

How the Brain Really Works

New techniques are letting researchers look at the activity of the whole brain at once

• By ALISON GOPNIK

- [smallerLarger](#) For the last 20 years neuroscientists have shown us compelling pictures of brain areas "lighting up" when we see or hear, love or hate, plan or act. These studies were an important first step. But they also suggested a misleadingly simple view of how the brain works. They associated specific mental abilities with specific brain areas, in much the same way that phrenology, in the 19th century, claimed to associate psychological characteristics with skull shapes.

Most people really want to understand the mind, not the brain. Why do we experience and act on the world as we do? Associating a piece of the mind with a piece of the brain does very little to answer that question. After all, for more than a century we have known that our minds are the result of the stuff between our necks and the tops of our heads. Just adding that vision is the result of stuff at the back and that planning is the result of stuff in the front, it doesn't help us understand how vision or planning work.



John S. Dykes

But new techniques are letting researchers look at the activity of the whole brain at once. What emerges is very different from the phrenological view. In fact, most brain areas multitask; they are involved in many different kinds of experiences and actions. And the brain is dynamic. It can respond differently to the same events in different times and circumstances.

A new study in *Nature Neuroscience* by Jack L. Gallant, Tolga Çukur and colleagues at the University of California, Berkeley, dramatically illustrates this new view. People in an fMRI scanner watched a half-hour-long sequence combining very short video clips of everyday scenes. The scientists organized the video content into hundreds of categories, describing whether each segment included a plant or a building, a cat or a clock.

Then they divided the whole brain into small sections with a three-dimensional grid and recorded the activity in each section of the grid for each second. They used sophisticated statistical analyses to find the relationship between the patterns of brain activity and the content of the videos.

The twist was that the participants either looked for human beings in the videos or looked for vehicles. When they looked for humans, great swaths of the brain became a "human detector"—more sensitive to humans and less sensitive to vehicles. Looking for vehicles turned more of the brain into a "vehicle detector." And when people looked for humans their brains also became more sensitive to related objects, like cats and plants. When they looked for vehicles, their brains became more sensitive to clocks and buildings as well.

In fact, the response patterns of most brain areas changed when people changed the focus of their attention. Something as ineffable as where you focus your attention can make your whole brain work differently.

People often assume that knowing about the brain is all that you need to explain how the mind works, so that neuroscience will replace psychology. That may account for the curious popular enthusiasm for the phrenological "lighting up" studies. It is as if the very thought that something psychological is "in the brain" gives us a little explanatory frisson, even though we have known for at least a century that everything psychological is "in the brain" in some sense. But it would be just as accurate to say that knowing about the mind explains how the brain works.

The new, more dynamic picture of the brain makes psychology even more crucial. The researchers could only explain the very complex pattern of brain activity by relating it to what they knew about categorization and attention. In the same way, knowing the activity of every wire on every chip in my computer wouldn't tell me much if I didn't also know the program my machine was running.

Neuroscience may be sexier than psychology right now, and it certainly has a lot more money and celebrity. But they really cannot get along without each other.

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For the first time in history neuro science has been used for researching the impact of radio ads in the brain. 538, Mindshare and neuromarketing agency scanned the brain activity of 25 male subjects in the age of 20 to 49 years and listeners of 538 for this research. While lying in the fMRI scanner they listened to radio ads. They thought they were participating in a language study and were asked to do tasks with letters. One task kept their attention away from the ads only slightly, a more difficult task simulated the situation of radio listening as a background activity. This way a conscious and an unconscious listening situation were created. 32 different commercials were tested with different characteristics. This way we also obtained insights about the effectiveness of humor, sound logos, visual transfer and about the differences between tactical ads and brand ads. This research gives us insights which advertisers, media agencies and sales houses can use.

The results

1. Radio Works, both consciously and unconsciously

The way an ad enters the brain (consciously or unconsciously) determines strongly the way it is processed. During conscious listening the listener weighs the value of the facts in the commercial. During unconscious listening the brain is busy with something else and has less capacity to evaluate the arguments given by the commercial and trusts the ad based on prior knowledge of the brand In other words: it is easier to activate the promise of the product in the brain. Also, the listener is 'off guard' as he is not aware that a commercial message is being received. It's not all positive, as expected there is more irritation when auditive stimuli are distracting from a difficult task.

① Brand ads have to create a positive brand awareness. So it could be better to advertise at moments that the listener is busy and 'off guard'. Sales driven ads could benefit more from a conscious contact as more rational arguments must be transferred. Conscious contact means more capacity to process the offer.

2. Visual Transfer is really Emotional Transfer

When there is Visual Transfer the radio ad fits a corresponding tv ad. Listening to the radio ad will bring back the image of the tv ad in the brain, according to established assumptions. This research shows that this is not how transfer works. The transfer doesn't take place in the visual part of the brain (visual cortex), nor in memory areas (hippocampus). Instead, emotions connected to the tv ad, are recalled in the brain when exposed to the radio ad. Positive or negative. This means that tv ads which were not strong on the relevant emotions are better not used for visual/emotional transfer.

① These findings suggest that radio is much more than expected a relevant medium for building brands, extending or intensifying the effect initially built by tv.

3. Sound logo increases effect

A sound logo increases the potential effect of the commercial. There is a better reaction on attention, emotional response and effect. This goes for all brands but especially big strong brands.

① So all advertisers should use a sound logo, for any media channel with an auditive component. This includes tv and prerolls.

Visual transfer does not exist, emotional transfer does

fMRI scanning shows what consumers subconsciously hear

For the first time in marketing history the impact of radio advertising on the consumer brain has been explored using fMRI technology, through a collaboration between neuromarketing bureau Neurensics, Dutch radio station 538 and media giant Mindshare. The spectacular results of the

research provide unique insight into the processing and effectiveness of radio advertising, information relevant to all businesses making use of auditory marketing.

The brains of 25 male subjects were scanned while they listened to radio commercials. Participants were unaware of the true nature of the study; they were lead to believe they were participating in a study about language proficiency. The most interesting finding of the study is that radio ads have a different impact on the brain when processed consciously or unconsciously. During unconscious processing, the consumer uses simple, automated rules and heuristics that fall prey to persuasive advertising. Unconscious processing of radio ads results in greater trust in the communicated message and, consequently, greater anticipated reward or expectation associated with the advertised object. During conscious processing the consumer listens more critically to the commercial arguments: resulting in less trust, but more overall emotional activation. Still, listening to advertising while heavily distracted (unconscious processing) results in greater agitation, or anger.

Small advertising elements have a large effect

In addition to the difference between conscious and unconscious processing, the study also found that radio commercials with a sound logo are more effective in activating brain areas that are relevant in determining purchasing behavior, than commercials without sound logo. This holds true for all tested brands, but it works especially for strong, well-established brands. Humor in radio advertisements results in greater attention and more overall brain activity compared to ads without humor. Humorous radio ads score more extremely (negative/positive), which does not make them necessarily more effective than non-humorous commercials. If the aim is to stand out and create attention, humor is an effective tool. However, the polarizing effects of humor may be detrimental to effective brand building.

Visual transfer does not exist

The last interesting finding concerns visual transfer. Visual transfer is the mental activation of imagery associated with a television commercial upon hearing the corresponding radio advertisement. Or so theory assumed. The current research provides evidence for an emotional, rather than visual transfer of information. The emotional pattern (negative/positive) that a TV-commercial elicits in the consumer's brain is reactivated upon hearing the radio edit. Contrary to theory, the visual cortex (responsible for processing visual information) and memory structures (e.g. hippocampus) are not more active for radio ads with a television commercial, than for radio ads without a television version. The radio ads that have a television version activate the same emotional pattern (negative/positive) as their television counterpart.

Jikke Romijn (Head of research at Mindshare): “These findings are a first in marketing history and highly relevant in the planning and creation of effective radio advertising. Not only do we know how the consumer's brain processes radio commercials, we also know how we can improve the effectiveness of the ads.”

4. Humor increases the attention but also polarizes.

Commercials with humor show more attention, more activity in the brain than commercials without humor. Commercials with humor show extreme results, positive and negative. In terms of effectiveness, humor may not always be helpful.

① If primary awareness and attention are the objectives, humor is a great instrument. For brand building campaigns it may be better to stay away from humor.

5. Action gets more reaction than brand advertising

A commercial with a concrete call to action gets more attention and triggers the expected reward and other positive dimensions more easily than ads for brand building purposes. This is probably because of the 'what's in it for me' effect: listeners can easily judge the relevance of the message in their personal situation. This results in lower 'advertising suspicion' too.

① Promotional campaigns can benefit from conscious contacts more, as rational arguments need to be transferred and judged. Brand building ads benefit most when the brain is 'off guard' and implicit brand images can easily be transferred. Emotional transfer with a tv ad and the use of a soundlogo greatly enhance this effect.

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- **The value of using recognition is that it taps into both explicit and implicit memory, which means we can get a much better idea of the actual level of advertising exposure that has taken place. By identifying those people who have seen the advertising and subsequently forgotten it we should be able to test directly how effective recall is at evaluating emotive advertising.**
- **A controlled test of Recall vs. Recognition metrics:**
- **The critical area of debate in this paper concerns the implication that the processing of Affect has for ad tracking research. If, as is predicted by the Low Attention Processing Model, brand associations and their emotive links endure in memory beyond the point at which conscious recollection of the ad itself disappears, then measures such as claimed ad awareness and detailed recall are likely to underestimate the effectiveness of advertising which has a high affective content. In simple terms, significant numbers of people who have been exposed to the ad and influenced by it will not actively remember it and will therefore not believe the brand has been advertised recently.**
- **This hypothesis can be tested by collecting both claimed ad awareness and recognition and cross-tabulating them against a dependent measure which**

links to sales. Sales intention is one possible dependent measure, but Barnard has found that this is more influenced by what was bought last time than by what is likely to be bought next time (33). A better measure is favourability, which has been shown in longitudinal tests to predict future brand choice (34).

10 Truths About the Unconscious You

The center that I cannot find is known to my *unconscious mind*. ~ Auden

What if I told you that your unconscious mind actually *controls* your conscious mind?

Not exactly what you had in mind, now is it?

In my studies of neuroscience and neuro-practices, I've learned truths about our unconscious minds that literally blew me away. Many of the beliefs I'd been taught for decades became little more than urban myth.

I want to share some of these powerful truths with you. The more we understand about our minds, the easier it becomes to step into our full potential. Our minds are designed for each and every one of us to create BIG potential!

Today I'm sharing a list of 10 truths that IMO we all should know. Over the next few weeks, I'll post more about each truth and how it impacts our business and personal worlds. So here goes!

Your Unconscious Mind(UM):

1) Processes all of the data inputs from our five senses.

That's now around 11M bits/second, which is a lot of info to handle. More than any supercomputer out there can manage. Your UM uses deletion, distortion and generalization to manage all that data. *We'll talk more about this process on Wednesday.*

2) Is the master of your conscious mind.

In fact, your conscious mind only gets involved in data processing and responses when the unconscious mind calls upon it. That's when the UM decides it needs logical input to analyze something that's new and different, that doesn't fit the known patterns. Until then, your unconscious rules.

3) Is symbolic.

Your UM stores all of your memories in symbols and images - not in text or paragraph form. That's one reason why visual is a stronger communication/memory system than simple text.

4) Enjoys serving you, but needs clear direction.

Your UM is programmed to serve you. It runs all of your body's systems, instinctually responds to danger and more. It's designed to serve you but it also needs very clear direction. That's where we humans sometimes get in trouble.

5) Does not process negatives.

That's right - your UM does not hear that negation or negative. When you talk or think about what you do not want to happen, it's the same as telling your UM to go out and get that very thing. That's why it's so important to *say what you want.*

6) Takes everything personally.

Since perception is all about our own unique meta programs and processes that are used to analyze, store and respond to information - everything is personal to your UM. Each of us has to consciously strive for objectivity, stepping beyond our unique programs and perspectives to see various viewpoints.

7) Controls and maintains all perceptions.

Our initial perceptions are formed in early childhood. Between the ages of 0-7, every single thing that happens in our world becomes a truth to our UM. We then build on those initial perceptions and they become like fly paper - attracting more experiences that match the perception to make it true.

8) Works on the principle of least effort.

Our minds want to use the least resources possible to manage inputs, run our bodies and more. The smaller the effort, the more mental capacity we have for emergency processing - like when that woolly mammoth charges us or when all heck breaks loose in our business.

9) Maintains instincts and generates habits.

The more we can respond out of habit or instinct, the less energy our UM has to use. We create habit after habit to allow our minds to have excess capacity for those all important moments. The challenge is that those instincts and habits often get in the way of our own best path.

10) Is programmed to constantly seek more and more.

This is why there is always more and more to discover, why we never stop learning and expanding. It's the function of our UM to expand and as such, so does mankind.

Big Decision Ahead? Let Your Subconscious Choose

Written by Brian Krans | Published on February 19, 2013



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TEXT SIZE: **AAA**

New research shows that our brains continue solving problems subconsciously when we turn our attention to something else.

The more we learn about our brains, the more we find that they work better without our input.

In fact, a great deal of human behavior stems from our subconscious mind. Research into the subconscious has found that it helps to initiate goal-orientated behavior, creativity, insight, memory consolidation, and decision making.

The funny thing about your brain, as researchers from Carnegie Mellon University (CMU) recently discovered, is that it'll keep solving a problem for you while you do something else. In fact, giving your subconscious time to work makes for better decisions.

How You Subconsciously Decide

For most people, picking a new apartment or car is a complicated process fraught with countless unknowns: if you can afford it, if you'll get your money's worth, and if the timing is right.

To see how much influence your subconscious has on this type of decision-making, a research team at Carnegie Mellon enlisted 27 healthy adults to undergo brain-imaging scans during mental testing.

The subjects were given information about cars and other items while connected to a **magnetic resonance imaging, or MRI, machine**. Before they were allowed to make a decision, they had to memorize a sequence of numbers. Researchers did this to prevent the subjects from actively thinking about the cars.

The brain scans showed that while test subjects were learning about the cars and other items, the visual and prefrontal cortices—the parts of the brain responsible for decision-making and learning—were working as usual.

The surprising part—which researchers say provides the first insight into the way the brain unconsciously processes information—is that these same areas remained active during the number memorization task.

Processing Information in the Background

For lack of a better analogy, it's like when your phone downloads a song while you send a text message. Your phone is focusing on the new information (the text), while it processes something more complicated at the same time.

Even with the memorization distraction, researchers found that allowing the brain to unconsciously process information leads to more clear-headed decisions. Those whose brains showed the most continuing activity during the memory task were more likely to choose the “best” car in the set.

“This research begins to chip away at the mystery of our unconscious brains and decision-making,” J. David Creswell, assistant professor of psychology at CMU, said in a press release. “It shows that brain regions important for decision-making remain active even while our brains may be simultaneously engaged in unrelated tasks, such as thinking about a math problem. What's most intriguing about this finding is that participants did not have any awareness that their brains were still working on the decision problem while they were engaged in an unrelated task.”

The research was published in the latest issue of the Oxford Journal *Social Cognitive and Affective Neuroscience*.

How to Get the Most Out of Your Subconscious

Sure, you could flip a coin to make a decision, but if you let your whole brain help you make the choice, you'll most likely be better off.

If you're about to make a big decision, allow some time for it to “sink in,” as you've probably heard before. Let the big decision stew in your subconscious mind. The best part is that your conscious mind can do something better, like watch a movie.

And now that you know the importance of the subconscious in decision-making, be wary of salesmen. If someone is trying to sell you something and doesn't allow you much

time to think—like a one-time-offer or a one-day-sale—you know what they're up to. They're hoping for that knee-jerk buying reaction.

Who knows? Maybe buyer's remorse is merely your subconscious telling you you should've slept on it.

NEW DELHI: Chocolates can boost brain power. Exercise makes you feel happy. Pomegranate juice will keep your brain healthy. Recent years have seen a flood of such studies. It is being called the Golden Age of neuroscience - the study of how the human brain works. Riding on a combination of imaging technology, computing power and genetics, neuroscientists are dizzy with success. And the money is flowing in. President Obama has announced a \$100 million BRAIN Initiative to map every neuron, the European Commission has given a billion euros to build a computer model of all 86 billion neurons in the human brain.

But a study published this week in Nature Reviews Neuroscience has thrown a bucket of cold water on the euphoria. It found that most brain related studies are not reliable and may be exaggerating things. Scientists from the University of Bristol, UK, teamed up with those from Stanford University, the University of Virginia and the University of Oxford to analyze published neuroscience studies and came to a startling conclusion: the average "statistical power" of these studies was just 20%. This means only one in five times will the studies' claim be valid. Most scientists regard an 80% power as sufficient.

Kate Button, one of the authors from Bristol University told TOI that the statistical power of a study is its ability to detect the effect it is looking for. "Power is dependent on both sample size (number of participants) and the size of effect being investigated, with increases in both leading to increased power," she said.

The other problem that Button found is that of exaggeration of effect. The smaller the sample, the more probable it is that a small individual variation will get highlighted as a major effect. "Imagine that antidepressants actually improve mood by 10% on average, but we select a group of people and do a study and find that, in our select sample, it improves mood by 20% on average. This would be an overestimation of the true effect."

Putting these two effects together and you will find the euphoria about neuroscience studies flagging. Button and her colleagues used 49 metastudies published in 2011 that had collated the results of 730 studies on neuroscience themes. The scientists analysed 461 brain imaging studies and found that their statistical power was just 8%. They analyzed 41 rat-in-the-maze type of studies which study memory functions and found that their average power was between 18 and 31%.

'Neuromarketing': can science predict what we'll buy?

Advertisers have long used science to peer into consumers' brains; today 'neuromarketing' has given them the power to delve into our subconscious, finds Alex Hannaford

Neuromarketing Illustration Photo: NEIL WEBB

By Alex Hannaford

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 3 Comments

In 2008, a team of scientists in Germany published a study showing how the brain unconsciously prepares our decisions: that several seconds before we consciously decide what we're going to do, its outcome can be predicted by looking at unconscious activity in our grey matter.

The researchers, from the Max Planck Institute in Leipzig, told participants in the study that they could freely decide if they wanted to press a button with their left or right hands, whenever they wanted, but they had to remember at which time they felt they had made up their mind. **They found that it was possible to predict from their brain signals which option they would choose seven seconds before they consciously made their decision.**

"It's all very Minority Report," Steve Sands says, referring to the Tom Cruise film in which a special police department known as "PreCrime" tracks down criminals based on knowledge provided by psychics. "But we're not too far from that now."

In fact, it's incredible how close Sands is. For the past 20 years, from his lab in El Paso, Texas, he's been using technology to look inside our heads and show what consumers really feel, as opposed to what marketers think we feel. Using EEG tests (essentially a plastic swimming cap complete with electrodes to measure brain signals), functional magnetic resonance imaging (fMRI, which measures brain activity by looking at changes in blood flow), and eye-tracking technology, neuromarketing, as it's known, has completely revolutionised the worlds of advertising and marketing.

Sands sits opposite me, looking relaxed in a white shirt and jeans. In his office there's a framed 1995 cover of Newsweek on the wall with the headline: "The new science of the brain: why men and women think differently".

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A similar cap worn by those taking part in the experiments for Neuromarketing (Getty Images)

“That’s the first cap I made,” he says of the EEG-outfitted woman on the cover. Sands used to work with rhesus monkeys in the psychology department at the University of Texas. When his lab closed down he started Neuroscan, which became one of the world’s largest suppliers of EEG equipment to research scientists. After selling Neuroscan, Sands and his team started to use the same machines to look at the brain’s response to advertising.

He recently finished a one-and-a-half year project for POPAI, an international trade association, for which Sands's researchers used eye-tracking and EEG technology to gain insight into shopper habits. The results were fascinating. Forget scrawled shopping lists on the back of an envelope: Sands found that the vast majority (76 per cent) of US grocery shoppers make their purchase decisions in-store, and that shoppers using non-cash payment methods are most likely to make impulse purchases. So shelf-placement and in-store marketing are more crucial than ever.

Sands's team would pop a pair of eye-tracking glasses on their volunteers (which were in turn wired up to a MacBook Air, carried in a rucksack), then send them off around the store to do their shopping. The researchers then waded through three terabytes of data and analysed 80,000 eye movements from the shoppers that agreed to take part in the study. Sands says a single eye movement takes just 200 milliseconds, the time a product in store gets to persuade a shopper to buy it. "And it only takes one eye movement to change their behaviour," he says.

The researchers noted what Sands calls "approach-avoidance" taking place in the sweets and chocolate aisle, and that the eyes sought out the shopper's favourite sweets, even though they may have decided not to succumb to buying them. "Twenty per cent of eye movements relate to what you're going to buy. The rest are alternatives," Sands says. "We'd watch them pick up a packet of doughnuts, put them back, then walk away. Some came back later and put them in their shopping cart."



EEG shopper.

Sands says one interesting observation was that while the fizzy drinks aisle was the most organised in the entire supermarket, the sweets and chocolate aisle was the least: what Sands describes as "a potpourri of different sizes, shapes and brands that makes a lot of noise".

"Our brain is looking for something simple, and it's happiest when it finds what it's looking for," he says. "Candy is unusually noisy. The industry doesn't organise itself as well as the canned drinks one does. Visual clutter really does matter. All you're doing is frustrating the brain."

The neuromarketing industry isn't just interested in what makes shoppers choose the products they do in the supermarket. Much of their work is done before they've even walked through the door.

Each year, Sands Research screens the commercials that have aired during the Super Bowl, the FA Cup of American football, to a test group of around 30 people. As in other tests, his team wires each person up to an EEG machine to monitor their brain signals, and each wears a pair of eye-tracking glasses so the Sands researchers can see what, specifically, they're focusing on.

Super Bowl ads are the most sought-after and expensive slots in the industry. In 2011, among the companies vying for hearts, minds, and cold, hard cash, were Coca-Cola and Volkswagen, both of which came out with brilliant spots. Coca-Cola's featured two border guards in different military uniforms at some godforsaken desert outpost, who bond over a bottle of Coke.

As for Volkswagen, their ad for the VW Passat saw a pint-size Darth Vader walking down the hallway of his suburban home, attempting to use "The Force" on his parents' exercise bike, the washing machine — even the family dog. When his father arrived home in his Passat, the boy was almost ready to admit defeat: he ran outside and tried one last time to use his powers on the car, while inside the house his dad saw what he was trying to do and started the car's ignition with the remote control. The boy turned around, astonished that The Force worked.



"The Force" Volkswagen's advert for the new Passat (Volkswagen)

Of all the ads Sands has ever tested, The Force was, to use the American vernacular, off the charts, achieving the highest "neuro-engagement score" ever. Adweek named it 2011's best commercial; it won two Gold Lions at Cannes. Before the game even began it had attracted 12 million YouTube views. At the time of writing it's had almost 58 million.

The man behind the advert was Deutsch LA's Doug Van Praet. He says Sands's research demonstrated that The Force ad had an inordinate capacity to engage the brain. "It galvanised our attention, our engagement and our emotion, and it turned out to be a very powerful predictor of end-market

performance.” As he writes in his book *Unconscious Branding: How Neuroscience Can Empower (and Inspire) Marketing*, “it drove significant increases in purchase consideration, upped traffic to the VW website by half, and contributed to a hugely successful sales year for the brand.”

Amazingly, it’s taken big business 20-plus years to realise how effective neuromarketing can be. British psychologist Dr David Lewis-Hodgson founded one of the earliest firms, Mindlab International, in the UK in 1988. One of his early “products” was Mindscan, a piece of software which measured the brain’s responses to marketing messages, working on the premise: “What can’t speak, can’t lie.”

Hollywood’s interest was piqued by a 2012 study by Innerscope Research. They showed 40 film trailers to more than 1,000 people, measuring their heart rate, breathing, how much they sweat and motion responses – as well as what they focused on using eye-tracking technology.

Using the results, they found they could predict box office hits. According to *Fast Company* magazine, “If a film’s trailer fails to reach a specific emotional engagement threshold (65), it will very likely generate less than \$10 million in revenue on opening weekend.” But a film whose trailer exceeds an engagement threshold of 80 “will very likely earn more than \$20 million the first weekend”. Studios such as Fox and Paramount have now started taking neuromarketing very seriously.

And in January, the research agency Millward Brown announced its clients Unilever and Coca-Cola would be using facial coding technology – where emotions are tracked in facial expressions – in all their advertising testing in 2013. According to the company, this would “automatically interpret viewers’ emotional and cognitive states, moment by moment”.

As well as gauging an audience’s reaction to Super Bowl commercials and tracking shoppers in supermarkets, Sands Research also tests ads before they’ve aired, letting agencies know what works and what doesn’t. “By looking at the EEG readout we can tell whether they’re disengaged or engaged,” Sands says. “And we’ve found that storyline wins every time. If you want to lose someone’s attention, have several storylines in your commercial.”



Journalist Alex Hannaford wearing eye-tracking glasses at Sands Research. (Sands Research)

In a small office adjoining his, Sands sits me in front of two computer monitors and hooks me up to a pair of eye-tracking glasses. On the left-hand screen I can see my eyes, with a target indicating where my pupils are as they flit from left to right; on the right-hand screen is an ad for the Hyundai Sonata hybrid. The places on the screen where my eyes land are denoted by a frenetic green dot that jumps around at incredible speeds. When we play back the recording of my viewing session, I seem to have focused on exactly what the advertisers intended: initially the various characters in the commercial, but by far the longest spell is devoted to eyeing up the car itself.

Only when he places an EEG cap on the head of his test subjects, however, can Sands really tell whether they like what they're seeing. He says he once looked at an ad for a telecoms company and the panel he showed it to had such a negative reaction he had to tell the agency to think again. "There were two competing storylines," he says. "Young creatives think they're multitaskers, and this influences how they design things. And it doesn't work. Simplicity wins every time."

Using EEG, Sands records the electrical activity of the brain along the scalp. In ads that really engage an audience, a large portion of the cerebral cortex, the part of the brain that plays a role in memory, attention, awareness and thought, is activated. Sands says that during portions of an ad that "work", the frontal lobe, which deals with emotion and processes information, lights up. On the computer screen, Sands sees a line, much the same as you see on a heart monitor, which shows the exact moments during the commercial that different parts of the brain are engaged.

Sands's company has also been using EEG technology to gauge taste and smell. "From our experience, people usually tell market researchers what they think they want to hear. We're social animals and we don't want to offend anyone." But by looking at the brain's response to scents, Sands can tell exactly which fragrance you prefer.

Van Praet acknowledges that neuromarketing is not without its pitfalls; that in studying the human brain, we have to be comfortable with paradox and contradictions. For example, he says you can like an ad and it can create a positive emotion, but if it doesn't leave you with an appropriate and corresponding set of associations and emotions for that product, it's no use to the company trying to sell it. He gives an example: Quiznos, the US sandwich chain that now has some locations in the UK. "They ran an ad that featured cartoonlike rodents, and it was funny as heck," Van Praet says. "It was very likeable and engaging and people remembered it. But there's a bad association between rats and food. It wasn't very successful."

Seducing The Subconscious

- By Robert Heath

Some observations about effective advertising

based on Robert Heath's book

Robert Heath, in his book

Seducing the Subconscious

, suggests

that much of 20

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Century thinking about how advertising really works –

based on research analysis and case histories of successful campaigns

– can be discounted.

It was long held that a high "attention score" for an ad was a sign of success. Specifically, the strength of an ad was measured by how many copy points a subject could play back. It was also believed that simplicity and directness are highly regarded attributes of a successful ad campaign.

Overly creative, highly stylized ads were considered distracting and lowered the likeness of success. Researchers claimed that if consumers didn't recite specific characteristics of the ad, repeat details of the primary message, or pay undivided attention to the ad while it played, the campaign would fail.

Robert Heath suggests a different view about what really works in advertising.

His theory: people have a "love-hate" relationship with advertising,

and pay minimal attention to ads, as they are felt to be intrusive. In fact, consumers purposely ignore advertising in an attempt to minimize its influence.

Heath contends that the more consumers “ignore” an ad (purposely distancing themselves from conscious involvement) the more they subconsciously assimilate the message.

Hence, the more successful the ad will be in affecting brand preferences and eliciting a positive reaction from the consumer.

Conversely, the more a consumer consciously absorbs and interacts with the ad, the stronger their resistance to the message. And strong resistance, or counter arguments, often lead to discounting what the advertiser is saying, thus rendering the ad neutral or worthless

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The Copywriters Checklist: 20 Tips For More Effective Ads

1

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Go Under The Radar:

Successful advertising effortlessly slips “under the radar” (i.e. the natural defenses people put up against ads) and influences behavior without the consumer really understanding how it did so.

2

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Strong Brand Claims Arouse Suspicion:

The more advertising makes us think about a claim, the easier it is to contradict that claim, as the message’s “facts” are coming from an unfamiliar or untrustworthy source.

3

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If It’s Not Creative, It Often Won’t Sell

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Less creative, and less

likable ads threaten a consumer's senses, making them less likely to consider claims convincing and more likely to counter-argue the message thus discounting what the advertiser is saying. In more "likable" creative executions, it's more likely the message will be absorbed.

4

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Creativity Gives Permission:

The more creative and non-threatening the ad, the less attention we pay to the underlying message and effectively give permission to the advertiser to influence our subconscious

5.

Emotion Connects:

Emotion in advertising is a primary influencer, directly guides decisions and makes us subconsciously vulnerable to message registration and less attentive to a counter-argument

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Your Product Here:

Product placement is the most subconsciously seductive of all advertising techniques.

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Subconscious Learning Is Key:

Implicit or subconscious learning that takes place when we are not aware that we are learning is automatic and has the greatest influence on brand selection.

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We're Always Learning:

Implicit Learning is the primary, most

common way we process advertising as, willingly or not, it is always happening and is never turned off.

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The Passive Connection:

Passive Learning is a semi-conscious level of awareness that connects previous learning and brand association, which is valuable to registering the message.

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Embody Benefits In The Execution:

Identifying brand benefits through association strengthens the retention of advertising – despite the level of attention paid to the actual ad.

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The Power Of The Familiar:

In presenting the brand story, use familiar, positive sub-conscious influencers that reinforce product acceptability and make the consumer more receptive to the message

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Choose An Appropriate Influencer:

Influencers can be based on beliefs, color, sound, music, animals, celebrities, animated characters, tastes, or other attributes. The key is to choose the most positive influencer.

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Get To The Implicit Learning Level:

Our subconscious makes no moral judgments, so messaging that reaches the level of implicit learning is likely to effect product preferences

14

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Direct The Message To The Subconscious:

Messages delivered

subconsciously have the most impact on our decision-making.

15

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Create Balance Between Selling Components:

The more

attention given to a single component of an ad the more it can steal from other important components, like key messaging and brand registration.

16

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Consumers Filter & Rank:

Our mind has a natural “perceptual filtering” mechanism that ranks ad components. Those attributes most important to our subconscious tend to take center stage to support the main selling message

17

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Make Music:

Music makes an emotional connection by providing a subconscious mood to reinforce the selling message.

18

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Symbol As Message:

Symbolism strongly influences subconscious registration, provided the symbols reflect the main selling message. (e.g. equating the softness of a puppy’s fur to the softness of bathroom tissue.)

19

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Consumers Must Like

You

, Not Just Your Product:

A

consumer's fondness toward a company is more impactful in influencing a purchase decision than the level of fondness toward their advertising or product.

20

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Show & Sell!

Don't merely

say

something about your brand.

Demonstrate it, by using creativity that subconsciously verifies the key messaging. It's the creativity surrounding the message that builds favorable brand relationships, not the product facts

A Harvard Neuroscience Scheme To Change Decisions In Your Brain

A researcher wants to reverse your choices before you even know you've made them.

By [Rose Pastore](#) Posted 04.11.2013 at 4:30 pm [3 Comments](#)

Brain Power Medi-Mation

This week at the British Neuroscience Association, Harvard scientist Gabriel Kreiman described a rather diabolical-sounding experiment: He wants to reverse someone's decision to push a button before the person is even aware they were going to press it.

Kreiman has already demonstrated he can predict decisions before volunteers become conscious of making them. [Back in 2011](#), he used brain imaging to measure the activity

of individual neurons in the brains of 12 people with epilepsy (they already had electrodes implanted to identify the source of seizures.) The volunteers were told they could press a button whenever they liked and to remember the position of a clock's second hand at the moment they decided to act.

Five seconds before the volunteers reported they had decided to press the button, Kreiman noticed electrical activity in the area of the brain involved in initiating movement, called the supplementary motor area, as well as in the brain region that controls motivation and attention, called the anterior cingulate cortex.

Now, Kreiman is taking that experiment a step further. As soon as he sees the telltale brain activity that signals a decision to push the button, he flashes a "stop" sign on a screen in front of the volunteer. "So far all we have is people saying, 'that was weird, you read my mind'," Kreiman says.

So, no mind control yet—just a bit of harmless mind reading. Kreiman says that figuring out the mechanisms of volition could eventually help people with Parkinson's or other diseases in which people lose voluntary movement

Market Leader, Autumn 2004

EMOTIONAL ADVERTISING WORKS

What marketers need to know about low attention processing

Robert Heath

The Value Creation Company

I should start by explaining what low attention processing actually is. In a nutshell: it is now commonly accepted that brands (fmcg) particularly) match each other's functional performance swiftly. In our increasingly time-poor environment this leads to a decline in considered brand choice and a rise in the use of feelings to make brand decisions. Consumers no longer feel they need to seek out information about brands, which in turn inhibits any desire they have to pay active attention to advertising.

However, certain types of advertising are able to operate even at very low attention levels, creating brand associations and emotive values which endure long after the advertising itself has been forgotten. These associations and values can exert a powerful influence on brand choice. Hence we find consumers choosing advertised products, yet unable to recall the advertising and strenuously denying that it has influenced their choice.

I should also take this opportunity to correct a few of the more common misinterpretations of the theory. Firstly, it is called low attention processing rather than low involvement processing. High and low involvement is widely used to refer to the level of interest that consumers have with a product or market category. My theory is about the levels of attention applied to advertising, and perhaps surprisingly, there is absolutely no evidence of a correlation between the two.

Secondly, the theory isn't about brainwashing (Richard Tomkins, Financial Times, 28 May), or the 'irrational mind' (Leader, Marketing Week, 10 June), or advertising that 'slips under the radar of consciousness' (Alan Mitchell, Marketing Week, 10 June). Ads processed without consciousness are classified as subliminal, a form of advertising which is now banned. But frankly it wouldn't matter if subliminal advertising were not banned, because it doesn't work. The thing about low attention processing (LAP) is that consumers are able to see/hear and pay attention to the advertising, but they choose not to. In this context any brainwashing that occurs is being done with the subject's tacit consent. And this lack of attention isn't usually because the advertising is deficient: if anything it is because brands are so successful, and consumers take it on trust that advertising can safely be ignored.

Thirdly, exploiting LAP isn't about wasteful repetition to 'ram home' messages (Alan Mitchell, op. cit.). We are all of us vulnerable to emotional appeals unless we are able to counter-argue them, but counter-argument requires attention. The first couple of times we see an advertisement we often pay a bit more attention to it, and this may enable us to 'rationalise' away the emotional power of the message. But even the lowest weight campaign these days is designed to generate more than two opportunities to see, so for every campaign there will be a lengthy period where the ad is not attended to, and the emotional message cannot be resisted.

For example, most of us have been exposed to British Airways advertising, and some may even be able to hum the music. Rather than do that, get hold of a copy of the opera (Lakme by Delibes) and listen to the duet. It is a beautiful and emotive piece of music and you'll find just listening to it will make you feel relaxed. Now, here's the crunch. Every time you are exposed to a British Airways TV ad that feeling is automatically conveyed and associated in your mind with BA. You have no way of protecting yourself, other than turning down the sound or wearing ear-plugs.

Is this new? Not really: virtually all of the most successful ad campaigns are underpinned by a strong emotional element. Is it legal? Absolutely. Is it ethical? I personally believe it is, unless it is being exploited to sell unethical or harmful products, and there certainly are examples (e.g. cigarettes) where the power of emotion has been, and still is, abused. The more important question is how ethical marketers can exploit LAP, and what it means for the management of their brands.

Exploiting low attention processing

There are two schools of thought over the issue of attention towards advertising. The traditional school sees low attention as the fault of advertising itself. The solution, as has been famously recommended, is to make the ads more attention- getting: 'Instead of showing a big picture of the car, you show a big picture of Marilyn Monroe and a little picture of the car. If that doesn't work, you take some clothes off her.'

This approach is surprisingly popular among the increasingly fee-driven ad agency industry. More attention = more variety = more executions and new campaigns = more fees. But it's a pointless exercise, because the advertising often focuses so much on waking the audience up that it fails to

communicate anything at all about the brand. There are sound psychological reasons for this, which emanate from our extraordinary ability to selectively filter out anything we do not want to perceive.

The more enlightened school of agencies and clients see loss of attention as an incurable ailment. What they do is to design into their advertising elements which carry powerful emotive associations that can be processed even at low levels of attention. The BA music is a classic example, as are the soft and lovable Andrex puppy, Tango's irreverent 'orange' people, Tesco's difficult shopper Dottie, the over-sexed Papa & Nicole, the rugged Marlboro cowboy, Hamlet's consolatory 'air on a G string', the Michelin man, and so on. This approach takes more than a little management skill to initiate, and here are some of the rules I recommend.

Rule 1: Learn the language

Words are poor at describing emotional values. For example, persuasion is used to describe everything from a rational argument to anything that shifts attitudes. Few would say the BA music is persuasive, yet it does change attitudes. My best advice is to abandon words and use examples of advertising as your language.

Rule 2: Unique associations and distinctive emotive values

The campaigns mentioned previously all used unusual elements which conveyed distinctive emotional values. The Tango campaign would have achieved nothing if it had shown ordinary people conveying pleasure; instead it showed orange people creating a shock. Likewise Marlboro abandoned traditional smoothness in favour of the unique cowboy, who was visibly tough and self-reliant. Distinctiveness is needed because the memory systems we use when we are processing at low attention are no good at working things out. Subtlety, which works wonderfully when you are paying attention, becomes a meaningless blur when you are not. And sometimes the whole approach backfires. The early executions in the recent NatWest campaign were bleak and depressing, supposedly showing the way that other banks exploit their customers: when processed at low attention, however, the bleak misery reflected back on NatWest itself.

Rule 3: Branding

Many traditional ads try so hard to get the viewer's attention that the brand becomes lost, selectively filtered out from consideration. This is also a pitfall for LAP. Brand name processing at low attention is inefficient, so the brand identity needs to be spoon-fed to the consumer. It is not just a question of name prominence, the branding needs to be structural. For example, I can usually identify a BMW ad from the moment it starts, because of their unique moody style.

Rule 4: Consistency

LAP may not be good for working things out, but it is good at reinforcing and strengthening associations and emotions that have been processed before. To exploit this you need to use the same

elements in every ad, a point which is overlooked time and again by advertisers. The Dulux Dog would never have become a symbol of the brand if a different breed were used in each ad, yet we frequently find different music tracks and treatments used on ads in the same campaign. It's as if marketers wanted to make life deliberately difficult for the consumer!

Consistency is particularly important in multimedia campaigns. Too often the top creative team does the TV, but press and radio are farmed out to a second-rank team who come up with a completely different approach. The result is no synergy and wasted opportunity. The only approach that really works is to use the same visuals in TV, press, posters and brochures and the same sounds in TV and radio.

Rule 5: Measurement

When they start out in marketing, everyone is told that advertising has to be remembered in order to be effective. The consequence is that recall is the most common way in which advertising is measured all around the world, and experiments in psychology have proved conclusively that recall is enhanced by attention. So advertising which works at low attention levels will be less well recalled than advertising which works at high attention, no matter how effective it is.

The most common recall metric used in the world is claimed ad awareness, where you prompt the brand name and ask if the respondent has 'seen any advertising recently'. Two recent experiments found that claimed ad awareness suggested ads were ineffective, even when recognition-based metrics showed conclusively that they had worked (Heath & Hyder 2004). Magnify these findings to represent the tens of thousands of brands which are measured each year using claimed ad awareness, and you can see the importance of these results. So if you are using advertising which is designed mainly to influence feelings and emotions, don't rely on metrics like claimed ad awareness to evaluate it. If you do, you will, as many brands have, find yourself throwing away what might actually be a brilliant campaign.

Conclusion

Low attention processing is not going to pass away. Regardless of the popularity of Tivo and other such devices, advertising will continue to intrude on consumers, and the attention they give it will decrease. Marketers who need to sell direct have no choice but to strive for the greatest attention they can achieve. Marketers who want to build their brand values do have a choice. They can fight against the tide of indifference and inattention or they can exploit it, via low attention processing.

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Robert Heath lectures at Bath University School of Management. After graduating from Cambridge he spent 25 years in mainstream marketing and advertising, and in 1998 began an investigation into how advertising is processed at low attention levels. He has published numerous papers and articles and runs The Value Creation Company, visit www.lowattentionprocessing.com

Big Decision Ahead? Let Your Subconscious Choose

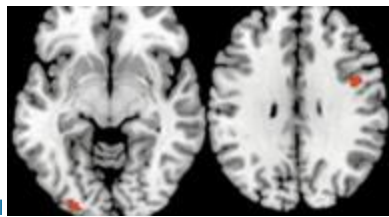
Written by Brian Krans | Published on February 19, 2013



|

TEXT SIZE: **AAA**

New research shows that our brains continue solving problems subconsciously when we turn our attention to something else.



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The more we learn about our brains, the more we find that they work better without our input.

In fact, a great deal of human behavior stems from our subconscious mind. Research into the subconscious has found that it helps to initiate goal-orientated behavior, creativity, insight, memory consolidation, and decision making.

The funny thing about your brain, as researchers from Carnegie Mellon University (CMU) recently discovered, is that it'll keep solving a problem for you while you do something else. In fact, giving your subconscious time to work makes for better decisions.

How You Subconsciously Decide

For most people, picking a new apartment or car is a complicated process fraught with countless unknowns: if you can afford it, if you'll get your money's worth, and if the timing is right.

To see how much influence your subconscious has on this type of decision-making, a research team at Carnegie Mellon enlisted 27 healthy adults to undergo brain-imaging scans during mental testing.

The subjects were given information about cars and other items while connected to a [magnetic resonance imaging, or MRI, machine](#). Before they were allowed to make a decision, they had to memorize a sequence of numbers. Researchers did this to prevent the subjects from actively thinking about the cars.

The brain scans showed that while test subjects were learning about the cars and other items, the visual and prefrontal cortices—the parts of the brain responsible for decision-making and learning—were working as usual.

The surprising part—which researchers say provides the first insight into the way the brain unconsciously processes information—is that these same areas remained active during the number memorization task.

Processing Information in the Background

For lack of a better analogy, it's like when your phone downloads a song while you send a text message. Your phone is focusing on the new information (the text), while it processes something more complicated at the same time.

Even with the memorization distraction, researchers found that allowing the brain to unconsciously process information leads to more clear-headed decisions. Those whose brains showed the most continuing activity during the memory task were more likely to choose the “best” car in the set.

“This research begins to chip away at the mystery of our unconscious brains and decision-making,” J. David Creswell, assistant professor of psychology at CMU, said in a press release. “It shows that brain regions important for decision-making remain active even while our brains may be simultaneously engaged in unrelated tasks, such as thinking about a math problem. What's most intriguing about this finding is that participants did not have any awareness that their brains were still working on the decision problem while they were engaged in an unrelated task.”

The research was published in the latest issue of the Oxford Journal [Social Cognitive and Affective Neuroscience](#).

How to Get the Most Out of Your Subconscious

Sure, you could flip a coin to make a decision, but if you let your whole brain help you make the choice, you'll most likely be better off.

If you're about to make a big decision, allow some time for it to "sink in," as you've probably heard before. Let the big decision stew in your subconscious mind. The best part is that your conscious mind can do something better, like watch a movie.

And now that you know the importance of the subconscious in decision-making, be wary of salesmen. If someone is trying to sell you something and doesn't allow you much time to think—like a one-time-offer or a one-day-sale—you know what they're up to. They're hoping for that knee-jerk buying reaction.

Who knows? Maybe buyer's remorse is merely your subconscious telling you you should've slept on it.

Learn More on Healthline.com:

Think Twice: How the Gut's "Second Brain" Influences Mood and Well-Being

The emerging and surprising view of how the enteric nervous system in our bellies goes far beyond just processing the food we eat

By [Adam Hadhazy](#)

102
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Science at the Winter Olympics **There's more to figure skating than spandex and sequins, specifically physics. Learn more about the science behind curling, speed skating and other Olympic events** » February 24, 2010



GUT CHECK: A complex, independent nervous system lines the gastrointestinal tract that has been dubbed the "second brain". *Image: ISTOCKPHOTO/ERAXION*

As Olympians go for the gold in Vancouver, even the steeliest are likely to experience that familiar feeling of "butterflies" in the stomach. Underlying this sensation is an often-overlooked network of neurons lining our guts that is so extensive some scientists have nicknamed it our "second brain".

A deeper understanding of this mass of neural tissue, filled with important neurotransmitters, is revealing that it does much more than merely handle digestion or inflict the occasional nervous pang. The little brain in our innards, in connection with the big one in our skulls, partly determines our mental state and plays key roles in certain diseases throughout the body.

Although its influence is far-reaching, the second brain is not the seat of any conscious thoughts or decision-making.

"The second brain doesn't help with the great thought processes...religion, philosophy and poetry is left to the brain in the head," says Michael Gershon, chairman of the Department of Anatomy and Cell Biology at New York–Presbyterian Hospital/Columbia University Medical Center, an expert in the nascent field of neurogastroenterology and author of the 1998 book *The Second Brain* (HarperCollins).

Technically known as the enteric nervous system, the second brain consists of sheaths of neurons embedded in the walls of the long tube of our gut, or alimentary canal, which measures about nine meters end to end from the esophagus to the anus. The second brain contains some 100 million neurons, more than in either the spinal cord or the peripheral nervous system, Gershon says.

This multitude of neurons in the enteric nervous system enables us to "feel" the inner world of our gut and its contents. Much of this neural firepower comes to bear in the elaborate daily grind of digestion. Breaking down food, absorbing nutrients, and expelling of waste requires chemical processing, mechanical mixing and rhythmic muscle contractions that move everything on down the line.

Thus equipped with its own reflexes and senses, the second brain can control gut behavior independently of the brain, Gershon says. We likely evolved this intricate web of nerves to perform digestion and excretion "on site," rather than remotely from our brains through the middleman of the spinal cord. "The brain in the head doesn't need to get its hands dirty with the messy business of digestion, which is delegated to the brain in the gut," Gershon says. He and other researchers explain, however, that the second brain's complexity likely cannot be interpreted through this process alone.

"The system is way too complicated to have evolved only to make sure things move out of your colon," says Emeran Mayer, professor of physiology, psychiatry and biobehavioral sciences at the David Geffen School of Medicine at the University of California, Los Angeles (U.C.L.A.). For example, scientists were shocked to learn that about 90 percent of the fibers in the primary visceral nerve, the vagus, carry information from the gut to the brain and not the other way around. "Some of that info is decidedly unpleasant," Gershon says.

The second brain informs our state of mind in other more obscure ways, as well. "A big part of our emotions are probably influenced by the nerves in our gut," Mayer says. Butterflies in the stomach—signaling in the gut as part of our physiological stress response, Gershon says—is but one example. Although gastrointestinal (GI) turmoil can sour one's moods, everyday emotional well-being may rely on messages from the brain below to the brain above. For example, electrical stimulation of the vagus nerve—a useful treatment for depression—may mimic these signals, Gershon says.

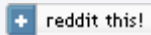
Given the two brains' commonalities, other depression treatments that target the mind can unintentionally impact the gut. The enteric nervous system uses more than 30 neurotransmitters, just like the brain, and in fact 95 percent of the body's serotonin is found in the bowels. Because antidepressant medications called selective serotonin reuptake inhibitors (SSRIs) increase serotonin levels, it's little wonder that meds meant to cause chemical changes in the mind often provoke GI issues as a side effect. Irritable bowel syndrome—which afflicts more than two million Americans—also arises in part from too much serotonin in our entrails, and could perhaps be regarded as a "mental illness" of the second brain.

Scientists are learning that the serotonin made by the enteric nervous system might also play a role in more surprising diseases: In a new *Nature Medicine* study published online February 7, a drug that inhibited the release of serotonin from the gut counteracted the bone-deteriorating disease osteoporosis in postmenopausal rodents. (*Scientific American* is part of Nature Publishing Group.) "It was totally unexpected that the gut would regulate bone mass to the extent that one could use this regulation to cure—at least in rodents—osteoporosis," says Gerard Karsenty, lead author of the study and chair of the Department of Genetics and Development at Columbia University Medical Center.

Serotonin seeping from the second brain might even play some part in autism, the developmental disorder often first noticed in early childhood. Gershon has discovered that the same genes involved in synapse formation between neurons in the brain are involved in the alimentary synapse formation. "If these genes are affected in autism," he says, "it could explain why so many kids with autism have GI motor abnormalities" in addition to elevated levels of gut-produced serotonin in their blood.

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BRAIN IMAGING SPOTS OUR ABSTRACT CHOICES BEFORE WE DO

- 16:46 10 April 2013 by [Caroline Williams](#)
- For similar stories, visit the [The Human Brain](#) Topic Guide

When it comes to making decisions, it seems that the conscious mind is the last to know.

We already had evidence that it is possible to detect brain activity associated with movement before someone is aware of making a decision to move. Work presented this week at the [British Neuroscience Association](#) (BNA) conference in London not only extends it to abstract decisions, but suggests that it might even be possible to pre-emptively reverse a decision before a person realises they've made it.

In 2011, [Gabriel Kreiman](#) of Harvard University measured the activity of individual neurons in 12 people with epilepsy, using electrodes already implanted into their brain to help identify the source of their seizures. The volunteers took part in the "Libet" experiment, in which they press a button whenever they like and remember the position of a second hand on a clock at the moment of decision.

Kreiman discovered that electrical activity in the supplementary motor area, involved in initiating movement, and in the anterior cingulate cortex, which controls attention and motivation, appeared up to 5 seconds before a volunteer was aware of deciding to press the button ([Neuron](#), doi.org/btkcpz). This backed up [earlier fMRI studies by John-Dylan Haynes](#) of the Bernstein Center for Computational Neuroscience in Berlin, Germany, that had traced the origins of decisions to the prefrontal cortex a whopping 10 seconds before awareness ([Nature Neuroscience](#), doi.org/cs3rzv).

"It's always nice when two lines of research converge and to know that what we see with fMRI is actually there in the neurons," says Haynes.

STOP sign for the brain

Kreiman told the BNA conference that he is now working on predicting decisions in real time, and to see if it is possible to reverse a decision before it hits consciousness – by flashing up the word "stop" on a screen as soon as telltale activity shows up in the brain.

There are no firm results yet, but Kreiman suspects there may be a measureable "point of no return" in the brain. "So far all we have is people saying, 'that was weird, you read my mind'," he says.

If this kind of "mind-reading" is possible, a new study by Haynes, published this week and also presented at the meeting, suggests that it may not be restricted to decisions about moving a finger. [Using fMRI, Haynes has found that the very brain areas involved in deciding to move are also active several seconds before a more abstract decision, like whether to add or subtract a series of numbers.](#)

He suggests that the prefrontal and parietal cortex may be general decision-making circuitry, passing activity on to different parts of the brain depending on the task at hand ([PNAS](#), doi.org/k6b). "Perhaps decisions arise from a similar set of areas, then either flow into motor systems, for pressing buttons, or the parietal cortex for doing calculations," he says.

Not hijacking the mind

Unless you happen to have electrodes inserted into your brain, there is no chance of decisions being hijacked by unscrupulous scientists, and Kreiman is keen to point out that he is not bent on world domination. "We're not trying to do mind control; we are trying to find out the mechanisms of volition," he says. "It might help people with Parkinson's disease, where people lose voluntary movement."

As for what it means for one of the longest-running debates in science – the question of whether we do or do not have free will – Haynes is pretty clear. "What we need now is 20 years of serious neuroscience, not more speculation about the handful of studies that have been done so far," he says.

Kreiman agrees, but says that these early results at least bring the question of free will out of the realms of magic and mystery. "There is no magic. There are neurons, and there are ions that flow through membranes, and that is what is orchestrating our decisions," he says. "We don't need to invoke freedom."

SCIENTISTS FIND A WAY TO SEE YOUR DREAMS

By [Michelle Starr](#) | April 8, 2013 | 4

(Credit: Flaming June by Frederic Leighton, oil on canvas, 1895)

Japanese scientists have developed an algorithm that is able to predict what a dreamer sees from their neurological patterns.

At the [ATR Computational Neuroscience Laboratories](#) in Kyoto, Japan, Yukiyasu Kamitani and his colleagues have spent a long time trying to assemble the data they need to image a sleeper's dreams on a screen — and it looks like they might be nearly there.

Using functional magnetic resonance imaging ([fMRI](#)), which examines the flow of blood in the brain to monitor activity, the team has managed to create an algorithm that can accurately display in real time what images are appearing in a dream. This is the first time, it is believed, that objective data has been collected from dreams.

Except it's a little more complicated than that. The study is predicated on the idea that our brains repeat activity when repeating thoughts; for example, every time you think about a cat, your brain will behave in the same, or a similar, way. This idea is seen in a 2011 experiment from the University of California that [accurately imaged a person's thoughts](#) as they watched film trailers.

Three test subjects took part in the research, sleeping for three-hour blocks in an MRI machine while attached to an EEG machine, which monitored the electrical activity in the brain. As the subjects drifted into Stage 1 non-REM sleep, their brains exhibited activity; the scientists would wake them up and ask them what they had seen. The process was repeated nearly 200 times for each subject over the course of 10 days.

After this stage, the scientists gathered a collection of images from the web that correlated with the 20 most common categories of images seen by each subject, for example, buildings or people. They showed these images to the subjects while they were awake, still monitoring brain activity, to see if their brains responded the same way to the images both asleep and awake.

In this way, the scientists were able to glean a rough translation of each subject's brain activity, and fed that data into a learning algorithm that could refine its accuracy based on further data. When the subjects were once again connected, sleeping, to the MRI machine, the algorithm scanned their brain activity, producing visualisations. As it turned out, it was only correct 60 per cent of the time — a number that Kamitani believes is significant, since it is too high to be chance.

WHY IDEAS POP INTO YOUR HEAD WHEN YOU'RE TRYING TO FALL ASLEEP

THORIN KLOSOWSKI TODAY 4:00 AM

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You lay down to go to bed, ready to fall asleep quickly and get a good night's rest. Just as you're about to fall asleep, some thought pops into your head, you can't stop thinking about it, and then before you know it the clock reads three in the morning. It's annoying, but Scientific American sheds a little light on why this happens.

Photo by [iamtheo](#)

We all have ideas that pop into our heads throughout the day, but when you're laying down to go to bed it's one of the few times when you're not distracted by anything else. Speaking with Scientific American, Barry Gordon, professor of neurology and cognitive science at John Hopkins University School of Medicine, explains what's going on:

We are aware of a tiny fraction of the thinking that goes on in our minds, and we can control only a tiny part of our conscious thoughts. The vast majority of our thinking efforts goes on subconsciously. Only one or two of these thoughts are likely to breach into consciousness at a time. Slips of the tongue and accidental actions offer glimpses of our unfiltered subconscious mental life... Although thoughts appear to "pop" into awareness before bedtime, their cognitive precursors have probably been simmering for a while. Once those preconscious thoughts gather sufficient strength, the full spotlight of consciousness beams down on them. The mind's freewheeling friskiness is only partly under our control, so shutting our mind off before we sleep is not possible.

Essentially, when your brain is finally given a moment of a rest, those subconscious thoughts can bubble up to the surface and keep you awake. Unfortunately, you can't simply switch your brain off just so you can get some sleep. To really avoid those restless nights the best thing you can do is [get better sleep](#) and [train yourself to fall asleep quicker](#). If all else fails, a [little maths](#) might at least direct that consciousness spotlight onto something more mundane.

Can we control our thoughts? Why do thoughts pop into my head as I'm trying to fall asleep? [Scientific American]