity*. Taylor & Francis.
- Migeot, J., Hesse, E., Fittipaldi, S., Mejía, J., Fraile, M., García, A.M., García, M., del C., Ortega, R., Lawlor, B., Lopez, V., Ibáñez, A., 2023. Allostatic-interoceptive anticipation of social rejection. *NeuroImage* 276, 120200. <https://doi.org/10.1016/j.neuroimage.2023.120200>.
- Milkowski, M., Litwin, P., 2022. Testable or bust: Theoretical lessons for predictive processing. *Synthese* 200 (6), 462. <https://doi.org/10.1007/s11229-022-03891-9>.
- Mill, J.S., 1856. *A System of Logic, Ratiocinative and Inductive: I*. Parker.
- Miller, M., Kiverstein, J., Rietveld, E., 2022. The Predictive Dynamics of Happiness and Well-Being. *Emotion Review* 14 (1), 15–30. <https://doi.org/10.1177/17540739211063851>.
- Millidge, B., Tschantz, A., Seth, A.K., Buckley, C.L., 2020. On the Relationship Between Active Inference and Control as Inference. In: Verbelen, T., Lanillos, P., Buckley, C.L., De Boom, C. (Eds.), *Active Inference*. Springer International Publishing, pp. 3–11. [https://doi.org/10.1007/978-3-030-64919-7\\_1](https://doi.org/10.1007/978-3-030-64919-7_1).
- Millikan, R.G., 1987. *Language, Thought, and Other Biological Categories: New Foundations for Realism*. MIT Press.
- Millikan, R.G., 1989. In Defense of Proper Functions. *Philos. Sci.* 56 (2), 288–302.
- Mitchell, S.D., 2003. *Biological Complexity and Integrative Pluralism*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511802683>.
- Mitchell, S.D., 2012. *Unsimple Truths: Science, Complexity, and Policy*. University of Chicago Press. (<https://press.uchicago.edu/ucp/books/book/chicago/U/bo8205034.html>).
- Mobbs, D., Adolphs, R., Fanselow, M.S., Barrett, L.F., LeDoux, J.E., Ressler, K., Tye, K.M., 2019. Viewpoints: approaches to defining and investigating fear. *Article 8 Nat. Neurosci.* 22 (8). <https://doi.org/10.1038/s41593-019-0456-6>.
- Moerland, T.M., Broekens, J., Jonker, C.M., 2018. Emotion in reinforcement learning agents and robots: a survey. *Mach. Learn.* 107 (2), 443–480. <https://doi.org/10.1007/s10994-017-5666-0>.
- Möller, T.J., Georgie, Y.K., Schillaci, G., Voss, M., Hafner, V.V., Kaltwasser, L., 2021. Computational models of the “active self” and its disturbances in schizophrenia. *Conscious. Cogn.* 93, 103155. <https://doi.org/10.1016/j.concog.2021.103155>.
- Moore, J.W., 2016. What is the sense of agency and why does it matter. *Front. Psychol.* 7, 1272. <https://doi.org/10.3389/fpsyg.2016.01272>.
- Moors, A., 2017a. Integration of two skeptical emotion theories: Dimensional appraisal theory and Russell’s psychological construction theory. *Psychological Inquiry* 28 (1), 1–19.
- Moors, A., 2017b. The integrated theory of emotional behavior follows a radically goal-directed approach. *Psychological Inquiry* 28 (1), 68–75.
- Moors, A., 2022. *Demystifying emotions: A typology of theories in psychology and philosophy*. Cambridge University Press.
- Moors, A., Fischer, M., 2019. Demystifying the role of emotion in behaviour: toward a goal-directed account. *Cogn. Emot.* 33 (1), 94–100. <https://doi.org/10.1080/02699931.2018.1510381>.
- Morganti, M., Tahko, T.E., 2017. Moderately naturalistic metaphysics. *Synthese* 194 (7), 2557–2580. <https://doi.org/10.1007/s11229-016-1068-2>.
- Morris, W.N., Schnurr, P.P., 1989. *Mood: The frame of mind*, 261. Springer-Verlag Publishing, p. xii.
- Mulligan, K., Scherer, K.R., 2012. Toward a working definition of emotion. *Emot. Rev.* 4 (4), 345–357.
- Na, S., Rhoads, S.A., Yu, A.N.C., Fiore, V.G., Gu, X., 2023. Towards a neurocomputational account of social controllability: From models to mental health. *Neurosci. Biobehav. Rev.* 148, 105139. <https://doi.org/10.1016/j.neubiorev.2023.105139>.
- Nagel, T., 1974. What Is It Like to Be a Bat. *Philos. Rev.* 83 (4), 435–450. <https://doi.org/10.2307/2183914>.
- Nave, K., 2023. *A Drive to Survive: The free energy principle and the meaning of life (draft)*. PsyArXiv. <https://doi.org/10.31234/osf.io/ds9mn>.
- Neal, R.M., 2012. *Bayesian Learning for Neural Networks*. Springer Science & Business Media.
- Neander, K., 1995. Misrepresenting & Malfunctioning. *Philos. Stud.: Int. J. Philos. Anal. Tradit.* 79 (2), 109–141.
- Neimeyer, R.A., Klass, D., Dennis, M.R., 2014. A social constructionist account of grief: Loss and the narration of meaning. *Death Stud.* 38 (6–10), 485–498. <https://doi.org/10.1080/07481187.2014.913454>.



- Neiss, R., 1988. Reconceptualizing arousal: psychobiological states in motor performance. *Psychol. Bull.* 103 (3), 345–366. <https://doi.org/10.1037/0033-2909.103.3.345>.
- Neisser, U., 1963. The Imitation of Man by Machine: the view that machines will think as man does reveals misunderstanding of the nature of human thought. *Science* 139 (3551), 193–197. <https://doi.org/10.1126/science.139.3551.193>.
- Nelkin, N., 1989. Unconscious sensations. *Philos. Psychol.* 2 (2), 129–141. <https://doi.org/10.1080/09515088908572969>.
- Nesse, R.M., 1990. Evolutionary explanations of emotions. *Hum. Nat.* 1 (3), 261–289. <https://doi.org/10.1007/BF02733986>.
- Newen, A., Bruin, L.D., Gallagher, S., Newen, A., Bruin, L.D., Gallagher, S. (Eds.), 2018. *The Oxford Handbook of 4E Cognition*. Oxford University Press.
- Newton, I., 1999. *The Principia: Mathematical principles of natural philosophy*. Univ of California Press, Berkeley.
- Niv, Y., Daw, N.D., Joel, D., Dayan, P., 2007. Tonic dopamine: opportunity costs and the control of response vigor. *Psychopharmacology* 191 (3), 507–520. <https://doi.org/10.1007/s00213-006-0502-4>.
- Norman, D., 2002. Emotion & design: attractive things work better. *Interactions* 9 (4), 36–42. <https://doi.org/10.1145/543434.543435>.
- Norman, D.A., 2013. *The Design of Everyday Things*. MIT Press.
- Notturmo, M.A., Popper, K., 2014. *Myth Framew.: Def. Sci. Ration.*
- Nummenmaa, L., Hari, R., Hietanen, J.K., Glerean, E., 2018. Maps of subjective feelings. *Proc. Natl. Acad. Sci.* 115 (37), 9198–9203. <https://doi.org/10.1073/pnas.1807390115>.
- O'Regan, J.K., Noë, A., 2001. A sensorimotor account of vision and visual consciousness. *Behav. Brain Sci.* 24 (5), 939–973. <https://doi.org/10.1017/S0140525X01000115>.
- Oatley, K., Johnson-Laird, P.N., 2014. Cognitive approaches to emotions. *Trends Cogn. Sci.* 18 (3), 134–140. <https://doi.org/10.1016/j.tics.2013.12.004>.
- Ochsner, K.N., Gross, J.J., 2005. Putting the 'I' and the 'Me' in emotion regulation: Reply to Northoff. *Trends Cogn. Sci.* 9 (9), 409–410. <https://doi.org/10.1016/j.tics.2005.06.004>.
- Ochsner, K.N., Phelps, E., 2007. Emerging perspectives on emotion-cognition interactions. *Trends Cogn. Sci.* 11 (8), 317–318. <https://doi.org/10.1016/j.tics.2007.06.008>.
- Oishi, S., Choi, H., Koo, M., Galinha, I., Ishii, K., Komiya, A., Luhmann, M., Scollon, C., Shin, J., Lee, H., Suh, E.M., Vittersø, J., Heintzelman, S.J., Kushlev, K., Westgate, E. C., Buttrick, N., Tucker, J., Ebersole, C.R., Axt, J., Besser, L.L., 2020. Happiness, Meaning, and Psychological Richness. *Affect. Sci.* 1 (2), 107–115. <https://doi.org/10.1007/s42761-020-00011-z>.
- Okon-Singer, H., Hendler, T., Pessoa, L., Shackman, A.J., 2015. The neurobiology of emotion-cognition interactions: Fundamental questions and strategies for future research. *Front. Hum. Neurosci.* 9. <https://www.frontiersin.org/articles/10.3389/fnhum.2015.00058>.
- Omrato, M.D., Phillips, E., 2021. The mind of the hungry agent: hunger, affect and appetite. *Topoi* 40 (3), 517–526. <https://doi.org/10.1007/s11245-020-09733-y>.
- Ormerod, R.J., 2009. The history and ideas of critical rationalism: the philosophy of Karl Popper and its implications for OR. *J. Oper. Res. Soc.* 60, 441–460.
- Ortony, A., 1988. Are emotion metaphors conceptual or lexical. *Cogn. Emot.* 2 (2), 95–104. <https://doi.org/10.1080/02699938808408066>.
- Oxford English Dictionary. (2023). -ome, comb. Form. Oxford University Press; Oxford English Dictionary. <https://doi.org/10.1093/OED/7066684522>.
- Pace-Schott, E.F., Amole, M.C., Aue, T., Balconi, M., Bylsma, L.M., Critchley, H., Demaree, H.A., Friedman, B.H., Gooding, A.E.K., Gosseries, O., Jovanovic, T., Kirby, L.A.J., Kozłowska, K., Laureys, S., Lowe, L., Magee, K., Marin, M.-F., Merner, A.R., Robinson, J.L., VanElzakker, M.B., 2019. Physiological feelings (this issue). *Neurosci. Biobehav. Rev.* 103, 267–304. <https://doi.org/10.1016/j.neubiorev.2019.05.002>.
- Pacherie, E., 2007. The sense of control and the sense of agency. *Psyche* 13 (1), 1.
- Pacherie, E., 2008. The phenomenology of action: a conceptual framework. *Cognition* 107 (1), 179–217. <https://doi.org/10.1016/j.cognition.2007.09.003>.
- Pak, J.H., 2021. Toward Understanding the Psychology of Emotion, Indigenous Spirituality and Christianity in Korea. In: Dueck, A. (Ed.), *Indigenous Psychology of Spirituality: In My Beginning is My End*. Springer International Publishing, pp. 203–225. [https://doi.org/10.1007/978-3-030-50869-2\\_9](https://doi.org/10.1007/978-3-030-50869-2_9).
- Palacios, E.R., Razi, A., Parr, T., Kirchhoff, M., Friston, K., 2020. On Markov blankets and hierarchical self-organisation. *J. Theor. Biol.* 486, 110089 <https://doi.org/10.1016/j.jtbi.2019.110089>.
- Panksepp, J., 1998. The periconscious substrates of consciousness: Affective states and the evolutionary origins of the self. *Journal of consciousness studies* 5 (5-6), 566–582.
- Panksepp, J., 2004. *Affective Neuroscience: The Foundations of Human and Animal Emotions*. Oxford University Press, USA.
- Panksepp, J., 2005. Affective consciousness: core emotional feelings in animals and humans. *Conscious. Cogn.* 14 (1), 30–80. <https://doi.org/10.1016/j.concog.2004.10.004>.
- Panksepp, J., 2008. The affective brain and core consciousness: How does neural activity generate emotional feelings? In *Handbook of emotions*, 3rd ed. The Guilford Press, pp. 47–67.
- Panksepp, J., 2010. Affective neuroscience of the emotional BrainMind: Evolutionary perspectives and implications for understanding depression. *Dialog. Clin. Neurosci.* 12 (4), 533–545. <https://doi.org/10.31887/DCNS.2010.12.4/jpanksepp>.
- Panksepp, J., Watt, D., 2011. What is basic about basic emotions? Lasting lessons from affective neuroscience. *Emot. Rev.* 3 (4), 387–396. <https://doi.org/10.1177/1754073911410741>.
- Paolo, E.D., Buhrmann, T., Barandiaran, X., 2017. *Sensorimotor Life: An enactive proposal*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780198786849.001.0001>.
- Papineau, D., 1984. Representation and Explanation. *Philos. Sci.* 51 (4), 550–572.
- Parkes, C.M., 2013. *Love and Loss: The Roots of Grief and its Complications*. Routledge.
- Parr, T., Pezzulo, G., Friston, K.J., 2022. Active Inference: The Free Energy Principle in *Mind, Brain, and Behavior*. MIT Press.
- Paterson, R.J., Neufeld, R.W., 1987. Clear danger: situational determinants of the appraisal of threat. *Psychol. Bull.* 101 (3), 404–416. <https://doi.org/10.1037/0033-2909.101.3.404>.
- Paul, E.S., Sher, S., Tamietto, M., Winkielman, P., Mendl, M.T., 2020. Towards a comparative science of emotion: Affect and consciousness in humans and animals. *Neuroscience & Biobehavioral Reviews* 108, 749–770. <https://doi.org/10.1016/j.neubiorev.2019.11.014>.
- Paul, L.A., 2012. Metaphysics as modeling: the handmaiden's tale. *Philos. Stud.* 160, 1–29.
- Peacocke, C. (2006). *Mental Action and Self-Awareness*. <https://philpapers.org/ec/PEAMAA>.
- Pereira, A., 2021. Developing the concepts of homeostasis, homeorhesis, allostasis, elasticity, flexibility and plasticity of brain function. *Article 4 NeuroSci* 2 (4). <https://doi.org/10.3390/neurosci2040027>.
- Pernau, M., 2021. Studying emotions in South Asia. *South Asian Hist. Cult.* 12 (2–3), 111–128. <https://doi.org/10.1080/19472498.2021.1878788>.
- Perniss, P., Vigliocco, G., 2014. The bridge of iconicity: from a world of experience to the experience of language. *Philos. Trans. R. Soc. B: Biol. Sci.* 369 (1651), 20130300. <https://doi.org/10.1098/rstb.2013.0300>.
- Pessiglione, M., Heerema, R., Daunizeau, J., Vinckier, F., 2023. Origins and consequences of mood flexibility: a computational perspective. *Neurosci. Biobehav. Rev.* 147, 105084 <https://doi.org/10.1016/j.neubiorev.2023.105084>.
- Peters, A., McEwen, B.S., Friston, K., 2017. Uncertainty and stress: why it causes diseases and how it is mastered by the brain. *Prog. Neurobiol.* 156, 164–188. <https://doi.org/10.1016/j.pneurobio.2017.05.004>.
- Petzschner, F.H., Weber, L.A.E., Gard, T., Stephan, K.E., 2017. Computational psychomatics and computational psychiatry: toward a joint framework for differential diagnosis. *Biol. Psychiatry* 82 (6), 421–430. <https://doi.org/10.1016/j.biopsych.2017.05.012>.
- Pezzulo, G., Levin, M., 2016. Top-down models in biology: explanation and control of complex living systems above the molecular level. *Journal of The Royal Society Interface* 13 (124), 20160555.
- Pezzulo, G., Rigoli, F., Friston, K., 2015. Active Inference, homeostatic regulation and adaptive behavioural control. *Prog. Neurobiol.* 134, 17–35. <https://doi.org/10.1016/j.pneurobio.2015.09.001>.
- Pezzulo, G., Parr, T., Friston, K., 2021. The evolution of brain architectures for predictive coding and active inference. *Philos. Trans. R. Soc. B: Biol. Sci.* 377 (1844), 20200531. <https://doi.org/10.1098/rstb.2020.0531>.
- Pezzulo, G., Parr, T., Friston, K., 2022. The evolution of brain architectures for predictive coding and active inference. *Philosophical Transactions of the Royal Society B* 377 (1844), 20200531.
- Pfeifer, R., Bongard, J., 2006. *How the Body Shapes the Way We Think: A New View of Intelligence*. The MIT Press. <https://doi.org/10.7551/mitpress/3585.001.0001>.
- Pham, M.T., 1998. Representativeness, relevance, and the use of feelings in decision making. *Journal of consumer research* 25 (2), 144–159.
- Picard, R.W., 2000. *Affective Computing*. MIT Press. <https://doi.org/10.7551/mitpress/1140.001.0001>.
- Pinker, S., 2010. The cognitive niche: coevolution of intelligence, sociality, and language. *Proc. Natl. Acad. Sci.* 107 (supplement\_2), 8993–8999. <https://doi.org/10.1073/pnas.0914630107>.
- Piredda, G., 2020. What is an affective artifact? A further development in situated affectivity. *Phenomenology and the Cognitive Sciences* 19, 549–567.
- Pitcher, G., 1965. Emotion. *Mind* 74 (295), 326–346.
- Pitt, D., 2004. The phenomenology of cognition or “what is it like to think that P?”. *Philos. Phenomenol. Res.* 69 (1), 1–36.
- Plutchik, R., 1982. A psychoevolutionary theory of emotions. *Soc. Sci. Inf. /Sur Les. Sci. Soc.* 21 (4–5), 529–553. <https://doi.org/10.1177/053901882021004003>.
- Plutchik, R., Kellerman, H., 2013. *Theories of Emotion*. Academic Press.
- Podilchak, W., 1991. Distinctions of fun, enjoyment and leisure. *Leis. Stud.* 10 (2), 133–148. <https://doi.org/10.1080/02614369100390131>.
- Poincaré, H., 2022. *The foundations of science: Science and hypothesis, the value of science, science and method*. DigiCat.
- Popper, K.R., 1963. Science as falsification. *Conjectures Refutations* 1 (1963), 33–39.
- Porges, S.W., 1997. Emotion: an evolutionary by-product of the neural regulation of the autonomic nervous system. *Ann. N. Y. Acad. Sci.* 807 (1 Integrative N), 62–77. <https://doi.org/10.1111/j.1749-6632.1997.tb51913.x>.
- Poria, S., Cambria, E., Bajpai, R., Hussain, A., 2017. A review of affective computing: from ambient analysis to multimodal fusion. *Inf. Fusion* 37, 98–125. <https://doi.org/10.1016/j.inffus.2017.02.003>.
- Port, R.F., Van Gelder, T., 1995. *Mind as Motion: Explorations in the Dynamics of Cognition*. MIT Press.
- Posner, J., Russell, J.A., Peterson, B.S., 2005. The circumplex model of affect: an integrative approach to affective neuroscience, cognitive development, and psychopathology. *Dev. Psychopathol.* 17 (3), 715–734. <https://doi.org/10.1017/S0954579405050340>.
- Pribram, K.H., McGuinness, D., 1975. Arousal, activation, and effort in the control of attention. *Psychol. Rev.* 82 (2), 116–149. <https://doi.org/10.1037/h0076780>.
- Price, C., 2006. Affect without object: Moods and objectless emotions. *Eur. J. Anal. Philos.* 2 (1), Article 1.



- Prokopenko, M., Boschetti, F., Ryan, A.J., 2009. An information-theoretic primer on complexity, self-organization, and emergence. *Complexity* 15 (1), 11–28. <https://doi.org/10.1002/cplx.20249>.
- Pugmire, D., 1998. *Rediscovering Emotion: Emotion and the Claims of Feeling*, first ed. Edinburgh University Press.
- Pylyshyn, Z.W., 1986. *Computation and cognition: Toward a foundation for cognitive science*, 292. The MIT Press, p. xxiii.
- Quadt, L., Critchley, H.D., Garfinkel, S.N., 2018. The neurobiology of interoception in health and disease. *Ann. N. Y. Acad. Sci.* 1428 (1), 112–128. <https://doi.org/10.1111/nyas.13915>.
- Quadt, L., Critchley, H., Nagai, Y., 2022. Cognition, emotion, and the central autonomic network. *Auton. Neurosci.: Basic Clin.* 238, 102948 <https://doi.org/10.1016/j.autneu.2022.102948>.
- Raber, J., Arzy, S., Bertolus, J.B., Depue, B., Haas, H.E., Hofmann, S.G., Kangas, M., Kensinger, E., Lowry, C.A., Marusak, H.A., Minnier, J., Mouly, A.-M., Mühlberger, A., Norrholm, S.D., Peltonen, K., Pinna, G., Rabinak, C., Shiban, Y., Soreq, H., Boutros, S.W., 2019. Current understanding of fear learning and memory in humans and animal models and the value of a linguistic approach for analyzing fear learning and memory in humans (this issue). *Neurosci. Biobehav. Rev.* 105, 136–177. <https://doi.org/10.1016/j.neubiorev.2019.03.015>.
- Railton, P., 2017. At the core of our production and functionality. Synthesecapacity to act for a reason: the affective system and evaluative model-based learning and control. *Emot. Rev.* 9 (4), 335–342. <https://doi.org/10.1177/1754073916670021>.
- Ramstead, M.J., Kirchhoff, M.D., Friston, K.J., 2020. A tale of two densities: active inference is enactive inference. *Adapt. Behav.* 28 (4), 225–239. <https://doi.org/10.1177/1059712319862774>.
- Rapaport, W.J., 2012. Semiotic systems, computers, and the mind: how cognition could be computing. *Int. J. Signs Semiot. Syst.* 2 (1), 32–71. <https://doi.org/10.4018/IJSS.2012010102>.
- Reuter, K., forthcoming. Experimental Philosophy of Consciousness, in: Nichols, S., Knobe, J. (Eds.), *Oxford Studies of Consciousness*. Oxford University Press.
- Reyes, J., 2015. Loób and kapwa: an introduction to a filipino virtue ethics. *Asian Philos.* 25 (2), 148–171. <https://doi.org/10.1080/09552367.2015.1043173>.
- Ringstrom, T.J., 2022. *Reward is not necessary: how to create a compositional self-preserving agent for life-long learning* (arXiv:2211.10851). arXiv. <https://doi.org/10.48550/arXiv.2211.10851>.
- Robbins, T.W., 1997. Arousal systems and attentional processes. *Biol. Psychol.* 45 (1–3), 57–71. [https://doi.org/10.1016/s0301-0511\(96\)05222-2](https://doi.org/10.1016/s0301-0511(96)05222-2).
- Robbins, T.W., Everitt, B.J., 1995. Arousal systems and attention. In *The cognitive neurosciences*. The MIT Press, pp. 703–720.
- Robinson, M.D., Clore, G.L., 2002. Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychol. Bull.* 128 (6), 934–960. <https://doi.org/10.1037/0033-2909.128.6.934>.
- Roediger, H.L., 1990. Implicit memory: retention without remembering. *Am. Psychol.* 45 (9), 1043–1056. <https://doi.org/10.1037/0003-066X.45.9.1043>.
- Roessler, J., Eilan, N., 2003. *Agency and Self-Awareness: Issues in Philosophy and Psychology*. Oxford University Press.
- Roseman, I.J., Smith, C.A., 2001. Appraisal theory: overview, assumptions, varieties, controversies. In: *Appraisal processes in emotion: Theory, methods, research*. Oxford University Press, pp. 3–19.
- Rosenblueth, A., Wiener, N., Bigelow, J., 1943. Behavior, Purpose and Teleology. *Philos. Sci.* 10 (1), 18–24. <https://doi.org/10.1086/286788>.
- Rosenthal, D., 2019. Consciousness and confidence. *Neuropsychologia* 128, 255–265. <https://doi.org/10.1016/j.neuropsychologia.2018.01.018>.
- Rosenthal, D.M., 1991. The independence of consciousness and sensory quality. *Philos. Issues* 1, 15–36. <https://doi.org/10.2307/1522921>.
- Rosker, J.S., 2021. *Interpreting Chinese Philosophy: A New Methodology*. Bloomsbury Publishing.
- Roth, W.-M., Jornet, A., 2013. Situated cognition. *WIREs Cogn. Sci.* 4 (5), 463–478. <https://doi.org/10.1002/wcs.1242>.
- Rotter, J.B., 1966. Generalized expectancies for internal versus external control of reinforcement. *Psychol. Monogr.: Gen. Appl.* 80 (1), 1–28. <https://doi.org/10.1037/h0092976>.
- Roy, M., Shohamy, D., Daw, N., Jepma, M., Wimmer, G.E., Wager, T.D., 2014. Representation of aversive prediction errors in the human periaqueductal gray. *Nature neuroscience* 17 (11), 1607–1612.
- Ruiz-Mirazo, K., Moreno, A., 2012. Autonomy in evolution: From minimal to complex life. *Synthese* 185 (1), 21–52. <https://doi.org/10.1007/s11229-011-9874-z>.
- Russell, B., 1905. On denoting. *Mind* 14 (56), 479–493.
- Russell, J.A., 1980. A circumplex model of affect. *Journal of personality and social psychology* 39 (6), 1161.
- Russell, J.A., 2003. Core affect and the psychological construction of emotion. *Psychol. Rev.* 110 (1), 145–172. <https://doi.org/10.1037/0033-295X.110.1.145>.
- Russell, J.A., Weiss, A., Mendelsohn, G.A., 1989. Affect Grid: a single-item scale of pleasure and arousal. *J. Personal. Soc. Psychol.* 57 (3), 493–502. <https://doi.org/10.1037/0022-3514.57.3.493>.
- Rutledge, R.B., Skandali, N., Dayan, P., Dolan, R.J., 2014. A computational and neural model of momentary subjective well-being. *Proc. Natl. Acad. Sci.* 111 (33), 12252–12257. <https://doi.org/10.1073/pnas.1407535111>.
- Ryan, O., Dablander, F., Haslbeck, J., 2023. Towards a generative model for emotion dynamics. *PsyArXiv*. <https://doi.org/10.31234/osf.io/x52ns>.
- Sajid, N., Ball, P.J., Parr, T., Friston, K.J., 2021. Active inference: demystified and compared. *Neural Comput.* 33 (3), 674–712. [https://doi.org/10.1162/neco\\_a\\_01357](https://doi.org/10.1162/neco_a_01357).
- Sander, D., Scherer, K., 2014. *Oxford Companion to Emotion and the Affective Sciences*. OUP, Oxford.
- Sander, D., Grafman, J., Zalla, T., 2003. The human amygdala: An evolved system for relevance detection. *Rev. Neurosci.* 14 (4), 303–316. <https://doi.org/10.1515/revneuro.2003.14.4.303>.
- Sander, D., Grandjean, D., Scherer, K.R., 2005. A systems approach to appraisal mechanisms in emotion. *Neural Netw.* 18 (4), 317–352. <https://doi.org/10.1016/j.neunet.2005.03.001>.
- Sartre, J.-P., 2022. *Being and Nothingness: An Essay in Phenomenological Ontology*. Taylor & Francis.
- Satpute, A.B., Lindquist, K.A., 2021. At the neural intersection between language and emotion. *Affect. Sci.* 2 (2), 207–220. <https://doi.org/10.1007/s42761-021-00032-2>.
- Satpute, A.B., Nook, E.C., Cakar, M.E., 2020. The role of language in the construction of emotion and memory: A predictive coding view. In *Neuroscience of enduring change: Implications for psychotherapy*. Oxford University Press, pp. 56–88. <https://doi.org/10.1093/oso/9780190881511.003.0004>.
- Satpute, A.B., Kragel, P.A., Barrett, L.F., Wager, T.D., Bianciardi, M., 2019. Deconstructing arousal into wakeful, autonomic and affective varieties. *Neurosci. Lett.* 693, 19–28. <https://doi.org/10.1016/j.neulet.2018.01.042>.
- Saxe, R., 2006. Uniquely human social cogSemiotic systems, computers, and thenition. *Curr. Opin. Neurobiol.* 16 (2), 235–239. <https://doi.org/10.1016/j.conb.2006.03.001>.
- Scarantino, A., 2015. Basic emotions, psychological construction, and the problem of variability, in: *The Psychological Construction of Emotion*. The Guilford Press, New York, NY, US, pp. 334–376.
- Scarantino, A., 2012. *How to define emotions scientifically*. *Emot. Rev.* 4 (4), 358–368.
- Scarantino, A., 2014. The motivational theory of emotions. In *Moral psychology and human agency: Philosophical essays on the science of ethics*. Oxford University Press, pp. 156–185. <https://doi.org/10.1093/acprof:oso/9780198717812.003.0008>.
- Scarantino, A., 2016. The philosophy of emotions and its impact on affective science. *Handb. Emot.* 4, 3–48.
- Scarantino, A., 2017. How to do things with emotional expressions: the theory of affective pragmatics. *Psychol. Inq.* 28 (2–3), 165–185. <https://doi.org/10.1080/1047840X.2017.1328951>.
- Scherer, K.R., 1982a. Emotion as a process: function, origin and regulation. *Soc. Sci. Inf.* 21 (4–5), 555–570. <https://doi.org/10.1177/053901882021004004>.
- Scherer, K.R., 1982b. The nature and function of emotion. *Soc. Sci. Inf.* 21 (4–5), 507–509. <https://doi.org/10.1177/053901882021004001>.
- Scherer, K.R., 1984. Emotion as a multicomponent process: A model and some cross-cultural data. *Review of Personality & Social Psychology* 5, 37–63.
- Scherer, K.R., 2005. What are emotions? And how can they be measured? *Soc. Sci. Inf.* 44 (4), 695–729.
- Scherer, K.R., 2009. The dynamic architecture of emotion: evidence for the component process model. *Cogn. Emot.* 23 (7), 1307–1351. <https://doi.org/10.1080/02699930902928969>.
- Scherer, K.R., Coutinho, E., 2013. How music creates emotion: a multifactorial process approach. In: Cochrane, T., Fantini, B., Scherer, K.R. (Eds.), *The Emotional Power of Music: Multidisciplinary perspectives on musical arousal, expression, and social control*. Oxford University Press, p. 0. <https://doi.org/10.1093/acprof:oso/9780199654888.003.0010>.
- Scherer, K.R., Moors, A., 2019. The emotion process: event appraisal and component differentiation. *Annu. Rev. Psychol.* 70, 719–745. <https://doi.org/10.1146/annurev-psych-122216-011854>.
- Scherer, K.R., Bänziger, T., Roesch, E., 2010. *A Blueprint for Affective Computing: A Sourcebook and Manual*. OUP Oxford.
- Schindler, S., 2018. *Theoretical virtues in science: Uncovering reality through theory*. Cambridge University Press.
- Schlosser, G., 1998. Self-reproduction and functionality. *Synthese* 116 (3), 303–354. <https://doi.org/10.1023/A:1005073307193>.
- Schuler, G.D., Boguski, M.S., Stewart, E.A., Stein, L.D., Gyapay, G., Rice, K., White, R.E., Rodriguez-Tomé, P., Aggarwal, A., Bajorek, E., Bentolila, S., Birren, B.B., Butler, A., Castle, A.B., Chiannikulchai, N., Chu, A., Clee, C., Cowles, S., Day, P.J.R., Hudson, T.J., 1996. A gene map of the human genome. *Science* 274 (5287), 540–546. <https://doi.org/10.1126/science.274.5287.540>.
- Schulkin, J., 2011. Social allostasis: anticipatory regulation of the internal milieu. *Frontiers in evolutionary neuroscience* 2, 111.
- Schulkin, J., Sterling, P., 2019. Allostasis: a brain-centered, predictive mode of physiological regulation. *Trends Neurosci.* 42 (10), 740–752. <https://doi.org/10.1016/j.tins.2019.07.010>.
- Schwarz, N., 1999. Self-reports: how the questions shape the answers. *Am. Psychol.* 54 (2), 93–105. <https://doi.org/10.1037/0003-066X.54.2.93>.
- Schwarz, N., 2012. Feelings-as-information theory. *Handb. Theor. Soc. Psychol.* 1, 289–308.
- Schwarz, N., Clore, G.L., 1983. Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *J. Personal. Soc. Psychol.* 45 (3), 513.
- Schwarz, N., Clore, G.L., 1996. Feelings and phenomenal experiences. In: *Social psychology: Handbook of basic principles*. The Guilford Press, pp. 433–465.
- Schwarz, N., Strack, F., 1999. Reports of subjective well-being: judgmental processes and their methodological implications. In *Well-being: The foundations of hedonic psychology*. Russell Sage Foundation, pp. 61–84.
- Schwarz, N., Clore, G.L., 2003. Mood as Information: 20 Years Later. *Psychol. Inq.* 14 (3–4), 296–303. <https://doi.org/10.1080/1047840X.2003.9682896>.
- Schwarz, N., Clore, G.L., 2007. Feelings and phenomenal experiences, in: *Social Psychology: Handbook of Basic Principles*, 2nd Ed. The Guilford Press, New York, NY, US, pp. 385–407.

- Schwarz, N., Clore, G., 1988. How do I feel about it? Informative functions of affective states, in: *Affect, Cognition, and Social Behavior: New Evidence and Integrative Attempts*. C.J. Hogrefe, Toronto, pp. 44–62.
- Seager, W., 1999. Conscious intentionality. In: Fiset, D. (Ed.), *Consciousness and Intentionality: Models and Modalities of Attribution*. Springer, Netherlands, pp. 33–49. [https://doi.org/10.1007/978-94-015-9193-5\\_2](https://doi.org/10.1007/978-94-015-9193-5_2).
- Searle, J.R., 1983. *Intentionality: An Essay in the Philosophy of Mind*. Cambridge University Press.
- Searle, J.R., 1992, 1st ed.. *The Rediscovery of the Mind*. Bradford Books, Cambridge, MA.
- Sebeok, T.A., 2001. *Signs: An Introduction to Semiotics*. University of Toronto Press.
- Sel, A., 2014. Predictive codes of interoception, emotion, and the self. *Front. Psychol.* 5. <https://www.frontiersin.org/articles/10.3389/fpsyg.2014.00189>.
- Sennesh, E., Theriault, J., Brooks, D., van de Meent, J.-W., Barrett, L.F., Quigley, K.S., 2022. Interoception as modeling, allostasis as control. *Biol. Psychol.* 167, 108242. <https://doi.org/10.1016/j.biopsycho.2021.108242>.
- Sequeira, P., Melo, F.S., Paiva, A., 2011. Emotion-Based Intrinsic Motivation for Reinforcement Learning Agents. In: D'Mello, S., Graesser, A., Schuller, B., Martin, J.-C. (Eds.), *Affective Computing and Intelligent Interaction, Lecture Notes in Computer Science*. Springer, Berlin, Heidelberg, pp. 326–336. [https://doi.org/10.1007/978-3-642-24600-5\\_36](https://doi.org/10.1007/978-3-642-24600-5_36).
- Seth, A.K., 2013. Interoceptive inference, emotion, and the embodied self. *Trends Cogn. Sci.* 17 (1), 565–573. <https://doi.org/10.1016/j.tics.2013.09.007>.
- Seth, A.K., Friston, K.J., 2016. Active interoceptive inference and the emotional brain. *Philos. Trans. R. Soc. B: Biol. Sci.* 371 (1708), 20160007. <https://doi.org/10.1098/rstb.2016.0007>.
- Shargel, D., Prinz, J., 2017. An Enactivist Theory of Emotional Content. In: Teroni, F., Naar, H. (Eds.), *The Ontology of Emotions*. Cambridge University Press, pp. 110–129. <https://doi.org/10.1017/9781316275221.007>.
- Shear, K., Shair, H., 2005. Attachment, loss, and complicated grief. *Dev. Psychobiol.* 47 (3), 253–267. <https://doi.org/10.1002/dev.20091>.
- Shiffman, S., Stone, A., Hufford, M., 2008. Ecological momentary assessment. *Annu. Rev. Clin. Psychol.* 4, 1–32. <https://doi.org/10.1146/annurev.clinpsy.3.022806.091415>.
- Shin, L.M., Liberzon, I., 2010. The neurocircuitry of fear, stress, and anxiety disorders. Article 1 *Neuropsychopharmacology* 35 (1). <https://doi.org/10.1038/npp.2009.83>.
- Shoemaker, S., 2003. *Identity, Cause, and Mind: Philosophical Essays*. Oxford University Press.
- Siddharthan, A., Cherbuin, N., Eslinger, P.J., Kozłowska, K., Murphy, N.A., Lowe, L., 2018. *WordNet-feelings: a linguistic categorisation of human feelings* (arXiv: 1811.02435). arXiv. <https://doi.org/10.48550/arXiv.1811.02435>.
- Siewert, C., 2012. On the Phenomenology of Introspection. In: Smithies, D., Stoljar, D. (Eds.), *Introspection and Consciousness*. Oxford University Press, p. 0. <https://doi.org/10.1093/acprof:oso/9780199744794.003.0005>.
- Siewert, C.P., 1998. *The Significance of Consciousness*. Princeton University Press. <https://www.jstor.org/stable/j.ct7sjtf>.
- Silva, L., 2021. Anger and its desires. *Eur. J. Philos.* 29 (4), 1115–1135. <https://doi.org/10.1111/ejop.12628>.
- Silva, L., 2023. Towards an affective quality space. *J. Conscious. Stud.* 30 (7–8), 164–195. <https://doi.org/10.53765/20512201.30.7.164>.
- Silvia, P.J., 2005. Cognitive appraisals and interest in visual art: exploring an appraisal theory of aesthetic emotions. *Empir. Stud. Arts* 23 (2), 119–133. <https://doi.org/10.2190/12AV-AH2P-MCEH-289E>.
- Silvia, P.J., 2008. Interest: the curious emotion. *Curr. Dir. Psychol. Sci.* 17 (1), 57–60.
- Simon, H.A., 1967. Motivational and emotional controls of cognition. *Psychol. Rev.* 74 (1), 29–39. <https://doi.org/10.1037/h0024127>.
- Slaby, J., Wüschner, P., 2014. Emotion and agency. In: Roeser, S., Todd, C. (Eds.), *Emotion and Value*. Oxford University Press, p. 0. <https://doi.org/10.1093/acprof:oso/9780199686094.003.0014>.
- Smith, A., 2006. Cognitive empathy and emotional empathy in human behavior and evolution. *Psychol. Rec.* 56 (1), 3–21. <https://doi.org/10.1007/BF03395534>.
- Smith, R., Parr, T., Friston, K.J., 2019. Simulating emotions: an active inference model of emotional state inference and emotion concept learning. *Front. Psychol.* 10, 2844. <https://doi.org/10.3389/fpsyg.2019.02844>.
- Smith, R., Badcock, P., Friston, K.J., 2021. Recent advances in the application of predictive coding and active inference models within clinical neuroscience. *Psychiatry Clin. Neurosci.* 75 (1), 3–13. <https://doi.org/10.1111/pcn.13138>.
- Smith, R., Varshney, L.R., Nagayama, S., Kazama, M., Kitagawa, T., Ishikawa, Y., 2022. A computational neuroscience perspective on subjective wellbeing within the active inference framework. Article 4 *Int. J. Wellbeing* 12 (4). <https://doi.org/10.5502/ijw.v12i4.2659>.
- Sober, E., 2015. *Ockham's razors*. Cambridge University Press.
- Solomon, R.C., 1978. Emotions and anthropology: the logic of emotional world views. *Inquiry* 21 (1–4), 181–199. <https://doi.org/10.1080/00201747808601841>.
- Solomon, R.C., 1993. *The Passions: Emotions and the Meaning of Life*. Hackett Publishing.
- Solomon, R.C., 2008. The philosophy of emotions. In *Handbook of emotions*, 3rd ed., The Guilford Press, pp. 3–16.
- Soteriou, M., 2013. *The Mind's Construction: The Ontology of Mind and Mental Action*. OUP, Oxford.
- Sporns, O., Tononi, G., Kötter, R., 2005. The human connectome: a structural description of the human brain. *PLoS Comput. Biol.* 1 (4), e42.
- Stefanova, E., Dubljevic, O., Herbert, C., Fairfield, B., Schroeter, M.L., Stern, E.R., Urben, S., Derntl, B., Wiebking, C., Brown, C., Drach -Zahavy, A., Kathrin Loeffler, L. A., Albrecht, F., Palumbo, R., Boutros, S.W., Raber, J., Lowe, L., 2020. Anticipatory feelings: neural correlates and linguistic markers (this issue). *Neurosci. Biobehav. Rev.* 113, 308–324. <https://doi.org/10.1016/j.neubiorev.2020.02.015>.
- Stein, N.L., Trabasso, T., Liwag, M., 1993. The representation and organization of emotional experience: unfolding the emotion episode. In *Handbook of emotions*. The Guilford Press., pp. 279–300.
- Stephan, A., Walter, S., 2020. Situated affectivity. In: Szanto, T., Landwehr, H. (Eds.), *The Routledge Handbook of Phenomenology of Emotion*, 1st ed. Routledge, pp. 299–311. <https://doi.org/10.4324/9781315180786-29>.
- Stephan, K.E., Manjaly, Z.M., Mathys, C.D., Weber, L.A.E., Paliwal, S., Gard, T., Tittgemeyer, M., Fleming, S.M., Haker, H., Seth, A.K., Petzschner, F.H., 2016. Allostatic self-efficacy: a metacognitive theory of dyshomeostasis-induced fatigue and depression. *Front. Hum. Neurosci.* 10. <https://www.frontiersin.org/articles/10.3389/fnhum.2016.00550>.
- Sterling, P., 2012. Allostasis: a model of predictive regulation. *Physiol. Behav.* 106 (1), 5–15. <https://doi.org/10.1016/j.physbeh.2011.06.004>.
- Sterling, P., 2020. *What Is Health?: Allostasis and the Evolution of Human Design*. MIT Press.
- Sterling, P., Eyer, J., 1988. Allostasis: A new paradigm to explain arousal pathology. In *Handbook of life stress, cognition and health*. John Wiley & Sons., pp. 629–649.
- Sterling, P., Laughlin, S., 2015. *Principles of Neural Design*. MIT Press.
- Stewart, J., 2010. Foundational Issues in Enaction as a Paradigm for Cognitive Science: From the Origin of Life to Consciousness and Writing. In: Stewart, J., Gapenne, O., Di Paolo, E.A. (Eds.), *Enaction: Toward a New Paradigm for Cognitive Science*. The MIT Press, p. 0. <https://doi.org/10.7551/mitpress/9780262014601.003.0002>.
- Stillings, N.A., Chase, C.H., Weisler, S.E., Feinstein, M.H., Rissland, E.L., 1995. *Cognitive Science: An Introduction*. MIT Press.,.
- Storbeck, J., Clore, G.L., 2007. On the interdependence of cognition and emotion. *Cogn. Emot.* 21 (6), 1212–1237. <https://doi.org/10.1080/02699930701438020>.
- Strack, F., Argyle, M., Schwarz, N. (Eds.), 1991. *Subjective Well-Being: An Interdisciplinary Perspective*, 1st ed. Pergamon Press, Oxford; New York.
- Strawson, G., 2004. Real intentionality. *Phenomenol. Cogn. Sci.* 3 (3), 287–313. <https://doi.org/10.1023/B:PHEN.0000049306.63185.0f>.
- Strevens, M., 2013. No understanding without explanation. *Stud. Hist. Philos. Sci. Part A* 44 (3), 510–515.
- Strigo, I.A., Craig, A.D.B., 2016. Interoception, homeostatic emotions and sympathovagal balance. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 371 (1708), 20160010. <https://doi.org/10.1098/rstb.2016.0010>.
- Sundararajan, L., 2015. *Understanding Emotion in Chinese Culture: Thinking Through Psychology*. Springer.
- Suppes, P., 1969. *Models of Data*. In: Suppes, P. (Ed.), *Studies in the Methodology and Foundations of Science: Selected Papers from 1951 to 1969*. Springer Netherlands, pp. 24–35. [https://doi.org/10.1007/978-94-017-3173-7\\_2](https://doi.org/10.1007/978-94-017-3173-7_2).
- Suri, G., Gross, J.J., 2022. What is an emotion? A connectionist perspective. *Emot. Rev.* 14 (2), 99–110. <https://doi.org/10.1177/17540739221082203>.
- Sutton, R.S., Barto, A.G., 2018. *Reinforcement Learning, second edition: an Introduction*. MIT Press.
- Synofzik, M., Vosgerau, G., Newen, A., 2008. I move, therefore I am: a new theoretical framework to investigate agency and ownership. *Conscious. Cogn.* 17 (2), 411–424. <https://doi.org/10.1016/j.concog.2008.03.008>.
- Synofzik, M., Vosgerau, G., Voss, M., 2013. The experience of agency: an interplay between prediction and postdiction. *Front. Psychol.* 4. <https://www.frontiersin.org/articles/10.3389/fpsyg.2013.00127>.
- Szanto, T., Landwehr, H. (Eds.), 2020. *The Routledge Handbook of Phenomenology of Emotion*. Routledge. <https://doi.org/10.4324/9781315180786>.
- Szycer, D., Lukaszewski, A.W., 2019. The emotion-valuation constellation: Multiple emotions are governed by a common grammar of social valuation. *Evol. Hum. Behav.* 40 (4), 395–404. <https://doi.org/10.1016/j.evolhumbehav.2019.05.002>.
- Tabery, J., 2014. *Beyond Versus: The Struggle to Understand the Interaction of Nature and Nurture*. MIT Press.
- Tabery, J., Preda, A., Longino, H., 2014. Pluralism, social action and the causal space of human behavior. *Metascience* 23 (3), 443–459. <https://doi.org/10.1007/s11016-014-9903-x>.
- Tangney, J.P., Stuewig, J., Mashek, D.J., 2007. Moral emotions and moral behavior. *Annu. Rev. Psychol.* 58, 345–372. <https://doi.org/10.1146/annurev.psych.56.091103.070145>.
- Tapolet, C., 2022. *Philosophy of emotion: A contemporary introduction*. Taylor & Francis.
- Tenenbaum, J.B., Kemp, C., Griffiths, T.L., Goodman, N.D., 2011. How to grow a mind: statistics, structure, and abstraction. *Science* 331 (6022), 1279–1285. <https://doi.org/10.1126/science.1192788>.
- Teoh, Y.Y., Cunningham, W.A., Hutcherson, C.A., 2023. Framing subjective emotion reports as dynamic affective decisions. *Affect. Sci.* <https://doi.org/10.1007/s42761-023-00197-y>.
- Teroni, F., 2007. Emotions and Formal Objects. *Dialectica* 61 (3), 395–415. <https://doi.org/10.1111/j.1746-8361.2007.01108.x>.
- Teroni, F., 2017. The phenomenology of memory. In *The Routledge Handbook of Philosophy of Memory*. Routledge.
- Teroni, F., 2023. Evaluative theories in psychology and philosophy of emotion. *Mind Lang.* 38 (1), 81–97. <https://doi.org/10.1111/mila.12374>.
- Thagard, P., 2005. *Mind, second edition: Introduction to Cognitive Science*. MIT Press.
- Thayer, R.E., 1978. Toward a psychological theory of multidimensional activation (arousal). *Motiv. Emot.* 2 (1), 1–34. <https://doi.org/10.1007/BF00992729>.
- Thelen, E., Smith, L.B., 1994. *A Dynamic Systems Approach to the Development of Cognition and Action*. MIT Press.
- Thompson, E., Lutz, A., Cosmelli, D., 2005. Neurophenomenology: An Introduction for Neurophilosophers. In *Cognition and the brain: The philosophy and neuroscience*

- movement. Cambridge University Press, pp. 40–97. <https://doi.org/10.1017/CBO9780511610608.003>.
- Tomasello, M., 2020. The moral psychology of obligation. *Behav. Brain Sci.* 43, e56 <https://doi.org/10.1017/S0140525X19001742>.
- Tomasello, M., 2022. *The Evolution of Agency: Behavioral Organization from Lizards to Humans*. The MIT Press.
- Tooby, J., Cosmides, L., 1990. On the universality of human nature and the uniqueness of the individual: the role of genetics and adaptation. *J. Personal.* 58 (1), 17–67. <https://doi.org/10.1111/j.1467-6494.1990.tb00907.x>.
- Tooby, J., Cosmides, L., 2008. The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In *Handbook of emotions*, 3rd ed., The Guilford Press, pp. 114–137.
- Trofimova, I., 2018. Functionality versus dimensionality in psychological taxonomies, and a puzzle of emotional valence. *Philos. Trans. R. Soc. B: Biol. Sci.* 373 (1744), 20170167. <https://doi.org/10.1098/rstb.2017.0167>.
- Tsakiris, M., Preester, H.D., 2018. *The Interoceptive Mind: From Homeostasis to Awareness*. Oxford University Press.
- Tschantz, A., Barca, L., Maisto, D., Buckley, C.L., Seth, A.K., Pezzulo, G., 2022. Simulating homeostatic, allostatic and goal-directed forms of interoceptive control using active inference. *Biol. Psychol.* 169, 108266 <https://doi.org/10.1016/j.biopsycho.2022.108266>.
- Tsikandilakis, M., Bali, P., Yu, Z., Karlis, A.-K., Tong, E.M.W., Milbank, A., Mevel, P.-A., Derrfuss, J., Madan, C., 2023. “The many faces of sorrow”: An empirical exploration of the psychological plurality of sadness. *Curr. Psychol.* <https://doi.org/10.1007/s12144-023-04518-z>.
- Tulving, E., 1987. Life after Kant: Natural purposes memory systems and consciousness. *Hum. Neurobiol.* 6 (2), 67–80.
- Tuske, J., 2021. The Concept of Emotion in Classical Indian Philosophy. In: Zalta, E.N. (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2021). Metaphysics Research Lab, Stanford University. <https://plato.stanford.edu/archives/fall2021/entries/concept-emotion-india/>.
- Tye, M., 1995. *Ten Problems of Consciousness: A Representational Theory of the Phenomenal Mind*. MIT Press. <https://doi.org/10.7551/mitpress/6712.001.0001>.
- Tye, M., 2003. *Consciousness and persons: Unity and identity*. MIT Press, Cambridge, MA, US.
- Tye, M., 2014. Transparency, qualia realism and representationalism. *Philos. Stud.* 170 (1), 39–57. <https://doi.org/10.1007/s11098-013-0177-8>.
- Uexküll, J. von, 2013. *A Foray into the Worlds of Animals and Humans: With A Theory of Meaning*. U of Minnesota Press.
- Van de Cruys, S., 2017. Affect. *Value Predict. Mind.* <https://doi.org/10.15502/9783958573253>.
- Van de Cruys, S., Bervoets, J., Moors, A., 2022. Preferences need inferences: Learning, valuation, and curiosity in aesthetic experience. In *The Routledge International Handbook of Neuroaesthetics*. Routledge.
- Van Dyck, E., Burger, B., Orlandou, K., 2017a. The Communication of Emotions in Dance. *The Routledge Companion to Embodied Music Interaction*. <https://doi.org/10.4324/9781315621364-14>.
- Van Fraassen, B.C., 1980. *The scientific image*. Oxford University Press.
- Van Gelder, T., 2022. Chapter Eight: Wooden Iron? Husserlian Phenomenology Meets Cognitive Science, in: *Naturalizing Phenomenology: Issues in Contemporary Phenomenology and Cognitive Science*. Stanford University Press, pp. 245–265. <https://doi.org/10.1515/9781503617421-011>.
- van Hooff, J.A.R.A.M., Aureli, F., 1994. Social homeostasis and the regulation of emotion. In *Emotions: Essays on emotion theory*. Lawrence Erlbaum Associates, Inc, pp. 197–217.
- van Swieten, M.M.H., Manohar, S.G., Bogacz, R., 2021. Eff. Hunger Model-Based Model-Free Decis. -Mak. <https://ora.ox.ac.uk/objects/uuid:1b99b295-430c-4896-b5e3-29ea9741760f>.
- Vardi, M.Y., 2012. What is an algorithm. *Commun. ACM* 55 (3), 5. <https://doi.org/10.1145/2093548.2093549>.
- Varela, F.G., Maturana, H.R., Uribe, R., 1974. Autopoiesis: The organization of living systems, its characterization and a model. *Biosystems* 5 (4), 187–196.
- Varela, F.J., 1979. *Principles of Biological Autonomy*. North-Holland.
- Varela, F.J., 1996. Neurophenomenology: a methodological remedy for the hard problem. *J. Conscious. Stud.* 3 (4), 330–349.
- Varela, F.J. (1997). *The naturalization of phenomenology as the transcendence of nature: Searching for generative mutual constraints*. <https://philpapers.org/rec/VARTNO-2>.
- Varela, F.J., Thompson, E., Rosch, E., 2017. *The Embodied Mind*, revised edition: Cognitive Science and Human Experience. MIT Press.
- Vazard, J., 2022. Feeling the unknown: emotions of uncertainty and their valence. *Erkenntnis*. <https://doi.org/10.1007/s10670-022-00583-1>.
- Vessel, E., Starr, G.G., Rubin, N., 2012. The brain on art: Intense aesthetic experience activates the default mode network. *Front. Hum. Neurosci.* 6. <https://www.frontiersin.org/articles/10.3389/fnhum.2012.00066>.
- Viinikainen, M., Jääskeläinen, L.P., Alexandrov, Y., Balk, M.H., Autti, T., Sams, M., 2010. Nonlinear relationship between emotional valence and brain activity: evidence of separate negative and positive valence dimensions. *Hum. Brain Mapp.* 31 (7), 1030–1040. <https://doi.org/10.1002/hbm.20915>.
- Villalobos, M., Ward, D., 2015. Living Systems: Autonomy, Autopoiesis and Enaction. *Philos. Technol.* 28 (2), 225–239. <https://doi.org/10.1007/s13347-014-0154-y>.
- Vogl, E., Pekrun, R., Murayama, K., Loderer, K., 2020. Surprised–curious–confused: Epistemic emotions and knowledge exploration. *Emotion* 20 (4), 625–641. <https://doi.org/10.1037/emo0000578>.
- Walter, S., 2014. Situated cognition: a field guide to some open conceptual and ontological issues. *Rev. Philos. Psychol.* 5 (2), 241–263. <https://doi.org/10.1007/s13164-013-0167-y>.
- Ward, D., Silverman, D., Villalobos, M., 2017. Introduction: the varieties of enactivism. *Topoi* 36 (3), 365–375. <https://doi.org/10.1007/s11245-017-9484-6>.
- Watson, D., Clark, L.A., Tellegen, A., 1988. Development and validation of brief measures of positive and negative affect: The PANAS scales. *J. Personal. Soc. Psychol.* 54 (6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>.
- Weber, A., Varela, F.J., 2002. Life after Kant: Natural purposes and the autopoietic foundations of biological individuality. *Phenomenol. Cogn. Sci.* 1 (2), 97–125. <https://doi.org/10.1023/A:1020368120174>.
- Weiskrantz, L., 1999. *Consciousness Lost and Found: A Neuropsychological Exploration, Revised Edition*. Oxford University Press, Oxford.
- Weisman, K., Dweck, C.S., Markman, E.M., 2017. Rethinking people’s conceptions of mental life. *Proc. Natl. Acad. Sci.* 114 (43), 11374–11379. <https://doi.org/10.1073/pnas.1704347114>.
- Wharton, T., de Saussure, L., 2023. *Pragmatics and Emotion*. Cambridge University Press. <https://uk.bookshop.org/p/books/pragmatics-and-emotion-tim-wharton/7439831>.
- Wharton, T., Bonard, C., Dukes, D., Sander, D., Oswald, S., 2021. Relevance and emotion. *J. Pragmat.* 181, 259–269. <https://doi.org/10.1016/j.pragma.2021.06.001>.
- Whewell, W., 1858. *Novum Organon Renovatum*. J. W. Parker and son.
- Whissell, C.M., 1989. Chapter 5—The Dictionary of Affect in Language. In: Plutchik, R., Kellerman, H. (Eds.), *The Measurement of Emotions*. Academic Press, pp. 113–131. <https://doi.org/10.1016/B978-0-12-558704-4.50011-6>.
- Wiener, N., 2019. *Cybernetics or Control and Communication in the Animal and the Machine, Reissue of the 1961 second edition*. MIT Press.
- Wiener, N., Hill, D., Mitter, S., 2019. *Cybernetics or Control and Communication in the Animal and the Machine, Reissue of the 1961, second edition* (Reprint edition). The MIT Press.
- Wiering, M., Van Otterlo, M. (Eds.), 2012. *Reinforcement Learning: State-of-the-Art*, Vol. 12. Springer. <https://doi.org/10.1007/978-3-642-27645-3>.
- Wilhelm, F.H., Grossman, P., 2010. Emotions beyond the laboratory: theoretical fundaments, study design, and analytic strategies for advanced ambulatory assessment. *Biol. Psychol.* 84 (3), 552–569. <https://doi.org/10.1016/j.biopsycho.2010.01.017>.
- Williams, D., Colling, L., 2018. From symbols to icons: the return of resemblance in the cognitive neuroscience revolution. *Synthese* 195 (5), 1941–1967. <https://doi.org/10.1007/s11229-017-1578-6>.
- Williams, J.H.G., Huggins, C.F., Zupan, B., Willis, M., Van Rheenen, T.E., Sato, W., Palermo, R., Ortner, C., Krippel, M., Kret, M., Dickson, J.M., Li, C.R., Lowe, L., 2020. this issue). A sensorimotor control framework for understanding emotional communication and regulation. *Neurosci. Biobehav. Rev.* 112, 503–518. <https://doi.org/10.1016/j.neubiorev.2020.02.014>.
- Williams, R., 2017. Anger as a basic emotion and its role in personality building and pathological growth: the neuroscientific, developmental and clinical perspectives. *Front. Psychol.* 8, 1950. <https://doi.org/10.3389/fpsyg.2017.01950>.
- Williams, R., 2020. *Culture and Materialism*. Verso Books.
- Wilson, T.D., 1994. The proper protocol: validity and completeness of verbal reports. *Psychol. Sci.* 5 (5), 249–252. <https://doi.org/10.1111/j.1467-9280.1994.tb00621.x>.
- Winkielman, P., Berridge, K.C., 2004. Unconscious Emotion. *Curr. Dir. Psychol. Sci.* 13 (3), 120–123. <https://doi.org/10.1111/j.0963-7214.2004.00288.x>.
- Wittgenstein, L., 1953. *Philosophical investigations*. Philosophische Untersuchungen. Macmillan, Oxford, England.
- Wittgenstein, L., 1958. *The Blue and Brown Books: Preliminary Studies for the “Philosophical Investigations”*. Harper & Row, pp. 12–13.
- Wollheim, R., 1999. *On the Emotions*, 1st ed. Yale University Press, New Haven, CT.
- Wolpert, D.M., Ghahramani, Z., Jordan, M.I., 1995. An Internal Model for Sensorimotor Integration. *Science* 269 (5232), 1880–1882. <https://doi.org/10.1126/science.7569931>.
- Woodward, J., 2014. A functional account of causation; or, a defense of the legitimacy of causal thinking by reference to the only standard that matters—Usefulness (as opposed to metaphysics or agreement with intuitive judgment). *Philos. Sci.* 81 (5), 691–713.
- Wray, K.B., 2002. The epistemic significance of collaborative research. *Philos. Sci.* 69 (1), 150–168. <https://doi.org/10.1086/338946>.
- Yik, M., 2010. How unique is Chinese emotion? In: Bond, M.H. (Ed.), *Oxford Handbook of Chinese Psychology*. Oxford University Press, p. 0. <https://doi.org/10.1093/oxfordhb/9780199541850.013.0015>.
- Yik, M., Mues, C., Sze, I.N.L., Kuppens, P., Tuerlinckx, F., De Roover, K., Kwok, F.H.C., Schwartz, S.H., Abu-Hilal, M., Adebayo, D.F., Aguilar, P., Al-Bahrani, M., Anderson, M.H., Andrade, L., Bratko, D., Bushina, E., Choi, J.W., Ciecuch, J., Dru, V., Russell, J.A., 2023. On the relationship between valence and arousal in

- samples across the globe. *Emot. (Wash., D. C.)* 23 (2), 332–344. <https://doi.org/10.1037/emo0001095>.
- Zahavi, D., Kriegel, U., 2015. *For-Me-Ness: What It Is and What It Is Not*. In *Philosophy of Mind and Phenomenology*. Routledge.
- Zajonc, R.B., Pietromonaco, P., Bargh, J., 1982. Independence and Interaction of Affect and Cognition. In *Affect and Cognition*. Psychology Press.
- Zajonc, R.B., Pietromonaco, P., Bargh, J., 2014. Independence and interaction of affect and cognition. In *Affect and cognition*. Psychology Press, pp. 211–227.
- Zeelenberg, M., van Dijk, W.W., Manstead, A.S.R., van der Pligt, J., 2000. On bad decisions and disconfirmed expectancies: the psychology of regret and disappointment. *Cogn. Emot.* 14 (4), 521–541. <https://doi.org/10.1080/026999300402781>.
- Zhou, P., Critchley, H., Garfinkel, S., Gao, Y., 2021. The conceptualization of emotions across cultures: a model based on interoceptive neuroscience. *Neurosci. Biobehav. Rev.* 125, 314–327. <https://doi.org/10.1016/j.neubiorev.2021.02.023>.
- Zoltowski, A.R., Failla, M.D., Cascio, C.J., 2022. Social touch and allostasis. *Curr. Opin. Behav. Sci.* 43, 69–74. <https://doi.org/10.1016/j.cobeha.2021.08.005>.
- Zuckerman, M., 1971. Physiological measures of sexual arousal in the human. *Psychol. Bull.* 75 (5), 297–329. <https://doi.org/10.1037/h0030923>.