EASY AND HARD PROBLEMS pdf

1: What is consciousness? (2): Is the hard problem really hard? - Mapping Ignorance

The hard problem of consciousness is the problem of explaining how and why sentient organisms have qualia or phenomenal experiencesâ€"how and why it is that some internal states are felt states, such as heat or pain, rather than unfelt states, as in a thermostat or a toaster.

Stating the Problem a. Still, Chalmers is among those most responsible for the outpouring of work on this issue. Specifying these functions tells us what learning is and allows us to see how brain processes could play this role. But according to Chalmers, What makes the hard problem hard and almost unique is that it goes beyond problems about the performance of functions. To see this, note that even when we have explained the performance of all the cognitive and behavioral functions in the vicinity of experienceâ€"perceptual discrimination, categorization, internal access, verbal reportâ€"there may still remain a further unanswered question: Why is the performance of these functions accompanied by experience? Reductive explanations of this type have two premises. The first presents a functional analysis of the target phenomenon, which fully characterizes the target in terms of its functional role. The second presents an empirically-discovered realizer of the functionally characterized target, one playing that very functional role. Then, by transitivity of identity, the target and realizer are deduced to be identical. For example, the gene may be reductively explained in terms of DNA as follows: By transitivity of identity, 1, 2. Chalmers contends that such reductive explanations are available in principle for all other natural phenomena, but not for consciousness. This is the hard problem. The reason that reductive explanation fails for consciousness, according to Chalmers, is that it cannot be functionally analyzed. If we had a satisfying functional analysis of consciousness, zombies should not be conceivable. If consciousness really could be functionally characterized, these problems would disappear. Since they retain their grip on philosophers, scientists, and lay-people alike, we can conclude that no functional characterization is available. But then the first premise of a reductive explanation cannot be properly formulated, and reductive explanation fails. We are left, Chalmers claims, with the following stark choice: Either way, we are faced with a special ontological problem, one that resists solution by the usual reductive methods. He argues that the facts about conscious states are inherently subjectiveâ€"they can only be fully grasped from limited types of viewpoints. However, scientific explanation demands an objective characterization of the facts, one that moves away from any particular point of view. Nagel argues for the inherent subjectivity of the facts about consciousness by reflecting on the question of what it is like to be a batâ€"for the bat. It seems that no amount of objective data will provide us with this knowledge, given that we do not share its type of point of view the point of view of a creature able to fly and echolocate. This is the hard problem of consciousness. The challenge of closing this explanatory gap is the hard problem. Levine argues that a good scientific explanation ought to deductively entail what it explains, allowing us to infer the presence of the target phenomenon from a statement of laws or mechanisms and initial conditions Levine , Deductive entailment is a logical relation where if the premises of an argument are true, the conclusion must be true as well. For example, once we discover that lightning is nothing more than an electrical discharge, knowing that the proper conditions for a relevantly large electrical discharge existed in the atmosphere at time t allows us to deduce that lightning must have occurred at time t. If such a deduction is not possible, there are three possible reasons, according to Levine. One is that we have not fully specified the laws or mechanisms cited in our explanation. Two is that the target phenomenon is stochastic in nature, and the best that can be inferred is a conclusion about the probability of the occurrence of the explanatory target. The third is that there are as yet unknown factors at least partially involved in determining the phenomenon in question. If we have adequately specified the laws and mechanisms in question, and if we have adjusted for stochastic phenomena, then we should possess a deductive conclusion about our explanatory target, or the third possibility is in effect. And this is the case with consciousness, according to Levine. No matter how detailed our specification of brain mechanisms or physical laws, it seems that there is an open question about whether consciousness is present. We can still meaningfully ask if consciousness occurred, even if we accept that the laws, mechanisms, and proper conditions are in place. And it seems that any further information of this type that we add to our

explanation will still suffer from the same problem. Thus, there is an explanatory gap between the physical and consciousness, leaving us with the hard problem. Underlying Reasons for the Problem But what it is about consciousness that generates the hard problem? It may just seem obvious that consciousness could not be physical or functional. But it is worthwhile to try and draw a rough circle around the problematic features of conscious experience, if we can. This both clarifies what we are talking about when we talk about consciousness and helps isolate the data a successful theory must explain. Uriah Kriegel ; see also Levine offers a helpful conceptual division of consciousness into two components. Focusing on the former, we find that subjects are aware of their conscious states in a distinctive way. Kriegel labels this feature the subjective component of consciousness. Kriegel labels this the qualitative component of consciousness. Subdividing consciousness in this way allows us to concentrate on how we are conscious and what we are conscious of. These features help explain why consciousness generates the hard problem. The first feature, which we can call immediacy, concerns the way we access consciousness from the first-person perspective. Conscious states are accessed in a seemingly unmediated way. It appears that nothing comes between us and our conscious states. We seem to access them simply by having themâ€”we do not infer their presence by way of any evidence or argument. This immediacy creates the impression that there is no way we could be wrong about the content of our conscious states. Error in perception or error in reasoning can be traced back to poor perceptual conditions or to a failure of rational inference. But in the absence of such accessible sources of error, it seems that there is no room for inaccuracy in the introspective case. And even if we come to believe we are in error in introspection, the evidence for this will be indirect and third-personalâ€”it will lack the subjective force of immediacy. Thus, there is an intuition of special accuracy or even infallibility when it comes to knowing our own conscious states. We might be wrong that an object in the world is really red, but can we be wrong that it seems red to us? But if we cannot be wrong about how things seem to us and conscious states seem inexplicable, then they really are inexplicable. In this way, the immediacy of the subjective component of consciousness underwrites the hard problem. But what we access may be even more problematic than how we access it: But conscious experience instead reveals various sensory qualitiesâ€”the redness of the visual experience of an apple or the painfulness of a stubbed toe, for example. But these qualities seem to defy informative description. We can call this feature of the qualitative component of consciousness indescribability. If someone has never seen red a congenitally blind person, for example , it seems there is nothing informative we could say to convey to them the true nature of this quality. We might mention prototypical red objects or explain that red is more similar to purple than it is to green, but such descriptions seem to leave the quality itself untouched. And if experienced qualities cannot be informatively described, how could they be adequately captured in an explanatory theory? It seems that by their very nature, conscious qualities defy explanation. This difficulty lies at the heart of the hard problem. A further problematic feature of what we access is that we can easily imagine our conscious mental processes occurring in conjunction with different conscious qualities or in the absence of consciousness altogether. The particular qualities that accompany specific mental operationsâ€”like the reddish quality accompanying our detection and categorization of an apple, sayâ€”seem only contingently connected to the functional processes involved in detection and categorization. We can call this feature of what is accessed independence. Independence is the apparent lack of connection between conscious qualities and anything else, and it underwrites the inverted and absent qualia thought experiments used by Chalmers to establish the hard problem compare Block If conscious qualities really are independent in this way, then there seems to be no way to effectively tie them to the rest of reality. The challenge of the hard problem, then, is to explain consciousness given that it seems to give us immediate access to indescribable and independent qualities. If we can explain these underlying features, then we may see how to fit consciousness into a physicalist ontology. Or it perhaps taking these features seriously motivates a rejection of physicalism and the acceptance of conscious qualities as fundamental features of our ontology. The following section briefly surveys the range of responses to the hard problem, from eliminativism and reductionism to panpsychism and full-blown dualism. Responses to the Problem a. Eliminativism Eliminativism holds that there is no hard problem of consciousness because there is no consciousness to worry about in the first place. Eliminativism is most clearly defended by Rey , but see

also Dennett , , Wilkes , and Ryle On the face of it, this response sounds absurd: Consciousness might be the one thing that is certain in our epistemology. If it is definitional of consciousness that it is nonfunctional, then holding that the mind is fully functional amounts to a denial of consciousness. Alternately, if qualia are construed as nonrelational, intrinsic qualities of experience, then one might deny that qualia exist Dennett And if qualia are essential to consciousness, this, too, amounts to an eliminativism about consciousness. What might justify consciousness eliminativism? First, the very notion of consciousness, upon close examination, may not have well-defined conditions of applicationâ€”there may be no single phenomenon that the term picks out Wilkes Or the term may serve no use at all in any scientific theory, and so may drop out of a scientifically-fixed ontology Rey If science tells us what there is as some naturalists hold , and science has no place for nonfunctional intrinsic qualities, then there is no consciousness, so defined. The entities posited by a theory stand or fall with the success of the theory. If the theory is falsified, then the entities it posits do not exist compare P. And there is no guarantee that folk psychology will not be supplanted by a better theory of the mind, perhaps a neuroscientific or even quantum mechanical theory, at some point. Thus, consciousness might be eliminated from our ontology. If that occurs, obviously there is no hard problem to worry about. No consciousness, no problem! But eliminativism seems much too strong a reaction to the hard problem, one that throws the baby out with the bathwater.

EASY AND HARD PROBLEMS pdf

2: â€œEasyâ€• vs â€œHardâ€• Problems of Consciousness â€“ manwithoutqualities

The hard problem of consciousness is the most important problem in understanding the mind, and thus far materialism has provided no insight. It is unclear how it even could provide insight. Nothing about the scientific characterization of matter-and nothing about materialism-explains the emergence of subjective experience.

Share In the debate between dualists and materialists over the relationship between the mind and the brain, materialists often invoke neuroscience to buttress their assertion that the brain causes the mind entirely, without need for an immaterial mind or soul. Indeed neuroscience has demonstrated many examples of correlation between physical brain processes and mind states. Do examples of correlation between brain states and mind states genuinely provide evidence for the materialist claim that mind states are merely brain states? Chalmers, who is probably best described as a property dualist, notes: Consciousness poses the most baffling problems in the science of the mind. There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain. All sorts of mental phenomena have yielded to scientific investigation in recent years, but consciousness has stubbornly resisted. Many have tried to explain it, but the explanations always seem to fall short of the target. Some have been led to suppose that the problem is intractable, and that no good explanation can be given. To make progress on the problem of consciousness, we have to confront it directly. In this paper, I first isolate the truly hard part of the problem, separating it from more tractable parts and giving an account of why it is so difficult to explain. There is not just one problem of consciousness. Each of these phenomena needs to be explained, but some are easier to explain than others. The easy problems of consciousness are those that seem directly susceptible to the standard methods of cognitive science, whereby a phenomenon is explained in terms of computational or neural mechanisms. The hard problems are those that seem to resist those methods. Chalmers characterizes the easy problems: There is no real issue about whether these [neurophysiological] phenomena can be explained scientifically. All of them are straightforwardly vulnerable to explanation in terms of computational or neural mechanisms. To explain access and reportability, for example, we need only specify the mechanism by which information about internal states is retrieved and made available for verbal report. To explain the integration of information, we need only exhibit mechanisms by which information is brought together and exploited by later processes. In each case, an appropriate cognitive or neurophysiological model can clearly do the explanatory workâ€¦. If these phenomena were all there was to consciousness, then consciousness would not be much of a problem. Although we do not yet have anything close to a complete explanation of these phenomena, we have a clear idea of how we might go about explaining them. This is why I call these problems the easy problems. Getting the details right will probably take a century or two of difficult empirical work. Still, there is every reason to believe that the methods of cognitive science and neuroscience will succeed. Chalmers describes the hard problem of consciousness: The really hard problem of consciousness is the problem of experience. When we think and perceive, there is a whir of information-processing, but there is also a subjective aspect. As Nagel has put it, there is something it is like to be a conscious organism. This subjective aspect is experience. When we see, for example, we experience visual sensations: Other experiences go along with perception in different modalities: Then there are bodily sensations, from pains to orgasms; mental images that are conjured up internally; the felt quality of emotion, and the experience of a stream of conscious thought. What unites all of these states is that there is something it is like to be in them. All of them are states of experienceâ€¦It is undeniable that some organisms are subjects of experience. But the question of how it is that these systems are subjects of experience is perplexing. Why is it that when our cognitive systems engage in visual and auditory information-processing, we have visual or auditory experience: How can we explain why there is something it is like to entertain a mental image, or to experience an emotion? It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises. Why should physical processing give rise to a rich inner life at all? It seems objectively unreasonable that it should, and yet it does. If any problem qualifies as the problem of consciousness, it is this one. Materialists such as Dr. Steven Novella deny the relevance of the hard problem of consciousness to our understanding of the mind. Referring

to an earlier reference of mine to the hard problem, Dr. We are subjects, not merely objects. First-person ontogeny is the aspect of our minds with which we are most familiar. In fact, first-person ontogeny is the only aspect of ourselves with which we are familiar, in the tautological sense that it is the only thing that we actually experience. It is the indispensable quality of the mind. The origin of subjective experience is the fundamental questionâ€”the hard problemâ€”in understanding the mind. Yet there is nothing in the material world that intrinsically refers to or explains subjective experience. There is nothing in third-person ontogeny from which one would infer first-person ontogeny. No theory in physics or chemistry invokes the emergence of first-person experience. A detailed scientific understanding of the physics and chemistry of the brainâ€”from molecular structure to neurochemistry to electrophysiology to neuroanatomyâ€”would not at any point provide a scientific explanation of why we are subjects and not just objects. This hard question about subjective experience in the relationship between the mind and the brain has been at the core of the most active and contentious issue in analytic philosophy in later 20th century and early 21st century. As science is a branch of philosophy natural philosophy , scientists must grapple with these profound philosophical issues. It is a matter of applying good philosophy or bad philosophy to this debate. The hard problem of consciousness is the most important problem in understanding the mind, and thus far materialism has provided no insight. It is unclear how it even could provide insight. Nothing about the scientific characterization of matterâ€”and nothing about materialismâ€”explains the emergence of subjective experience. The principal materialist response to this catastrophe for materialist ideology has been to deny the relevance of subjective experience to our understanding of the mind. Yet the retreat to science and the denial of the relevance of philosophy is no refuge. Science is natural philosophy. Materialists, left with the choice of denying materialism or denying the reality of subjective mental experience, deny subjective mental experience. There is no fanaticism like materialist fanaticism.

EASY AND HARD PROBLEMS pdf

3: The Hard and Easy Problems in the Mind-Brain Question | Evolution News

5 Grade School Math Problems That Are So Hard, You'll Wonder How You Ever Made it To High School. How can they be so easy and so not at the same time?!

Messenger Ipswich residents have been told their recycling waste will now be dumped into landfill because it is too expensive for the local council to recycle. Last year alone we exported more than , tonnes of waste to China. Australia does not currently have the capacity to handle this volume. Where do my recycled items go? In Queensland, this could not be happening at a worse time, given that the state will soon launch its own container refund scheme in a bid to boost recycling rates. Unfortunately, the case of Ipswich Council is likely to be repeated around Australia. Many local councils will be feeling the strain and considering their options as they face their own recycling mess. Use a stick A crude, but ultimately effective, strategy would be to increase landfill levies to make this option more expensive. This would create a clear and immediate incentive for businesses to consider exactly how much material they need to send to landfill. Until recently, Queensland had no levy on landfill. This prompted many New South Wales businesses to send their waste across the border for cheaper dumping. Queensland recently re-introduced a levy to deter this practice, which will presumably normalise the amount of waste going into its landfills. Increasing levies will mean a movement towards the correct cost of landfill while at the same time generating revenue than can be used to improve recycling infrastructure or, fingers crossed, even cut council tax rates. Australian recycling plants have no incentive to improve It is clear the domestic market is currently too small to increase the percentage of recycling it handles. To solve this, another simple solution would be to subsidise the cost of recycling this waste. Subsidies would provide immediate incentives for local recycling plants to increase their processing of this material. In the long run, this may result in more investment in local recycling infrastructure that will be essential to cope with the volume of waste. Subsidies are not new for Australian environmental policy. The same logic could be used for recycling. A savvy policymaker could implement a recycling subsidy that is fully funded by the revenue generated by a waste levy, thus requiring no additional taxpayer funding. Use a second, different, stick So far the proposed polices have focused on the existing problems within the landfill and recycling industries, but we need to look more closely at the root of the problem: Effective policies could reduce excessive packaging by encouraging companies to rethink their product delivery. One could tax product packaging, just as policymakers have done with the use of successful plastic bag taxes. Use a mirror Understandably, implementing tax and subsidy policies may not please everyone. Luckily, changing patterns of behaviour to reduce waste without levies and subsidies is often quite easy and relatively cheap. Some councils are taking the step of monitoring the contents of bins. Taking ownership of â€” and responsibility for â€” your own waste may prove an unlikely yet effective policy. We have options All in all, we have plenty of options for dealing with our recycling. Now that China is no longer offering a cheap and convenient option to push our waste problems offshore, we have an opportunity to make positive and long-lasting change. What we need most is strong and consistent leadership from policymakers who can imagine a low-waste Australian society.

4: Hard Problem of Consciousness | Internet Encyclopedia of Philosophy

They use the "same" basic knowledge that we learned at the start of a new chapter but why do their level of difficulty vary so much from each.

Historical predecessors[edit] The hard problem has scholarly antecedents considerably earlier than Chalmers, as Chalmers himself has pointed out. Divide matter into as minute parts as you will which we are apt to imagine a sort of spiritualizing or making a thinking thing of it vary the figure and motion of it as much as you pleaseâ€”a globe, cube, cone, prism, cylinder, etc. They knock, impel, and resist one another, just as the greater do; and that is all they can do Moreover, it must be confessed that perception and that which depends upon it are inexplicable on mechanical grounds, that is to say, by means of figures and motions. And supposing there were a machine, so constructed as to think, feel, and have perception, it might be conceived as increased in size, while keeping the same proportions, so that one might go into it as into a mill. That being so, we should, on examining its interior, find only parts which work one upon another, and never anything by which to explain a perception. Now I am far from pretending that it may not be capable of proof, or that it is not an important addition to our knowledge if proved, that certain motions in the particles of bodies are the conditions of the production of heat or light; that certain assignable physical modifications of the nerves may be the conditions not only of our sensations or emotions, but even of our thoughts; that certain mechanical and chemical conditions may, in the order of nature, be sufficient to determine to action the physiological laws of life. All I insist upon, in common with every thinker who entertains any clear idea of the logic of science, is, that it shall not be supposed that by proving these things one step would be made towards a real explanation of heat, light, or sensation; or that the generic peculiarity of those phenomena can be in the least degree evaded by any such discoveries, however well established. Let it be shown, for instance, that the most complex series of physical causes and effects succeed one another in the eye and in the brain to produce a sensation of colour; rays falling on the eye, refracted, converging, crossing one another, making an inverted image on the retina, and after this a motionâ€”let it be a vibration, or a rush of nervous fluid, or whatever else you are pleased to suppose, along the optic nerveâ€”a propagation of this motion to the brain itself, and as many more different motions as you choose; still, at the end of these motions, there is something which is not motion, there is a feeling or sensation of colour. Whatever number of motions we may be able to interpolate, and whether they be real or imaginary, we shall still find, at the end of the series, a motion antecedent and a colour consequent. The mode in which any one of the motions produces the next, may possibly be susceptible of explanation by some general law of motion: Where our consciousness recognises between two phenomena an inherent distinction; where we are sensible of a difference which is not merely of degree, and feel that no adding one of the phenomena to itself would produce the other; any theory which attempts to bring either under the laws of the other must be false; though a theory which merely treats the one as a cause or condition of the other, may possibly be true. Huxley wrote in But what consciousness is, we know not; and how it is that anything so remarkable as a state of consciousness comes about as the result of irritating nervous tissue, is just as unaccountable as the appearance of the Djin when Aladdin rubbed his lamp in the story, or as any other ultimate fact of nature. If physicalism is to be defended, the phenomenological features must themselves be given a physical account. But when we examine their subjective character it seems that such a result is impossible. The reason is that every subjective phenomenon is essentially connected with a single point of view, and it seems inevitable that an objective, physical theory will abandon that point of view. Neural correlates of consciousness Since , researchers including the molecular biologist Francis Crick and the neuroscientist Christof Koch have made significant progress toward identifying which neurobiological events occur concurrently to the experience of subjective consciousness. However, this research arguably addresses the question of which neurobiological mechanisms are linked to consciousness but not the question of why they should give rise to consciousness at all, the latter being the hard problem of consciousness as Chalmers formulated it. In "On the Search for the Neural Correlate of Consciousness", Chalmers said he is confident that, granting the principle that something such as what he terms global availability can be used as an indicator

of consciousness, the neural correlates will be discovered "in a century or two". One can always ask why these processes of availability should give rise to consciousness in the first place. As yet we cannot explain why they do so, and it may well be that full details about the processes of availability will still fail to answer this question. Certainly, nothing in the standard methodology I have outlined answers the question; that methodology assumes a relation between availability and consciousness, and therefore does nothing to explain it. Somewhere along the line we may be led to the relevant insights that show why the link is there, and the hard problem may then be solved. Integrated information theory Integrated information theory IIT , developed by the neuroscientist and psychiatrist Giulio Tononi in and more recently also advocated by Koch, is one of the most discussed models of consciousness in neuroscience and elsewhere. Tononi wrote along with two colleagues: As will be illustrated below, IIT offers a way to analyze systems of mechanisms to determine if they are properly structured to give rise to consciousness, how much of it, and of which kind. Chalmers argued that a "rich inner life" is not logically reducible to the functional properties of physical processes. He states that consciousness must be described using nonphysical means. This description involves a fundamental ingredient capable of clarifying phenomena that have not been explained using physical means. Use of this fundamental property, Chalmers argues, is necessary to explain certain functions of the world, much like other fundamental features, such as mass and time, and to explain significant principles in nature. The philosopher Thomas Nagel posited in that experiences are essentially subjective accessible only to the individual undergoing themâ€”i. So at this stage, he argued, we have no idea what it could even mean to claim that an essentially subjective state just is an essentially non-subjective state i. In other words, we have no idea of what reductivism really amounts to. These theorists have argued that once we really come to understand what consciousness is, we will realize that the hard problem is unreal. For instance, Dennett asserts that the so-called hard problem will be solved in the process of answering the "easy" ones which, as he has clarified, he does not consider "easy" at all. Instead of involving the nonphysical, he says, consciousness merely plays tricks on people so that it appears nonphysicalâ€”in other words, it simply seems like it requires nonphysical features to account for its powers. In this way, Dennett compares consciousness to stage magic and its capability to create extraordinary illusions out of ordinary things. He claims that this error of making consciousness more mysterious than it is could be a misstep in any developments toward an effective explanatory theory. Critics such as Galen Strawson reply that, in the case of consciousness, even a mistaken experience retains the essential face of experience that needs to be explained, contra Dennett. To address the question of the hard problem, or how and why physical processes give rise to experience, Dennett states that the phenomenon of having experience is nothing more than the performance of functions or the production of behavior, which can also be referred to as the easy problems of consciousness. So, unlike Chalmers and other dualists, Dennett says that the easy problems and the hard problem cannot be separated from each other. To him, the hard problem of experience is included amongâ€”not separate fromâ€”the easy problems, and therefore they can only be explained together as a cohesive unit. They misunderstand the nature of consciousness. The conception of consciousness which they have is incoherent. They have to go back to the drawing board and start all over again. Though the most common arguments against deflationary accounts and eliminative materialism are the argument from qualia and the argument that conscious experiences are irreducible to physical statesâ€”or that current popular definitions of "physical" are incompleteâ€”the objection has been posed[by whom? For example, the philosopher John Searle pointed out: Hence, the arguments beg the question. The authors suggest that "instead of letting our conclusions on the thought experiments guide our theories of consciousness, we should let our theories of consciousness guide our conclusions from the thought experiments". It is obvious that I cannot experience what it is like to be you, but I can potentially have a complete explanation of how and why it is possible to be you. Philosophers such as Chalmers or Nagel have rejected reductionist theories of consciousness because they believe that the reports of subjective experience constitute a vast and important body of empirical evidence which is ignored by modern reductionist theories of consciousness. Neuroscientist Michael Graziano , in his book Consciousness and the Social Brain, advocates what he calls attention schema theory , in which our perception of being conscious is merely an error in perception, held by brains which evolved to hold erroneous and incomplete models of their

own internal workings, just as they hold erroneous and incomplete models of their own bodies and of the external world. The hypothetical concept of qualia, pure mental experience, detached from any information-processing role, will be viewed as a peculiar idea of the prescientific era, much like vitalism

EASY AND HARD PROBLEMS pdf

5: 3 Easy Ways to Solve Math Problems (with Pictures)

At the start, it is useful to divide the associated problems of consciousness into "hard" and "easy" problems. The easy problems of consciousness are those that seem directly susceptible to the standard methods of cognitive science, whereby a phenomenon is explained in terms of computational or neural mechanisms.

How Hard is the Problem? Many of us have had the particularly frustrating experience of running our new program and observing that it seems to be running for a very long time without producing the output that we expected. Should I stop the program? Another minute passes and you ask yourself if you should let it run longer or bail out now. You wonder though if perhaps the program was just a moment away from giving you the right answer. After all, the problem might just inherently require a lot of computing time. True if the input program eventually halts and False otherwise. Recall from Chapter 3 that functions can take other functions as input. So there is nothing really strange about giving the hypothetical halt checker function another function as input. Then, the halt checker would somehow determine if the function in that string eventually halts. Clearly, that function runs forever because the function calls itself recursively and there is no base case to make it stop. Therefore, if we were to run our hypothetical haltChecker function it should return False: It would be easy to check for certain kinds of obvious problems, like the problem in the program foo in the example above. It seems though that it might be quite difficult to write a halt checker that could reliably evaluate any possible program that we would give it. After all, some programs are very complicated with all kinds of recursion, for loops, while loops, etc. Is it even possible to write such a halt checker program? That is, it is not possible to write a halt checker program that would tell us whether any other program eventually halts or not. That seems like an irresponsible statement to make. Easy, Hard, and Impossible. Generally speaking, time is the most precious resource so we want to know how much time it will take to solve a given problem. Roughly speaking, we can categorize problems into three groups: However, a program implements an algorithm. Rather, we mean that there exists an algorithm that runs fast enough that the problem can be solved in a reasonable amount of time. Our goal is to sort them from smallest to largest. In Chapter 5, we needed that sorting algorithm as one step in our music recommendation system. Now the algorithm knows the smallest element and it puts that element in the first position in the list by simply swapping the first element in the list with the smallest element in the list. Of course, it might be that the first element in the list is the smallest element in the list, in which case that swap effectively does nothing - but in any case we are guaranteed that the first element in the list now is the correct smallest element in the list. You might hear a computer scientist say: In practice, polynomial time is a reasonable amount of time. The good news is that there is a direct flight between every pair of cities and, for each pair, you are given the cost of flying between those two cities. Your objective is to start in your home city, visit each city exactly once, and return back home at lowest total cost. For example, consider the set of cities and flights shown in Figure 7. Cities and flight costs. A tempting approach to solving this problem is to use an approach like this: Starting at our home city, Aville, fly on the cheapest flight. From Beesburg, we could fly on the least expensive flight to a city that we have not yet visited, in this case Ceefield. From Ceefield we would then fly on the cheapest flight to a city that we have not yet visited. So now, we fly from Ceefield to Deesdale and from there to Eetown. In general, greedy algorithms are fast but often fail to find optimal or even particularly good solutions. It turns out that finding the optimal tour for the Traveling Salesperson Problem is very difficult. Of course, we could simply enumerate every one of the possible different tours, evaluate the cost of each one, and then find the one of least cost. Time to solve problems of various sizes using algorithms with different running times on a computer capable of performing one billion operations per second. Times are in seconds unless indicated otherwise. The exclamation point is appropriate because that quantity grows very rapidly. Computers are fast, but examining one trillion different tours would take a long time on even the fastest computer. One might be tempted to believe that in a few years, when computers get faster, this will no longer be a problem. The Traveling Salesperson Problem is just one of many problems for which algorithms exist but are much too slow to be useful - regardless of how fast computers become in the future. Moreover, these problems all have the property that if any one of them can be

solved efficiently in polynomial time then, amazingly, all of these problems can be solved efficiently. Metaphorically, we can think of the NP-hard problems as a giant circle of very big dominoes - one domino for the Traveling Salesperson Person and one for every NP-hard problem. Unfortunately, many important and interesting problems are NP-hard. For example, the problem of determining how a protein folds in three dimensions is NP-hard. As another example, imagine that we have a number of items of different size that we want to pack into shipping containers of some given size. How should we pack our items into shipping containers so as to minimize the number of containers used? This problem too is NP-hard. Many games and puzzles are also NP-hard. For example, the problem of determining whether large Sudoku puzzles are solvable is NP-hard as are problems related to solving Minesweeper games and many others. Computer scientists work on a variety of strategies for dealing with NP-hard problems. One strategy is something called approximation algorithms. An approximation algorithm is an algorithm that runs fast in polynomial time and finds solutions that are guaranteed to be within a certain percentage of the best possible solution. There are many other approaches as well to dealing with NP-hard problems. One approach is called heuristic design. There are many other approaches for dealing with NP-hard problems and this is an active area of research in computer science. For an example of an interesting biologically inspired technique for dealing with NP-hard problems, see below. One technique for dealing with NP-hard problems is borrowed from biology. Hopefully, the next generation will be more fit - that is, it will, on average, have less expensive tours. We repeat this process for some number of generations, keeping track of the most fit organism least cost tour that we have found and report this tour at the end. There are many possible ways we could define the process by which two parent orderings give rise to a child ordering. Imagine that we select two parent orderings from our current population to reproduce we assume that any two orderings can mate: In summary, a genetic algorithm is a computational technique that is effectively a simulation of evolution with natural selection. The technique allows us to find good solutions to hard computational problems by imagining candidate solutions to be metaphorical organisms and collections of such organisms to be populations. Instead, the population comprises a relatively small sample of organisms and this population evolves over time until we hopefully! Now we turn to problems that are downright impossible to solve, no matter how much time we are willing to spend. Therefore, there must be some problems for which there exist no programs. This is a strange and beautiful idea. This is what a mathematician calls an existence proof: We show that something exists in this case uncomputable problems without actually identifying a concrete example! The idea is also beautiful because it uses the notion of different sizes of infinities. In a nutshell, it turns out that there are an infinite number of different programs that we could write but there is a larger infinite number of different computational problems. Imagine that we gave you three jelly beans. Of course, you are good at counting and you instantly recognize that you have three jelly beans, but pardon us for a moment as we look at this another way. More precisely, a bijection is a matching of elements from one set e. That seems pretty obvious and more than a bit pedantic. Both sets are clearly infinite. Moreover, it seems that the set of counting numbers is about twice as large as the set of even counting numbers. Strangely though, the two sets have the same cardinality: We can establish a bijection - a perfect matching â€" between the two! Is every counting number associated with a distinct even counting number? Yes, because each pair of counting numbers is matched to two different even numbers. And, is every even counting number matched in this way to some counting number? So, strangely, these two sets have the same cardinality! By similar arguments, the set of all integers the counting numbers, the negatives of the counting numbers, and 0 also has a bijection with the counting numbers, so these two sets also have the same size. But such is the reality of infinity! So, as we noted above, the set of even counting numbers, the set of integers, and the set of all rational numbers are all countably infinite. The story begins in Germany in the last years of the nineteenth century. See the sidebar on proofs by contradiction. The approach is to assume that something is true e. We are therefore forced to conclude that our initial assumption e. The ancient Greeks, also according to legend, treated this result as an official secret, and Hippasus was murdered when he divulged it. This forces us to conclude that our assumption was false, thereby proving what we seek to prove!

6: 11 Math Problems That Look Simple But Are Not

The Hard Problem is a metaphysical and explanatory problem concerning the nature of conscious states. The Harder Problem is epistemological, and it concerns whether we can know, given physicalism, whether some creature physically different from us is conscious.

Does P mean "easy"? Quadratic fit suggests that empirical algorithmic complexity for instances with 50â€”10, variables is O log n 2. It is a common and reasonably accurate assumption in complexity theory; however, it has some caveats. First, it is not always true in practice. A theoretical polynomial algorithm may have extremely large constant factors or exponents thus rendering it impractical. There are algorithms for many NP-complete problems, such as the knapsack problem , the traveling salesman problem and the Boolean satisfiability problem , that can solve to optimality many real-world instances in reasonable time. The empirical average-case complexity time vs. An example is the simplex algorithm in linear programming , which works surprisingly well in practice; despite having exponential worst-case time complexity it runs on par with the best known polynomial-time algorithms. A key reason for this belief is that after decades of studying these problems no one has been able to find a polynomial-time algorithm for any of more than important known NP-complete problems see List of NP-complete problems. It is also intuitively argued that the existence of problems that are hard to solve but for which the solutions are easy to verify matches real-world experience. For example, in these statements were made: This is, in my opinion, a very weak argument. The space of algorithms is very large and we are only at the beginning of its exploration. Vardi , Rice University Being attached to a speculation is not a good guide to research planning. One should always try both directions of every problem. Prejudice has caused famous mathematicians to fail to solve famous problems whose solution was opposite to their expectations, even though they had developed all the methods required. Either direction of resolution would advance theory enormously, and perhaps have huge practical consequences as well. It is also possible that a proof would not lead directly to efficient methods, perhaps if the proof is non-constructive , or the size of the bounding polynomial is too big to be efficient in practice. The consequences, both positive and negative, arise since various NP-complete problems are fundamental in many fields. Cryptography, for example, relies on certain problems being difficult. A constructive and efficient solution [Note 2] to an NP-complete problem such as 3-SAT would break most existing cryptosystems including: Existing implementations of public-key cryptography , [27] a foundation for many modern security applications such as secure financial transactions over the Internet. Cryptographic hashing as the problem of finding a pre-image that hashes to a given value must be difficult in order to be useful, and ideally should require exponential time. On the other hand, there are enormous positive consequences that would follow from rendering tractable many currently mathematically intractable problems. For instance, many problems in operations research are NP-complete, such as some types of integer programming and the travelling salesman problem. Efficient solutions to these problems would have enormous implications for logistics. Many other important problems, such as some problems in protein structure prediction , are also NP-complete; [30] if these problems were efficiently solvable it could spur considerable advances in life sciences and biotechnology. But such changes may pale in significance compared to the revolution an efficient method for solving NP-complete problems would cause in mathematics itself. Namely, it would obviously mean that in spite of the undecidability of the Entscheidungsproblem , the mental work of a mathematician concerning Yes-or-No questions could be completely replaced by a machine. After all, one would simply have to choose the natural number n so large that when the machine does not deliver a result, it makes no sense to think more about the problem. Similarly, Stephen Cook says [33] Example problems may well include all of the CMI prize problems. A method that is guaranteed to find proofs to theorems, should one exist of a "reasonable" size, would essentially end this struggle. It would allow one to show in a formal way that many common problems cannot be solved efficiently, so that the attention of researchers can be focused on partial solutions or solutions to other problems. For example, it is possible that SAT requires exponential time in the worst case, but that almost all randomly selected instances of it are efficiently solvable. Russell Impagliazzo has

described five hypothetical "worlds" that could result from different possible resolutions to the average-case complexity question. A Princeton University workshop in studied the status of the five worlds. Classification Relativizing proofs Imagine a world where every algorithm is allowed to make queries to some fixed subroutine called an oracle a black box which can answer a fixed set of questions in constant time, such as a black box that solves any given traveling salesman problem in 1 step , and the running time of the oracle is not counted against the running time of the algorithm. Most proofs especially classical ones apply uniformly in a world with oracles regardless of what the oracle does. These proofs are called relativizing. Natural proofs In , Alexander Razborov and Steven Rudich defined a general class of proof techniques for circuit complexity lower bounds, called natural proofs. However, Razborov and Rudich showed that, if one-way functions exist, then no natural proof method can distinguish between P and NP. These barriers have also led some computer scientists to suggest that the P versus NP problem may be independent of standard axiom systems like ZFC cannot be proved or disproved within them. The interpretation of an independence result could be that either no polynomial-time algorithm exists for any NP-complete problem, and such a proof cannot be constructed in e. ZFC, or that polynomial-time algorithms for NP-complete problems may exist, but it is impossible to prove in ZFC that such algorithms are correct. Additionally, this result implies that proving independence from PA or ZFC using currently known techniques is no easier than proving the existence of efficient algorithms for all problems in NP. Claimed solutions [edit] While the P versus NP problem is generally considered unsolved, [43] many amateur and some professional researchers have claimed solutions. Consider all languages of finite structures with a fixed signature including a linear order relation. Then, all such languages in P can be expressed in first-order logic with the addition of a suitable least fixed-point combinator. Effectively, this, in combination with the order, allows the definition of recursive functions. As long as the signature contains at least one predicate or function in addition to the distinguished order relation, so that the amount of space taken to store such finite structures is actually polynomial in the number of elements in the structure, this precisely characterizes P. Similarly, NP is the set of languages expressible in existential second-order logic â€”that is, second-order logic restricted to exclude universal quantification over relations, functions, and subsets. The languages in the polynomial hierarchy , PH , correspond to all of second-order logic. Thus, the question "is P a proper subset of NP" can be reformulated as "is existential second-order logic able to describe languages of finite linearly ordered structures with nontrivial signature that first-order logic with least fixed point cannot? Polynomial-time algorithms[edit] No algorithm for any NP-complete problem is known to run in polynomial time. However, these algorithms do not qualify as polynomial time because their running time on rejecting instances are not polynomial. The following algorithm, due to Levin without any citation , is such an example below. If there is an algorithm say a Turing machine , or a computer program with unbounded memory that can produce the correct answer for any input string of length n in at most cnk steps, where k and c are constants independent of the input string, then we say that the problem can be solved in polynomial time and we place it in the class P. Formally, P is defined as the set of all languages that can be decided by a deterministic polynomial-time Turing machine.

7: Hard problem of consciousness - Wikipedia

Hard problems and easy problems. The hard problem contrasts with so-called easy problems, such as explaining how the brain integrates information, categorizes and discriminates environmental stimuli, or focuses attention.

Such phenomena are functionally definable. That is, roughly put, they are definable in terms of what they allow a subject to do. So, for example, if mechanisms that explain how the brain integrates information are discovered, then the first of the easy problems listed would be solved. The same point applies to all other easy problems: For the easy problems, once the relevant mechanisms are well understood, there is little or no explanatory work left to do. Experience does not seem to fit this explanatory model though some reductionists argue that, on reflection, it does; see the section on reductionism below. Although experience is associated with a variety of functions, explaining how those functions are performed would still seem to leave important questions unanswered. We would still want to know why their performance is accompanied by experience, and why this or that kind of experience rather than another kind. So, for example, even when we find something that plays the causal role of pain, e. Such problems are hard problems. Cognitive models of consciousness Barrs are sometimes described as potential solutions to the hard problem. However, it is unclear that any such model could achieve that goal. For example, consider global workspace theory , according to which the contents of consciousness are globally available for various cognitive processes such as attention, memory , and verbal report. Even if this theory is correct, the connection between such processes and experienceâ€”e. For similar reasons, discovering neural correlates of consciousness might leave the hard problem unsolved: Nevertheless, scientific advances on cognitive models and neural correlates of consciousness might well play important roles in a comprehensive solution. Relation to arguments against physicalism and the explanatory gap The hard problem is often discussed in connection to arguments against physicalism or materialism which holds that consciousness is itself a physical phenomenon with solely physical properties. One of these arguments is the knowledge argument Jackson , which is based on thought experiments such as the following. Mary is a super-scientist with limitless logical acumen, who is raised far in the future in an entirely black-and-white room. By watching science lectures on black-and-white television, she learns the complete physical truthâ€”everything in completed physics, chemistry, neuroscience , etc. Then she leaves the room and experiences color for the first time. It seems intuitively clear that upon leaving the room she learns new truths about what it is like to see in color. Advocates of the knowledge argument take that result to indicate that there are truths about consciousness that cannot be deduced from the complete physical truth. It is inferred from that premise that the physical truth fails to completely determine the truth about consciousness. And the latter result, most agree, would undermine physicalism. The hard problem relates closely to the claim that Mary learns new truths about color experiences when she first has such experiences. Arguably, if she learns new truths at that time, this is because the nature of color experiences cannot be fully explained in purely physical terms; otherwise, the reasoning runs, she would have already known the relevant truths. If such experiences are fully explicable in physical terms, then they should be objectively comprehensible, and Mary seems well positioned to grasp all objectively comprehensible properties. The general idea here is sometimes expressed as the claim that there is an explanatory gap Levine between the physical and the phenomenal. A second argument often associated with the hard problem is the conceivability argument Kripke , Chalmers According to one version of the conceivability argument, also called the zombie argument, one can conceive of a micro-physical duplicate of a human that lacks conscious experiences. Given this, it is argued, such a micro-physical duplicate is possible, which entails that the physical facts do not necessitate the phenomenal or experiential facts. This, according to most philosophers, indicates that physicalism is false. While many philosophers doubt that the conceivability of these zombie duplicates is indicative of their possibility, the hard problem primarily concerns the first step of the argument. If we can conceive of micro-physical duplicates of ourselves that lack consciousness, then we lack a complete explanation for why the physical facts give rise to the experiential or phenomenal facts. This again shows the existence of an explanatory gap. Reductionism There is no consensus about the status of the explanatory gap.

Reductionists deny that the gap exists. They argue that the hard problem reduces to a combination of easy problems or derives from misconceptions about the nature of consciousness. For example, Daniel Dennett argues that, on reflection, consciousness is functionally definable. On his view, once the easy problems are solved, there will be nothing about consciousness and the physical left to explain. Reductionists often appeal to analogies from the history of science. These philosophers compare nonreductionists, who accept the existence of the explanatory gap, to 17th Century vitalists concerned about the hard problem of life. Comparisons are also made to the scientifically ignorant concerned about hard problems of heat or light Churchland Science has shown that the latter concerns are overblown: Likewise, say reductionists, for consciousness. Nonreductionists usually reject such analogies. Part of the analogy is usually accepted: However, what the vitalists sought to explain was how certain functions are performed. By contrast, consciousness does not seem to consist in the performance of functions. Nonreductionists take that difference to undermine the analogy between the hard problem of consciousness and the alleged hard problem of life. Reductionism is entailed by influential theories in the philosophy of mind , including philosophical behaviorism , analytic functionalism , and eliminative materialism. Some philosophers take the merits of those positions, such as their relative parsimony, to provide grounds for a reductionist approach to the hard problem. Other philosophers accept the existence of the explanatory gap and thus regard the hard problem as evidence against those theories. For nonreductionist physicalists, the gap reflects something about our perspective on the world, not the world itself. These philosophers hold that consciousness is an entirely physical phenomenon, and thus that phenomenal truths are nothing over and above physical truths, even though phenomenal truths cannot be deduced from micro-physical truths or the sorts of truths that Mary learns from her lectures. Non-reductionists must explain how to reconcile physicalism with the explanatory gap. Reductionists do not share this burden, since they reject the gap. Here nonreductionists sometimes invoke analogies to Kripkean empirical necessities. According to Kripke, the fact that heat is decoherent molecular motion is absolutely necessaryâ€”there is no possible situation in which there is one without the otherâ€”even though that fact was discovered empirically. One might object on the grounds that we can easily imagine a situation in which there is heat but, it turns out, no molecular motion. Against this, Kripke argues that on reflection such a situation is inconceivable. What we imagine existing without molecular motion is the sensation of heatâ€”an experience typically caused in us by molecular motionâ€”and not heat itself. Non-reductionists sometimes argue that similar reasoning could be used to explain why, in spite of the explanatory gap, the physical truth necessitates the truth about consciousness. However, as Kripke himself argues, in the case of consciousness there does not appear to be a distinction corresponding to that between heat and the sensation of heat. For example, anything that feels like pain is ipso facto pain. Many nonreductionists acknowledge that more is required to reconcile physicalism with the explanatory gap. Here it is common to appeal to distinctive features of phenomenal concepts. Some propose that phenomenal concepts are distinctive in that their referentsâ€”phenomenal statesâ€”are constituents of those very concepts. For example, David Papineau suggests that phenomenal concepts have the form that state: Some nonreductionists take the hard problem as a reason to reject physicalism. On most nonphysicalist views, consciousness is regarded as an irreducible component of nature. These views tend to differ primarily on how they characterize the causal relationship between consciousness and the physical world. According to interactionist dualism , for example, consciousness has both physical causes and physical effects; according to epiphenomenalism consciousness has physical causes but no physical effects; and according to neutral monism phenomenal properties are the categorical bases of physical properties, which are dispositional neutral monism might or might not count as a version of physicalism, depending on whether the categorical bases physical properties are considered physical. Psychophysical theories Some believe that solving the hard problem will require constructing a psychophysical theory that includes fundamental laws. No such theory has been developed in great detail, but some speculative proposals have been advanced. Certain interactionist dualists argue that phenomenal properties affect brain processes by filling in gaps resulting from quantum indeterminacy Eccles Theories emerging from that sort of argument may involve positing psychophysical laws. And David Chalmers , a leading nonreductionist, tentatively proposes that the basic link between the phenomenal and the

physical exists at the level of information. He formulates a double aspect principle, on which phenomenal states realize informational states that are also realized in physical, cognitive systems such as the brain. Either proposal might provide a kind of solution to the hard problem: An important vestige of the hard problem would, of course, remain: Such theorists are likely to argue that these laws are primitive, just like the basic laws of physics, and so the vestigial hard problem is neither more nor less puzzling than the question as to why the physical constants are what they are. Reductionists will argue that such proposal are misconceived, either because they depend on confused notions of consciousness or because they presuppose that solutions to the easy problems will not yield a solution to the hard problem. Nonreductionist physicalists will reject those reductionist arguments, but they also tend to reject the need for a fundamental psychophysical theory. Not all such theories conflict with nonreductionist physicalism. Unlike Chalmers, however, they will regard phenomenal information as a special sort of physical informationâ€”special in that its connection to other sorts of physical information will remain opaque without appropriate psychophysical laws. Mysterianism Some argue that we are unable to solve the hard problem. This view is sometimes called mysterianism, and its best-known champion is Colin McGinn McGinn argues that our minds are simply not constructed to solve the hard problem; we are cognitively closed to it, in something like the way rats are cognitively closed to calculus problems. But unlike the rats, we can grasp the nature of the problem that, according to McGinn, we cannot solve. In his view, we form such concepts by extending concepts associated with perception of macroscopic objects. And he argues that any concepts produced by this mechanism will, like familiar physical concepts, inevitably leave the hard problem unsolved. This argumentâ€”both the premise about concept formation and the mysterian inferenceâ€”is controversial Stoljar And there are versions of mysterianism that do not rely on the argument. These include less pessimistic versions on which scientific advances may one day enable us to solve the hard problem Nagel , Stoljar Mysterians differ on both reductionism and physicalism. McGinn and Thomas Nagel, a less pessimistic mysterian, reject reductionism. Daniel Stoljar, another less pessimistic mysterian, is officially neutral on reductionism.

8: Facing Up to the Problem of Consciousness

Complexity theory is the study of the "easy" and "hard" problems - problems for which algorithmic solutions exist but the running time (or memory or other resources) may vary from modest to outrageous.

Also online is my response, " Moving Forward on the Problem of Consciousness ", to 26 articles commenting on this paper. That paper elaborates and extends many of the ideas in this one. There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain. All sorts of mental phenomena have yielded to scientific investigation in recent years, but consciousness has stubbornly resisted. Many have tried to explain it, but the explanations always seem to fall short of the target. Some have been led to suppose that the problem is intractable, and that no good explanation can be given. To make progress on the problem of consciousness, we have to confront it directly. In this paper, I first isolate the truly hard part of the problem, separating it from more tractable parts and giving an account of why it is so difficult to explain. I critique some recent work that uses reductive methods to address consciousness, and argue that such methods inevitably fail to come to grips with the hardest part of the problem. Once this failure is recognized, the door to further progress is opened. In the second half of the paper, I argue that if we move to a new kind of nonreductive explanation, a naturalistic account of consciousness can be given. I put forward my own candidate for such an account: Each of these phenomena needs to be explained, but some are easier to explain than others. At the start, it is useful to divide the associated problems of consciousness into "hard" and "easy" problems. The easy problems of consciousness are those that seem directly susceptible to the standard methods of cognitive science, whereby a phenomenon is explained in terms of computational or neural mechanisms. The hard problems are those that seem to resist those methods. The easy problems of consciousness include those of explaining the following phenomena: All of these phenomena are associated with the notion of consciousness. For example, one sometimes says that a mental state is conscious when it is verbally reportable, or when it is internally accessible. Sometimes a system is said to be conscious of some information when it has the ability to react on the basis of that information, or, more strongly, when it attends to that information, or when it can integrate that information and exploit it in the sophisticated control of behavior. We sometimes say that an action is conscious precisely when it is deliberate. Often, we say that an organism is conscious as another way of saying that it is awake. There is no real issue about whether these phenomena can be explained scientifically. All of them are straightforwardly vulnerable to explanation in terms of computational or neural mechanisms. To explain access and reportability, for example, we need only specify the mechanism by which information about internal states is retrieved and made available for verbal report. To explain the integration of information, we need only exhibit mechanisms by which information is brought together and exploited by later processes. In each case, an appropriate cognitive or neurophysiological model can clearly do the explanatory work. If these phenomena were all there was to consciousness, then consciousness would not be much of a problem. Although we do not yet have anything close to a complete explanation of these phenomena, we have a clear idea of how we might go about explaining them. This is why I call these problems the easy problems. Of course, "easy" is a relative term. Getting the details right will probably take a century or two of difficult empirical work. Still, there is every reason to believe that the methods of cognitive science and neuroscience will succeed. The really hard problem of consciousness is the problem of experience. When we think and perceive, there is a whir of information-processing, but there is also a subjective aspect. As Nagel has put it, there is something it is like to be a conscious organism. This subjective aspect is experience. When we see, for example, we experience visual sensations: Other experiences go along with perception in different modalities: Then there are bodily sensations, from pains to orgasms; mental images that are conjured up internally; the felt quality of emotion, and the experience of a stream of conscious thought. What unites all of these states is that there is something it is like to be in them. All of them are states of experience. It is undeniable that some organisms are subjects of experience. But the question of how it is that these systems are subjects of experience is perplexing. Why is it that when our cognitive systems engage in visual and auditory information-processing, we have visual or auditory

experience: How can we explain why there is something it is like to entertain a mental image, or to experience an emotion? It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises. Why should physical processing give rise to a rich inner life at all? It seems objectively unreasonable that it should, and yet it does. If any problem qualifies as the problem of consciousness, it is this one. In this central sense of "consciousness", an organism is conscious if there is something it is like to be that organism, and a mental state is conscious if there is something it is like to be in that state. Sometimes terms such as "phenomenal consciousness" and "qualia" are also used here, but I find it more natural to speak of "conscious experience" or simply "experience". Another useful way to avoid confusion used by e. Newell , Chalmers is to reserve the term "consciousness" for the phenomena of experience, using the less loaded term "awareness" for the more straightforward phenomena described earlier. If such a convention were widely adopted, communication would be much easier; as things stand, those who talk about "consciousness" are frequently talking past each other. The ambiguity of the term "consciousness" is often exploited by both philosophers and scientists writing on the subject. It is common to see a paper on consciousness begin with an invocation of the mystery of consciousness, noting the strange intangibility and ineffability of subjectivity, and worrying that so far we have no theory of the phenomenon. Here, the topic is clearly the hard problem - the problem of experience. Upon examination, this theory turns out to be a theory of one of the more straightforward phenomena - of reportability, of introspective access, or whatever. At the close, the author declares that consciousness has turned out to be tractable after all, but the reader is left feeling like the victim of a bait-and-switch. The hard problem remains untouched. The easy problems are easy precisely because they concern the explanation of cognitive abilities and functions. To explain a cognitive function, we need only specify a mechanism that can perform the function. The methods of cognitive science are well-suited for this sort of explanation, and so are well-suited to the easy problems of consciousness. By contrast, the hard problem is hard precisely because it is not a problem about the performance of functions. The problem persists even when the performance of all the relevant functions is explained. Here "function" is not used in the narrow teleological sense of something that a system is designed to do, but in the broader sense of any causal role in the production of behavior that a system might perform. To explain reportability, for instance, is just to explain how a system could perform the function of producing reports on internal states. To explain internal access, we need to explain how a system could be appropriately affected by its internal states and use information about those states in directing later processes. These are all problems about the explanation of functions. How do we explain the performance of a function? By specifying a mechanism that performs the function. Here, neurophysiological and cognitive modeling are perfect for the task. If we want a detailed low-level explanation, we can specify the neural mechanism that is responsible for the function. If we want a more abstract explanation, we can specify a mechanism in computational terms. Either way, a full and satisfying explanation will result. Once we have specified the neural or computational mechanism that performs the function of verbal report, for example, the bulk of our work in explaining reportability is over. In a way, the point is trivial. It is a conceptual fact about these phenomena that their explanation only involves the explanation of various functions, as the phenomena are functionally definable. All it means for reportability to be instantiated in a system is that the system has the capacity for verbal reports of internal information. All it means for a system to be awake is for it to be appropriately receptive to information from the environment and for it to be able to use this information in directing behavior in an appropriate way. To see that this sort of thing is a conceptual fact, note that someone who says "you have explained the performance of the verbal report function, but you have not explained reportability" is making a trivial conceptual mistake about reportability. All it could possibly take to explain reportability is an explanation of how the relevant function is performed; the same goes for the other phenomena in question. Throughout the higher-level sciences, reductive explanation works in just this way. To explain the gene, for instance, we needed to specify the mechanism that stores and transmits hereditary information from one generation to the next. It turns out that DNA performs this function; once we explain how the function is performed, we have explained the gene. To explain life, we ultimately need to explain how a system can reproduce, adapt to its environment, metabolize, and so on. All of these are questions about the performance of functions, and so are

well-suited to reductive explanation. The same holds for most problems in cognitive science. If we show how a neural or computational mechanism does the job, we have explained learning. We can say the same for other cognitive phenomena, such as perception, memory, and language. Sometimes the relevant functions need to be characterized quite subtly, but it is clear that insofar as cognitive science explains these phenomena at all, it does so by explaining the performance of functions. When it comes to conscious experience, this sort of explanation fails. What makes the hard problem hard and almost unique is that it goes beyond problems about the performance of functions. To see this, note that even when we have explained the performance of all the cognitive and behavioral functions in the vicinity of experience - perceptual discrimination, categorization, internal access, verbal report - there may still remain a further unanswered question: Why is the performance of these functions accompanied by experience? A simple explanation of the functions leaves this question open. There is no analogous further question in the explanation of genes, or of life, or of learning. If someone says "I can see that you have explained how DNA stores and transmits hereditary information from one generation to the next, but you have not explained how it is a gene", then they are making a conceptual mistake.

9: Math Problems â€“ Math Practice for Kids â€“ Math Blaster

Re: Easy, Medium and Hard questions on the test 24 Nov , I have studied already (3 months or so, give or take). To know this is helpful in the sense that if the you know how the levels of difficulty differ a lot or only insignificantly.

EASY AND HARD PROBLEMS pdf

The National Aboriginal Council on HIV/AIDS report (April 1, 2006-March 31, 2008). Assault amphibian vehicles Aptitude tutorial point Victorian painting Kanji for personal names Chapter 5 Biogenesis of Ethics and East-West Perception of Existence Tad Gonopolis and His Adventures in the Slumberyard No 3 (Tad Gonopolis His Adventures in the Slumberyard How heavy, how much, and how long? Don Quixote of the Mancha Miguel de Cervantes v.15. Research questions on rivers water polluted Awesome Origami Aircraft Models Of The Worlds Best Fighters. Spiritual causes for emotional and physical illness Telling untold stories A wilansky functional analysis An Act to Declare Certain Federal Lands Acquired for the Benefit of Indians to be Held in Trust for the T From mobilization to revolution Essentials of subfile programming and advanced topics in RPG Management of lower respiratory tract infections with cefuroxime axetil Population ecology of individuals Become An Ex-Smoker: Trading In The.Smoking Habit For Good Petroleum derived carbons UC Addams Family Weirdest Calculus transcendentals 8th edition james stewart Evolution of database management system Can you a on ipad Protecting markets What is workflow management systems Human resource management 11th edition Dentist (Gorman, Jacqueline Laks, People in My Community.) Pain and Its Relief in Childbirth Reposons-nous une heure ici : [from Carmen Bizet A book of the play: studies and illustrations of histrionic story, life, and character. Assessment and psychosocial intervention for older people with suspected dementia : a memory clinic persp Bruno Lipshitz and the Disciples of Dogma Origin evolution of man Compromising the classics Music and instruments of the Middle Ages Theres a Lot to Learn Interactive graphics in CAD The constant maid; or, Poll of Plympton