Antti Revonsuo

Consciousness

The Science of Subjectivity

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The study of consciousness is recognized as one of the biggest remaining challenges to the scientific community. This book provides a fascinating introduction to the new science that promises to illuminate our understanding of the subject.

Consciousness covers all the main approaches to the modern scientific study of consciousness, and also gives the necessary historical, philosophical and conceptual background to the field. Current scientific evidence and theory from the fields of neuropsychology, cognitive neuroscience, brain imaging and the study of altered states of consciousness such as dreaming, hypnosis, meditation and out-of-body experiences is presented. Revonsuo provides an integrative review of the major existing philosophical and empirical theories of consciousness and identifies the most promising areas for future developments in the field.

This textbook offers a readable and timely introduction to the science of consciousness for anyone interested in this compelling area, especially undergraduates studying psychology, philosophy, cognition, neuroscience and related fields.

Antti Revonsuo is Professor of Cognitive Neuroscience at the University of Skövde, Sweden, and Professor of Psychology at the University of Turku, Finland. He has been conducting research on consciousness since the early 1990s and has directed an undergraduate degree programme on consciousness studies since 1997. He is best known for his evolutionary–psychological theory of dreaming, the threat-simulation theory.

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Psychology Press
Taylor & Francis Group
HOVE AND NEW YORK

Published in 2010
by Psychology Press
27 Church Road, Hove, East Sussex BN3 2FA

Simultaneously published in the USA and Canada
by Psychology Press
270 Madison Avenue, New York NY 10016

This edition published in the
Taylor & Francis e-Library, 2009.

To purchase your own copy of this or any of
Taylor & Francis or Routledge's

collection of thousands of eBooks please go
to www.eBookstore.tandf.co.uk.

*Psychology Press is an imprint of the
Taylor & Francis Group, an
Informa business*

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
Revonsuo, Antti.
Consciousness : the science of subjectivity / Antti Revonsuo.
p. cm.
Includes bibliographical references and index.
1. Consciousness. I. Title.
BF311.R395 2010
153 – dc22 2009031336

ISBN 0-203-85960-X Master e-book ISBN

ISBN: 978–1–84169–725–3 (hbk)
ISBN: 978–1–84169–726–0 (pbk)

To all my students,

– past, present, and future

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Introduction

Consciousness and its place in the scientific view of the world

To study consciousness is to study a deep mystery about ourselves. It is to study the nature of our *existence*, but not the kind of existence that physics and the other sciences study because they study the *objective* existence of atoms, galaxies, oceans, cells, time and space, among other things. To study consciousness is to study the fundamental nature of our *personal* existence, our *subjective* existence, our life as a sequence of subjective experiences. In this new field of science, we want to understand ourselves not only as entities that are alive and behave or interact with their environment, like bacteria or trees or dragonflies do, but also as beings who directly *experience* or *feel* or *sense their own existence*, who are alive in a sense fundamentally different from the ordinary biological notion of "being alive".

Being alive as a conscious subject is something much more than being alive in the purely objective biological sense. A conscious being is not merely alive in the sense of realizing a collection of physiological processes and capacities (such as growth or self-replication) that separate biological organisms from nonliving physical systems. A conscious being is *mentally*, *internally* alive. Unlike physical objects and simple biological organisms, a being who possesses a conscious mind also senses or feels or experiences its own existence. To crystallize this idea: A conscious being has an *internal psychological reality*, a *mental life* consisting of subjective experiences, with a *stream of consciousness* flowing within. The inner stream of subjective experience, which is directly present for us and continuously revealing itself to us, is consciousness.

Consciousness as the seat of our subjective experiences is the mystery to be solved by science. In particular, it is the very phenomenon to be described and explained by the science of consciousness, which is why we may call this new science by the name "The Science of Subjective Experience", or "The Science of Subjectivity" as in the subtitle of this book.

This book is an invitation to the mystery of consciousness and an introduction to the new science that specifically enquires into the mystery. We will try to understand what kind of challenge consciousness poses to current science and we will review the modern scientific approaches to the study of consciousness. Whether or not they will ultimately be successful in solving or removing the mystery of consciousness may be too early to tell.

Be that as it may, it is clear that a new field, specifically concentrating on consciousness, is urgently needed. The already existing fields that study the mind or the brain have ignored consciousness. Psychology, behavioural science, cognitive science and cognitive neuroscience have avoided consciousness or have been reluctant to put subjective experience into the focus of their research programmes. Those fields of study are more interested in such things as behaviour, representation, information processing, neural activity and other perfectly *objective* phenomena that are fundamentally different from subjective mental life. Therefore, a fresh start is required in order to scientifically zoom in on the subjective stream of experience, or consciousness itself. But what exactly is such a science all about? Do we have a clear enough idea of consciousness to approach it scientifically? What *is* our "inner mental life", the "subjective psychological reality"? Perhaps we need some clarification of this at the outset.

A person's subjective psychological reality contains all the experiences one has at any particular moment. It consists of different perceptual experiences, such as seeing colours, shapes and visual objects, located within a perceptual space extending in all directions. It contains auditory experiences whose sources are perceived to be located in the space around you. It contains smells and tastes, such as the sweet fragrance experienced when deeply sniffing a rose, eyes closed (as in the cover image of this book). Furthermore, it contains feelings, emotions and bodily experiences; you perceive and feel your body as being a part of the world around you, but you also experience your body from the inside, as a three-dimensional, living, feeling, moving entity whose behaviour you can control at will. You have a mental space where thoughts are entertained, where internal images pass by, memories are relived and where you feel the pull of desires. Taken together, these experiences – the perceptual, the bodily and the mental – form the contents of your subjective psychological reality.

Experiential events are fleeting. They are directly and vividly present in consciousness only briefly, only for a few seconds perhaps. The contents of the stream of experience flow ever onwards. The patterns of experience change all the time, some only gradually, some abruptly, but they never cease to move on. Yet, there seems to be a persisting subject – or perhaps the underlying mental "space" of experience itself – that never changes. Underneath the ever-changing patterns in the restless stream of experience there is the stable riverbed that unifies these experiences into a single inner world, thus forming a single unified psychological reality, the *world-for-me*, a spatial unity and a temporal continuity of consciousness and self that transcends the short-lived and changeable contents that come and go.

The flow of subjective experiences constitutes our conscious life as we know it. We know not exactly when it first started flowing, but ever since the beginning it has been going on, save for brief pauses during the night in deep sleep when even the faintest dream images cease to exist. We know not when it will come to an end, to a

final moment of consciousness, or even if it ever will. "Is there life after death?" should be rephrased as "Will there still be a subjective psychological reality going on for me after death?" or "Will some sort of flow of subjective experiences continue for me even after my body and my brain are no longer alive in the biological sense of the word?" These are ultimate – and challenging – questions, and the answers depend on the discoveries to be made in the science of consciousness.

Why is consciousness considered a "mystery"? After all, we know consciousness intimately from the inside, it is the most natural thing there is for us and it is ever present in our lives. Of course, in that sense there is no mystery at all about consciousness. In fact, there is nothing in the world that we would be acquainted with better than the subjective experiences vividly present for us all the time. The problem, the absolute mystery, is elsewhere: we do not know how to fit consciousness together with the world-view of science. Physics and the other natural sciences describe a world where particles, force fields, atoms, molecules, stars and planets exist in an objective way and causally interact with each other. So far as we know, none of the things thoroughly described and explained by the sciences has an inner psychological reality, a stream of subjective experiences. Thus, despite all the amazing progress in physics, chemistry, biology and neuroscience, science remains incapable of describing – or even acknowledging the existence of – an inner subjective life. No matter how carefully we study the physics, chemistry and biology of an animal, the empirical evidence we acquire does not in any objective manner reveal whether the animal in some way feels or senses its own existence – whether it has an inner subjective psychological reality or not – nor, if it does, what its subjective experiences are like – what it would be *like* to *be* that animal and to see the world through its eyes.

At present we have no idea how our inner life could be explained in harmony with the world-view of the natural sciences. In that world-view, there is nothing that even remotely resembles our subjective lives. On the contrary, the scientific picture of the world is in many ways directly in conflict with our subjective experience. The physical universe as a whole is a giant, stagnant object in four-dimensional space–time where the dimensions of space and time all exist in one piece and nothing ever "happens". Past, present and future are simply different parts of the temporal dimension that coexist with each other and are equally fixed. The universe as described by physics has no particular moment of "now" that would be unique, in that only there do events flow forward, and behind it the past is fixed and before it the future lies wide open. The universe as described by the natural sciences includes no subjective qualities such as those that characterize each and every one of our experiences: colours, tastes, tones, pains, odours, feelings. The world as described by science consists of spatiotemporal causal structures, physical entities at microscopic (forces, particles, waves, fields) and macroscopic levels (planets, galaxies) and laws and mechanisms that can be described objectively and quantitatively.

By contrast, our subjective psychological reality is a forward-moving stream of qualitative experiences, located at a particular time and place in the physical universe, always happening in the "here and now" and taking place within a particular person's mind (or brain). How can such a thing exist in the physical universe? Is it something over and above the physical – something other-worldly, a spiritual bubble, a wandering soul – that has become attached to a biological organism inside the physical world? Somehow this small drop of precious soul-stuff seems to blow an inner mental

life into the organisms it inhabits, to live a life through them and to see the world through their eyes. Is that the way we are – tiny drops of magical soul-stuff trapped inside material human bodies that are located inside the giant physical machinery of the universe? If such a spiritual view of ourselves seems to be out of the question, then is our consciousness just some kind of complex physical or biological mechanism in our bodies? Is our precious inner world simply made out of quite ordinary, slimy and boring brain-stuff with no other-worldly magical souls involved?

As these profound questions suggest, the science of consciousness is about our very existence. What kind of beings are we really – our selves, our souls, if you like – in the final analysis? What is consciousness? Who or what is the "subject" or the "self" who "has" my conscious experiences? What are our thoughts, experiences and memories *made of*? What about moments of intense joy, happiness, beauty and awe, when we seem to reach a higher consciousness, full of meaning: are they only fleeting electrochemical symphonies played by billions of neurons in harmony, or perhaps glimpses of an other-worldly mental realm, entirely beyond matter? Are we, our inner selves, something spiritual, soul-like; could our subjective life thus survive bodily death? Could our consciousness perhaps be reborn in some other life-form, so that after death there would be an inner life once again for us, though in a form unlike the present one?

The answers to these rather fundamental questions depend on what the science of consciousness will find out about our subjective psychological reality and about its physical seat, our brain!

The contents of this book

We have now defined the science of consciousness as *the science whose task it is to describe and explain our subjective psychological reality* – the inner stream of subjective experience. Although this branch of science is brand new, it has deep philosophical, historical and conceptual roots. In this book, we will first get acquainted with the foundations on which the science of consciousness is built. Having a grasp of the foundations will help us to understand how the science of consciousness originated and where it stands now.

We will first review the philosophical foundations of this field. In philosophy, questions about the ultimate nature of existence are put forward, such as: What kind of stuff is the universe ultimately made of – is it entirely composed of physical matter or is there something else besides? What is our subjective psychological reality – our consciousness – ultimately made of? Is it physical or nonphysical? How does the subjective psychological reality relate to the objective physical reality?

Questions like the above are *metaphysical* or *ontological* questions in philosophy. In Chapter 1 we will outline the major philosophical theories that offer mutually exclusive answers to the questions concerning the ultimate nature of consciousness and the relation between consciousness and the rest of the world, especially the brain. Although the philosophical discussions have been going on for centuries, the final solutions to them remain open and the problems remain as acute as ever. Thus, philosophical discussions of the ultimate nature of consciousness are a necessary and integral part of the science of consciousness.

Although the science of consciousness in its modern form emerged only recently (during the 1990s), the study of consciousness has its roots deep in the history of psychology. In fact, it is possible to fully understand the current situation only by exploring the historical development of psychological science. We will find that, at one time, psychology actually defined itself as the science of the conscious mind, but later on it had a total change of heart. As a result of the radical turn of the tides, scientific psychology flatly rejected the study of consciousness. This sinister history is the main reason why experimental psychology during the last 50 years never became the science of consciousness (but rather the science of behaviour, or the science of cognition). The initiative for establishing the science of consciousness anew was taken in philosophy and cognitive neuroscience instead. In Chapter 2 we will learn about the many surprising twists and turns that the study of consciousness went through between the 1870s and the 1990s – during the roughly 120 years before the emergence of the current "new wave" of consciousness research.

The first task for any branch of science is to describe, clearly and systematically, the phenomena it aims to explain. Otherwise we would not really know what it is we are trying to explain, nor could we recognize and test whether our explanations are successful or not. Thus, long before there were proper astronomical or biological theories, astronomers, botanists and "natural historians" had made observations and described, meticulously and systematically, the unchanging constellations and the wandering planets in the sky, and countless species of flora and fauna found even in the remotest corners of the Earth. They had also developed systematic definitions and concepts for recognizing and labelling natural phenomena, so that the scientists could communicate clearly with each other about their observations of the relevant phenomena.

Hence, one of the first tasks for the science of consciousness is to produce a set of basic definitions and concepts that help the researchers to communicate their findings and theoretical ideas in a clear and systematic manner. Unfortunately, at this early stage of consciousness science, much controversy and confusion still remains concerning the most accurate and useful ways to define the phenomena that are to be explained. We will however try to steer clear of the conceptual confusions. I will therefore introduce the most fundamental concepts and try to define them as clearly as possible. That is the task before us in Chapter 3. In the rest of this book, the concepts defined there will serve as the conceptual framework, in the light of which we will survey the empirical findings and theories of consciousness.

After the foundations have been explained and clarified, the book then moves on to the four central domains of consciousness science: *neuropsychology and consciousness*; *neural correlates of consciousness*; *theories of consciousness*; and *altered states of consciousness*. In the first section on neuropsychology we will learn what happens to consciousness as a result of brain injury or neurological deficit. Depending on the location of the damage, different aspects of consciousness may be lost or at least radically and permanently altered. These surprising alterations and dissociations constitute an important line of evidence on the internal structure and unity of consciousness. They also provide us with evidence concerning the brain mechanisms involved in the realization of particular aspects of consciousness. In the second section on the neural correlates of consciousness we learn how the modern methods of cognitive neuroscience, such as functional magnetic resonance imaging (fMRI) and

electroencephalography (EEG), can be used to collect evidence on the neural mechanisms of consciousness, and what the evidence shows so far. The third section reviews the most significant theories of consciousness that have been put forward recently by philosophers, psychologists or neuroscientists. There, we will try to understand what it is that a theory of consciousness should explain, and we will evaluate how far in this task the already existing theories can take us. The fourth and final section focuses on altered states of consciousness as another important source of evidence for the science of consciousness. There, we study altered states of consciousness such as sleep, dreaming, hypnosis, meditation and higher states of consciousness such as flow or peak experiences and mystical experiences. These fascinating forms of consciousness may reveal aspects and mechanisms of subjectivity that could never be reached by just studying the paradigmatic "normal" waking state.

Higher states of consciousness lead us to a more practical question: What should we *do* with our consciousness? Is it possible to reach higher forms or states of consciousness that would make our subjective existence in this (sometimes boring or depressing) physical universe more bearable? How could we enhance states of consciousness that are positive and meaningful? Happiness and subjective well-being are states of consciousness that make subjective existence worthwhile. The science of consciousness might thus consider allying itself with the emerging new sciences of happiness and subjective well-being that focus on the *positive* qualities of our subjective existence – higher consciousness – and how to reach and cultivate such states.

All in all, this book offers an invitation to ponder a deep and awesome mystery from a scientific point of view; it is a basic introduction to the new science that attempts to solve one of the oldest and most difficult scientific (and philosophical) problems. If this new science one fine day proves to be successful, we will finally come to understand what the place of our mental life is in the physical world. And if the present book proves to be successful in *its* task, the reader will come to understand the very basics of this new, fascinating branch of science and, hopefully, will learn to appreciate the beauty and depth of the mystery – as well as catch a glimpse of the possible scientific solutions to it.

A cautionary note on the approach to consciousness taken in this book

In the book you will be reading, I have made an attempt to present the science of consciousness as a wide, multidisciplinary field where philosophy, psychology and neuroscience become seamlessly intertwined and entangled with each other. Still, I have selectively included only the topics that I personally see as the core of the science of consciousness and I have left out some others that seem more peripheral. Thus, the reader should bear in mind that this book does not cover everything that has been discussed in the enormously broad field of consciousness studies, and even the things that it does cover are presented in a simple and straightforward manner, often stepping rather quickly over the many complex controversies between different standpoints in the field. I felt a straightforward style of writing that emphasizes clarity, brevity and breadth of coverage to be a necessary feature for an introductory book to

a field often plagued by deep and complex philosophical and empirical controversies and much conceptual confusion.

I have attempted to present the materials from a relatively neutral standpoint that allows the reader to formulate his or her own opinion. Still, I do realize that a totally neutral way of even so much as just defining consciousness is impossible, and therefore some philosophical and theoretical choices and biases that are my own are, at places, unavoidable and rather obvious. To get a perspective that is independent of my biases, I recommend the reader to refer back to the original sources that are given in the References at the end of the book and the Further Reading lists at the end of each chapter.

The field of consciousness research is teeming with different and usually squarely opposing approaches, but it would not be possible to give all the different viewpoints and arguments an equal amount of space and attention and still end up with a readable textbook. Thus, although I attempt to give a neutral "bird's eye view" to the field, the current book is at least implicitly reflecting my own vision of the science of consciousness. This view is not universally accepted by all consciousness researchers, but then nor is any other view. In case the reader happens to be curious about my own explicit standpoint in the philosophy and science of consciousness, I give a brief account of it in the Epilogue of this book, and a thorough presentation with all the relevant background and sources can be found in my earlier monograph, *Inner Presence* (Revonsuo, 2006).

The present book has gradually taken form over the years as I have taught undergraduate and postgraduate courses on the mind–body problem, the history of psychology, the philosophy of science, the neuropsychology of consciousness, cognitive neuroscience, theories of consciousness and altered states of consciousness. Much of the groundwork for this book, as well as for my teaching, I have done by relying on a number of other texts, foremost among them being Farthing's (1992) excellent but somewhat dated and out-of-print book *The Psychology of Consciousness*. Other important books that I have used in teaching or that have otherwise had a great influence on my work are *The Nature of Consciousness*, edited by Block and others (1997), Hothersall's (2004) *History of Psychology, Fourth Edition*, Finger's (1994) *Origins of Neuroscience*, Churchland's (2002) *Brain-Wise, Studies in Neurophilosophy*, Gazzaniga et al.'s (2008) *Cognitive Neuroscience, The Biology of the Mind*, Blackmore's (2004) *Consciousness, An Introduction*, Velmans' and Schneider's edited volume (2007) *The Blackwell Companion to Consciousness* and the new two-volume *Encyclopedia of Consciousness* edited by Banks (2009).

I would greatly appreciate any feedback from the readers of this book, be they students, teachers, professionals in the field or lay readers. Your comments and suggestions would be invaluable to me, especially if ever I were to write a second edition where the inevitable shortcomings of the present one could be remedied.

Acknowledgements

This book is wholly inspired by my dear students. Teaching courses in consciousness and cognitive neuroscience for the past 10 years at the University of Skövde, Sweden, has given me the unique opportunity to interact with many bright students who are equally fascinated by consciousness as I myself am. During this time I have gradually realized how difficult it is to find easily readable, up-to-date undergraduate textbooks on consciousness that would describe the basic issues in a simple, clear and integrative manner. My goal was to write exactly such a book, for my students as much as for myself, as a helpful tool to introduce the field to the beginner. Whether or not this goal has now been met I must leave for my future students and other readers of this book to decide. I want to thank all my students in the Consciousness Studies Programme at the University of Skövde, Sweden: your endless curiosity – and your insightful but sometimes impossibly difficult questions – about consciousness have been invaluable to me. I hope I now have a better idea as to what needs to be explained in an introductory course on consciousness, and how it ought to be explained without any unnecessary philosophical complications or incomprehensible scientific jargon.

Over the years, there have been far too many colleagues and students involved in the fascinating discussions on consciousness to mention everyone here, but at the very least the following people I am not likely to forget as long as my consciousness has any lights on at all: Paavo Pylkkänen, with whom we originally put the Consciousness Studies Programme together; Anders Milton and Monica Bergman – among my first students in Sweden, now my fellow teachers; Karin Freidlitz and Daniel Labbe – the founding members of the unforgettable Skövde Mad Scientists' Society; Csengelle Dioszegi from the very first class of Consciousness Studies in 1997; Petri Kåhlman (no-one else has participated in so many of my courses!); Robin Brandt (never short of a few questions!); Almira Osmanovic (now graduate of the Karolinska Institute, Stockholm); Isabelle Clavenstam (thanks for the comments on the final manuscript!); all the other students who graduated or who participated in our Mini-conference on Consciousness, Spring 2009; and, finally, all the incredibly active

first-year students in our new undergraduate programme that combines the science of consciousness with the (even newer) science of happiness.

The members of my Consciousness Research Group at the Centre for Cognitive Neuroscience, University of Turku, Finland, have contributed significantly to my knowledge on various aspects of consciousness, and furthermore have given useful comments on the manuscript of the book: thanks to our hypnosis expert Sakari Kallio (also known as F. A. Mesmer), Mika Koivisto (the world's leading expert on VAN!), Katja Valli (the relentless Threat Simulator), Mirja Johanson, Valdas Noreika, Niina Salminen-Vaparanta, Pilleriin Sikka (the craazzyy AWEsome), Levente Moro, Heidi Sederholm (FLOWENLIT Meditation Master) and Panu Helle.

Two of my former students have played a crucial role in putting the manuscript of this book together for publication – without their help this poor little book might have never come into being. Linda Laurila did brilliant work in drawing the illustrations, based only on the vague sketches that I had hastily penned on paper. Linda Bergström did an equally brilliant job with checking and finalizing the whole manuscript for submission to the publisher and in keeping me firmly on schedule as the deadline was approaching. My warmest thanks to both of you!

I enjoyed writing this book, but would not have been able to even consider such a project without support from: the Signe och Ane Gyllenbergs Stiftelse and the Academy of Finland (project 8110957, "Neurophilosophy of Consciousness" and project 8124623, "Neuroethics of Brainreading"); the School of Humanities and Informatics, University of Skövde, Sweden; and the Department of Psychology, University of Turku, Finland. They have provided me with the financial and institutional support that made the writing of this book possible, which I am happy to acknowledge most gratefully.

Antti Revonsuo
Turku, June 2009

Part one

Background to the science of consciousness

Chapter 1

The philosophical foundations of consciousness science

Introduction

In philosophy, the *mind–body problem*, or the relationship between the inner mental world and the external physical world, has been discussed for thousands of years. What is the human soul, or the mind, or consciousness? What is its relationship to the body, the brain or physical matter in general? In some theories, the nature of consciousness (subjective psychological reality) and the nature of the brain (objective physical, biological reality) are seen as fundamentally different: made out of very different kinds of basic stuff. That solution makes it all the more difficult to explain how the two could be in close causal interaction with each other. Alternatively, other theories assume that consciousness and the rest of reality are not tremendously different after all, but consist of the same basic stuff. The problem for the latter is to show how consciousness could be just the same as ordinary physical matter – or vice versa! In addition to the mind–body problem, the science of consciousness also has to face the *other-minds problem:* How can we *know* about other minds? We cannot directly perceive, detect or measure the presence of consciousness. We do not seem to have any scientific access to the subjective psychological realities of other creatures. Thus, are they beyond science altogether?

1.1 The first distinction: Dualism and monism

We will first divide the philosophical mind–body theories into two different categories, *dualistic* theories and *monistic* theories.

Definition of dualism

All dualistic theories say that the world (the universe as a whole) consists of two categorically different types of entity or substance. One of them is physical. This substance constitutes physical matter, energy, force fields, elementary particles and forces, and all the rest of the things that the physical sciences take as the fundamental building blocks of the universe. In the final analysis, the more complex physical systems, such as stars, mountains and trees, consist of the elementary physical entities.

The other substance is mental by nature. "Mental" is taken by definition to be something nonphysical, something entirely different from the physical rather than a part or a variety of the physical. It is less clear *what* the mental substance is supposed to consist of, but it seems natural to assume that, whatever it is, it must be the same sort of stuff that forms our subjective psychological reality. Thus, the mental stuff consists of subjective, qualitative states of consciousness located within the mental space where conscious events happen. It is directly present for us in our sensations, percepts, thoughts, emotions, images, as they are subjectively experienced in the stream of consciousness. Typically, the nonphysical substance is depicted as some kind of ghostly mind-stuff or soul-stuff that is independent of physical matter and even of the laws of nature that govern the physical realm. Soul-stuff is presumed to be beyond all objective physical measurements and observations, consisting perhaps of extremely fine, ethereal "soul-atoms" that are unlike any physical particles, or

existing in a mental "soul-space", another dimension altogether that lies beyond the physical space–time.

Definition of monism

By contrast, all monistic theories say that the world (the universe as a whole) consists of only *one* type of substance. Different monistic theories, however, disagree about the ultimate nature of the fundamental substance. Some say that the universe is at bottom thoroughly physical (materialism or physicalism), whereas others say that the universe consists of nothing but mental substance across the board (idealism). Yet others claim that the universe is, at the rock bottom level, neither "mental" nor "physical" (neutral monism). We will return to these distinctions in due time. Now we will first explore dualistic theories of consciousness in more detail.

1.2 Dualistic theories of consciousness

Dualistic theories take it for granted that both physical matter and subjective consciousness are real phenomena that exist in their own right. Neither owes its existence to the other; they are both on an equal footing in the universe. They are just radically different kinds of stuff. This is one of the inviting characteristics of dualistic theories. They show due respect both to the external physical world – basically accepting all the physical sciences, as far as they go – and to our inner subjective world, saying that it is a reality of its own, beyond the physical one.

But dualistic theories also have some serious weaknesses. First, they have difficulty in telling us exactly what *kind* of stuff the nonphysical soul-stuff is supposed to be and where it is located in relation to physical space. They only tell us what it is *not*: it is not physical – it is nonphysical. But what is it to be nonphysical or immaterial? If our consciousness is based on nonphysical soul-stuff, then we need a testable scientific theory that describes and explains exactly what soul-stuff is, how it behaves and where it is to be found. Therefore, dualistic theories are not necessarily able to offer us terribly convincing answers to the ontological problem, enquiring about the basic nature of consciousness. What is worse, they are also in trouble when trying to answer the relational question: How exactly does the nonphysical soul-stuff *relate* to the physical world, especially to our bodies and brains?

If we know anything about the relationship between consciousness and physical reality, it is that those two realms seem to collaborate seamlessly whenever we perceive external objects or whenever we perform voluntary actions. On the one hand, the sensory organs in our bodies receive physical energy from the world and convert it to neural signals that in some way are transformed to subjective sensations and percepts in our inner psychological world. On the other hand, we formulate thoughts and plans and we experience desires and cravings in our consciousness. By a mere act of will we can make our physical muscles, limbs and bodies move through physical space, guided by our conscious will and intention. There seems to be a two-way interaction between consciousness and physical reality: first, the external world reaches into our consciousness, which thereby senses and perceives the world; second,

our mind reaches out to the external world and thereby guides the behaviour of the body at will.

Usually dualistic theories are differentiated from each other on the basis of how they answer the relational question, or how exactly does the nonphysical soul-stuff relate to the physical world, especially to our bodies and brains? The three main alternatives are known as interactionism, epiphenomenalism and parallelism.

Interactionism

The main idea in interactionism is, as the name hints, that there is *two-way causal interaction* between the external physical reality and the subjective psychological reality, or brain and consciousness. In other words, physical stimuli in the external world (e.g. electromagnetic energy such as light) first hit sensory organs (such as the retina in the back of the eye), then the signal is transformed into neural impulses that travel to the brain, especially the visual cortex in the backside of the brain, and there at some stage, veiled in mystery, the physical brain activation gets in touch with the nonphysical soul-stuff or consciousness, thus causing us to have the subjective experience of seeing. This is the "bottom-up" causal pathway leading from physical input into conscious output. The "top-down" causal pathway (also called "mental causation") travels in the opposite direction, leading from conscious input (a thought, a desire or an intention to act) to physical output. To take an example, let us say you feel a sudden strong urge to eat chocolate. The desire is a conscious experience. It causes you to look around for the chocolate bar and then, when you spot it, causes your hand to reach towards the bar, grab it quickly, move it into your mouth and sink your teeth into it. A conscious experience thus caused physical changes, first in the brain and then in the neural messages travelling from the brain to the muscles and finally these changes created physical movements of your body.

Often in our everyday behaviour the bottom-up and top-down causal pathways form interactive sensorimotor loops. If you step on a thorn barefoot, the signals from your foot travel quickly to your brain and you experience the pain in your foot and a strong urge to stop the pain. Then you try to locate the source of the pain, you look and touch the sore spot and when you spot the thorn sticking painfully there you pull it out in relief. If you walk on a strawberry field, looking for ripe red strawberries, when you see one (as a result of neural activity in the bottom-up pathway from the retina to the visual cortex to consciousness) you reach out to pick it (as a result of activity in the top-down pathway, from conscious perception and desire to overt physical behaviour).

The causal interaction between the physical and the nonphysical realms seems to work rather smoothly. In fact, in our everyday behaviour we never even need to think about it. We just open our eyes and let the physical stimuli flow in, resulting in conscious visual experience. We use our physical bodies to carry out our intentions and desires and all this seems to work absolutely flawlessly. The problem is to explain *how* exactly two radically different realms – physical processes such as neural activity, and nonphysical qualitative vibrations of the soul such as our sensations, thoughts and desires – could interact at all, let alone so smoothly. That is, the interactionist approach owes us a scientific theory, at least a preliminary one, concerning the actual mechanisms that mediate between the two worlds.

Well, why does not the interactionist then provide us with a theory or a description of the mechanisms? The trouble is that the physical realm is *causally closed* and, respectively, the nonphysical realm is *causally inert* (at least with respect to the physical). The causal closure of the physical world means that physical events can only be causally influenced by other physical events, and are able to cause further events only of the purely physical kind, through mechanisms that are themselves nothing but physical. Causation requires mechanisms that have physical properties, such as mass, energy, force fields, physical motion through physical space, and so on. The causal inertia of consciousness means that our experiences, if they are thoroughly nonphysical, have to be unnecessary for any physical events to happen and in fact they must be inherently incapable of moving or influencing anything in the physical world whatsoever, including neural activities in our brain. If consciousness consists of ghostly soul-stuff, then, like the prototypical ghosts, it will simply slide through all material things without having any effects on them!

The problem that the dualist faces is this. To causally interact with the physical realm (such as the brain), a thing needs to have at least some physical properties. Thus, soul-stuff should have some physical properties after all if it is to have any impact on our brain activity. But for the dualist consciousness is by definition something nonphysical. How could something thoroughly nonphysical, something devoid of mass, energy, motion, gravity, spatial extension and location and all imaginable physical features, cause anything at all to happen in any objects of the physical world, such as the brain? How exactly does soul-stuff pull the physical strings in the brain to actualize a physical manifestation of its free will? This is a complete mystery. Unless a convincing scientific hypothesis of the mechanisms working between the soul and the brain can be put forward, interactionism remains pure metaphysical speculation that can only be afforded within philosophy, not playing any part in the empirical science of consciousness.

The problem of explaining the nature of the two-way interaction between consciousness and brain is not the only problem for interactionism, although it is perhaps the most difficult one. Other problems arise when we attempt to fit the dualist view of consciousness in the scientific world-view with all the other branches of empirical science, such as evolutionary history (phylogeny), individual development (ontogeny) and neuropsychology. At what point in evolution did the immaterial soul-stuff for the first time become causally attached to biological organisms? How and why did that happen if divine intervention is not allowed? When did the first living creature get a soul, turning into a conscious being that could "see the light" and feel its own existence? Presumably, before that grand moment in the history of life on Earth, every creature on this planet had been a totally nonconscious zombie, a mere biological mechanism without any inner mental life. A similar question can be asked with regard to a human fetus or baby: When, how and why does the soul-stuff make a connection to its developing brain? When does the baby "see the light" of subjective existence for the very first time?

Soul-stuff alone is supposed to be able to turn mere biomechanical zombies into conscious human beings with an inner subjective life. Thus, there is a pressing need to find the answers to the questions concerning the emergence of the inner life in evolution and child development. At the same time it is very difficult to pinpoint any stage either in evolutionary history or in individual development that would mark such a