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RÉPUBLIQUE FRANÇAISE

PREMIER MINISTRE

Centre d'analyse stratégique

March 2010

Improving public health prevention with behavioural, cognitive and neuroscience

Supervised by
Olivier Oullier and Sarah Sauneron

Rapports et documents

Improving public health prevention with behavioural, cognitive and neuroscience

Report handed to Nathalie Kosciusko-Morizet, Secretary of State for Strategic Planning and the Development of the Digital Economy

Supervised by Olivier Oullier et Sarah Sauneron

Centre for Strategic Analysis
18, rue de Martignac – 75700 Paris cedex 07
www.strategie.gouv.fr

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Introduction

At the beginning of 2009, the Centre for Strategic Analysis of the Prime Minister of France[1] initiated a prospective programme called "Neuroscience and public policy"[2]. To our knowledge such a programme is a *premiere* at the governmental level. Its goal is to evaluate the potential uses of the newly found knowledge in behavioural and brain sciences outside of medical and scientific research laboratories. Their concrete applications, operational limits, as well as the ensuing ethical concerns inherent to such an initiative are dealt with following a multidisciplinary and critical approach[3].

The topics that are addressed can be seen as extremely diverse but with a shared goal: how a better understanding of human behavioral and brain dynamics can impact public policy. Through the organization of work sessions, seminars, conferences or workshops -where international experts present cutting edge scientific and medical research- together with the publication of briefs and official reports, our program has already made significant contributions on several topics ranging from economic and financial decision making (behavioral and neuroeconomics), the use of neuroscience in legal expertise and courts (neurolaw), to public health prevention strategies, education and training policies, or cognitive aging, to name only a few. The Centre for Strategic Analysis has participated and/or is serving as an expert on several national and international committees addressing these issues[4].

Among these topics, the question of exploring new methods in prevention in public health was initially the topic of a seminal workshop organized on June 16th, 2009. This event brought together stakeholders, prevention and communication experts, with scientists specialized in decision-making, consumer behaviour, cognitive and behavioural neuroscience. Given the importance of the issue, Nathalie Kosciusko-Morizet, Secretary of State for Strategic Planning and the Development of the Digital Economy, expressed a wish for more thorough work highlighting new ways to potentially improve the effectiveness of public health prevention strategies.

Three types of contributions are thus proposed in this book. The speakers who participated to the seminal workshop have extended and updated their contributions. International experts in social psychology, psychology of organisations, behavioural economics, social marketing and members of the World Economic Forum, agreed to join our efforts to share their views on the advances in and the reception of behavioural and brain sciences on a global scale. Finally, members of the Department of Social

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[1] *Centre d'analyse stratégique*, CAS. The Centre is an organisation working directly under the direction of the Prime Minister of France. Its objective is to assist the government in defining and implementing its economic, social, environmental and cultural policies.

[2] Olivier Oullier and Sarah Sauneron are currently heading the programme.

[3] More on the "Neuroscience and public policies" programme is available online on the Centre for Strategic Analysis' Website: www.strategie.gouv.fr/neurosciences/.

[4] The Centre for Strategic Analysis was interviewed at French Parliament (*Assemblée Nationale*), by the Parliamentary Commission in charge of the Revision of the Bioethics Laws chaired by Alain Claeys (09/22/2009) and by the Presidential Commission on Obesity Prevention chaired by Anne de Danne (10/28/2010).

Affairs at the Centre for Strategic Analysis have authored several chapters. All these contributions introduce the reader to innovating approaches to prevention, both more targeted and taking better account of the "emorational" drive behind the behaviours of human beings.

The content of the book was written and organised so that it can be read as individual chapters or a whole.

The first part of the report invites us to go beyond the model of the rational agent and rethink public health prevention along that line. It starts with a contribution by **Sara-Lou Gerber**, who offers an economic perspective on the issues of prevention. The second chapter summarizes some of the work of the **Global Agenda Council on Chronic Diseases and Conditions** of the World Economic Forum. Then, as a result of our interactions with **Robert Cialdini**, **Sendhil Mullainathan** and **Richard Thaler**, the third chapter offers an introduction to behavioural economics and nudges. Finally, after a short update on the advances on consumer neuroscience, **Dorothée Rieu** explains how she uses cognitive science in evaluating prevention campaigns.

The second part of the report is devoted to "poisoning", whether it is due to smoking or domestic accidents. **Jean-Louis Wilquin** and **Aurélie Martzel** offer us an evaluation of the campaigns run by the National Institute for Prevention and Education in Health (INPES)[1] in its fight against tobacco. These preventive strategies might benefit from the results of more recent neuroscience research addressing anti-smoking communication strategies. This is the conclusion of our collaboration with **Gemma Calvert** and **Karine Gallopel-Morvan**. This part of the book ends with the work done by **Frédéric Basso** and his team, where neuroscience is used to gain a better understanding of the factors causing domestic poisoning when people ingest cosmetic or cleaning products by mistake.

Finally, the last part of the work is focusing on the fight against obesity. It opens with a summary of proposals from French parliament member **Valérie Boyer**, who authored a national report on this topic. She shares her political analysis of the issue of obesity. The members of the Department for Social Affairs at the Centre for Strategic Analysis are considering the potential contribution of behavioural and brain sciences in the fight against obesity with a particular emphasis on the necessity to information and prevent as early as possible. The last chapter of the work is a contribution by **Hilke Plassmann,** who presents her latest work in consumer neuroscience and its implications for obesity prevention[2].

Above all else, we want this collective work, resulting from more than a year of inter-disciplinary interactions in France and abroad, to foster further discussions and exchanges. We strongly hope that existing collaborations will continue, and even that new ones will be triggered between all the actors of public health prevention in France and abroad and researchers in the areas of behavioural, cognitive and neuroscience. Our goal is to make the neverending quest for improving health and well being more efficient day after day.

[1] Institut national de prévention et d'éducation à la santé (INPES)
[2] To find out more about the different contributors, refer to their biographies at the end of the paper.

Foreword

by Vincent Chriqui

Director of the Centre for Strategic Analysis

Health prevention messages are currently coming up against limitations. Whether they deal with obesity or smoking, the campaigns intended for the general public often make it possible to raise awareness but fail to modify risk behaviour. This means that some problems take on alarming proportions. Thus, today in France, 15% of children between the ages of 5 and 11 years are overweight and 4 % are obese, an ever increasing figure during the last decade. Smoking is still the primary cause of avoidable death in France, with about 60,000 deaths per year.

In the face of such phenomena, allied to a constant social security deficit, it would seem necessary to fine-tune prevention strategies to make them more effective. It was with this in mind that Nathalie Kosciusko-Morizet, Secretary of State for Strategic Planning and the Development of the Digital Economy, asked the Centre for Strategic Analysis to examine the contributions made by behavioural and brain sciences to prevention strategies.

There are several ways to improve public health prevention communication strategies. Thus, appealing to reason, fear, surprise, responsibility, pleasure or disgust has different levels of effectiveness when addressing a range of young and elderly people, or addressing smokers and overweight people. By studying consumer behaviour jointly with neuroscience, we can gain a better understanding of how an individual reacts to a message or an image used within the framework of a prevention campaign. From now on, it is a question of going beyond raising awareness of the risks to achieve real changes in behaviour.

Carried out by the Centre for Strategic Analysis, in collaboration with French and international researchers in social marketing, neuroscience, consumer behaviour, social psychology and behavioural economics[1], this innovative work reveals the nature of the strategies considered to be the most effective in discouraging risk behaviours. It opens up promising perspectives and puts forward many simple and effective measures at a reasonable cost and follows-up on the work published by the Centre for Strategic Analysis[2] on mental health and wellbeing.

[1] See biographies at the end of the work.

[2] On November 20th, 2009 the Centre for Strategic Analysis submitted to Nathalie Kosciusko-Morizet a report called "Mental health, everyone's concern. For a consistent approach to the quality of life", published by *La Documentation Française*.

We will consider three examples that are currently attracting great social, policy and media interest in more detail here: the contribution of behavioural sciences to the fight against smoking, accidental home poisoning and obesity.

Our ambition is to nurture thinking on the Third National Health Nutrition Plan (PNNS)[1], expected to follow PNNS 2, which ends in 2010. Moreover, a review of what we can expect from prevention is a necessary prerequisite, given that a new 5 year public health law should be voted on soon in France.

[1] Programme National Nutrition Santé

Executive Summary

Improving public health prevention with behavioural, cognitive and neuroscience

Overall, France enjoys globally positive general state of health indicators. However, problems still persist: the incidence of premature death is one of the highest in the European Union and there are major inequalities across social groupings. Faced with such problems, and given that **so-called "diseases of society" are on the increase**, prevention is often presented as both a universal (effective for most individuals) and cheap (and sometimes even cost-saving) solution. However, this somewhat positive view needs to be tempered.

Yes, in terms of the health, social and economic consequences of chronic diseases and pathologies arising from risky behaviour, prevention strategies are certainly a beneficial tool for action. Nevertheless, the results do not always reach the target level of success, especially in the absence of any targeting in close relation to the realities experienced by the most vulnerable groups. Before any action is taken, we need to gain a better understanding of behaviour in response to risk. With this in mind, **modelling the decision making schema of a "subject of prevention" in a less simplifying way** than the one based on standard economic theory might enable us to select the most effective public health campaigns.

The aim of the report entitled "Improving public health prevention with behavioural, cognitive and neuroscience" is to estimate the extent to which behavioural, cognitive and neuroscience can enable us to gain a better understanding of information and action systems and optimise public health strategies, especially in terms of the fight against nicotine addiction and obesity.

1. Rethinking public health prevention: moving beyond the model of a rational agent

Towards an "emorational" model for decision-making

Brain imaging techniques are used not only to study the brain mechanisms involved in sensory perception, but also to try to gain **a better understanding of how consumers think, what influences them** and, more generally, **how their brain responds to the environmental signals to which they are exposed**. One of the major contributions of neuroscience to public health prevention is therefore to gain a more precise understanding of the cognitive and emotional biases involved in decision-making. In fact, far from being *homo œconomicus*, always calculating the best options, *homo consumerus* is formed by stories, emotions and desires, and constant interaction with his environment (be it social and/or physical).

The opposition between emotion and rationality is not so clear cut at a neurobiological level. The areas of the brain in question are connected by dense and

complex networks, constantly exchanging information in a largely interdependent way. **The brain appears to function in a rather hybrid mode i.e. according to a kind of "emorationality".** This finding is confirmed by observing daily life. Which of us is not emotional, impulsive, distracted, altruistic, subject to procrastination and motivated by instant gain? The best economic outcome is not really the major goal for human beings. Moreover, **having the relevant information about risky behaviour is not enough to make an individual give it up,** quite the contrary, in fact.

Guiding but not forcing: behavioural sciences in the service of prevention

Would it not be possible to use the knowledge gained from behavioural science experiments and observations to help people adopt behaviour that is less of a risk to their health? Such strategies have already been used successfully in sectors such as savings and energy, for example playing on the **effects of framing or anchoring** or even on **tendencies towards inertia** in the face of change and **adhesion to social norms**. The idea is to develop **resources that are likely to induce behavioural change** and guide people's decision-making, whilst still **leaving them the option of not following the direction suggested to them**. People will then remain the "choice architects". This is what Richard Thaler and Cass Sunstein, two advisers to President Obama, call a *nudge*: helping someone to make choices that improve his health and well-being.

By way of illustration, in the field of nutrition, a simple strategy can encourage people to change their diet. This involves asking people to plan their meals for the whole of the coming month. Seeing the series of meals on a planning chart makes them avoid choosing the same components for several days in a row, therefore varying their diet choices. Another example: a red crisp is placed at regular intervals in the usual cardboard crisp tube, reducing consumption by an average of 50%. In fact, the use of these visual markers draws the eater's attention, giving him pointers as to how much he is eating and encouraging him to take a break.

These examples show how small changes to the environment can have an appreciable effect on health. However, the aim is not to recommend a systematic transfer of strategies developed in other countries onto ours, but rather to inform people about them and nurture the debate on their potential effectiveness and ethical implications.

Using cognitive science to increase the effectiveness of prevention campaigns

People's reactions to an advertising message are not easy to anticipate, especially when the messages are complex, such as those conveyed by public health prevention campaigns. Knowledge acquired from behavioural sciences can enable us to gain a better understanding of these reactions, and also develop evaluation methods.

Given that all human beings are exposed to several hundred advertising messages per day, we don't pay attention to all of them. This is particularly true for recurrent, familiar or highly serious items. Health banners at the bottom of food advertisements are not seen enough, as shown by data obtained by eye-tracking on people as they watch the TV screen. Such a technique is **an interesting extra test, which is not biased by subjective statements from the subjects** as can happen with questionnaires, **and can be used to evaluate and optimise current prevention campaigns.**

Moreover, messages triggering sensations are not the only factor for effectiveness in communications, which **are assessed on their capacity for memorization, comprehension and follow-up effects on behaviour.** In the light of this, it would seem necessary for **the emotion conveyed by the prevention message to find a** *happy medium* between shock images or wording and a **semantic appropriate to the target population, so that they will recognise themselves and identify with it**.

2. Inside the brain of a smoker: neuroscience and anti-smoking campaigns

Using neuroscience to gain a better understanding of and prevent smoking is not new, since it has told us much about the brain dynamics involved in nicotine addiction. Moreover, new data that opens the window on a range of new information is essential so that we may develop more effective prevention strategies. In fact, **simply making people aware of the danger of tobacco is not enough (if this were the case, physicians would not smoke), it needs to be reinforced by additional measures.**

Acting on the social environment – a necessity

Giving up smoking is made even more difficult by the fact that **external stimulants can provoke the desire and need for tobacco at any moment**.

Banning traditional tobacco advertising has not had the effect intended. Not because it was not appropriate, but due to certain adverse effects: it has in fact stimulated the imagination of cigarette manufacturers to find ways around the ban and continue their communications with derivative products. A study aimed at measuring the reactions of the brain to a range of stimulants (cigarette packets, advertising posters, promotional items and brand exposure through sponsorship) showed that sponsorship images stimulate areas of the brain associated with the desire to smoke to the highest degree. In this way, using a colour code for items without any explicit mention of the brand itself is enough to trigger an association in the brain of a smoker that is equivalent to a potential nicotine high. These results demonstrate **the relevance of banning tobacco advertising** and invite us to consider **ways of regulating all forms of indirect advertising and sponsorship.**

Moreover, these experiments also show that even the sight of a packet can provoke the desire to smoke. Just going into a tobacconist's shop to make any kind of purchase might therefore lead to temptation. In order to respond to this problem, the British Government proposed a bill in 2008 to **ban the display of packets at sales outlets.** This could prove particularly effective with teenagers, who are at a pivotal age in terms of avoiding taking up smoking.

Finally, mass awareness campaigns have shown a progressive development in terms of the message conveyed and the way this is done. **Appeals to reason, fear, surprise, responsibility, shame and disgust** are strategies that all have their own strengths and weaknesses. Scientific experiments can help to evaluate their impact. A more recent study using neuroscience shows that one needs to **use the right amount of appeal to emotions triggered in wide scale awareness campaigns so that any interest aroused is not just temporary or due to surprise.**

The cigarette packet - at the heart of the fight

Appealing to emotions is not restricted to media campaigns, since it also applies to cigarette packets, the closest you can get to smokers. Thus, since 2003, new EU regulations require the inclusion of health messages on the front and back of packets. Some countries have opted to add shock images to these warnings, as recommended by the WHO. These images **promote awareness of the risks involved**. Moreover, **the total lack of "glamour" in these photos would make it possible to fight against making packets appear aesthetically attractive**, which is usually the factor to which teenagers are most sensitive, and which the tobacco industry uses as a powerful communication channel.

A recurrent reservation regarding the effectiveness of such measures is that they might provoke counter-productive reactions, be they conscious or otherwise. Smokers get used to seeing these images or simply avoid them. The sight of a cancerous lung might very well be informative, but it could trigger a strategy of denial. Brain imaging studies confirm this by showing that non-smokers are in fact the most receptive to this. Some people might even be attracted by a taste for danger. **However, this doesn't stop the use of these warnings, but acts as an incentive to develop content better**, including restrictive measures relating to the environment as mentioned above.

In order to counter the effects of habituation and avoidance, we need to **vary the messages and images on a regular basis.** Moreover, not all "shock information" has the same level of effect on the same people. A study concludes that the best types of shock are those that act on fear of a change in physical appearance (yellow teeth, facial lines etc) or sexual performance. The cultural factor is so important that we now need to **conduct the same type of study in France in order to select suitable warnings.** Moreover, images and messages might become more effective if they were **put on neutral or "generic" packets, from which logos and other attractive designs would be banned:** this would make the warnings more visible and the packets less attractive.

Finally, any preventive strategy based on emotion requires that we do not allow **people to feel helpless in the face of their problem.** It is advisable to provide a possible solution, such as the the French Tobacco Info Service number (3989), for example.

3. Obesity prevention: reconsidering preventive and educational strategies

Optimising public information strategies

Transmitting informative messages about obesity is no easy task - for a number of reasons. Firstly, prevention strategies are generally **less effective** when they are aimed not at stopping a behaviour but only **changing it**. Secondly, as strongly as people are convinced that smoking is bad for health, **the concept of a bad diet is contested with the same vigour**, as this is conditioned by methods of consumption (quantity, frequency, food association) and physical habits. Moreover, it is not enough just to inform. People tend to under-estimate the long-term risks, even more so if they are concerned by them: these methods of intervention have a wide range of impacts, as they are shown to be **more effective with people who are already sensitised to the problem** (mainly women watching what they eat). Finally, the influence exerted by

an **"obesogenic environment"** (attractive advertising, fast food everywhere you look, more time spent in front of the TV etc.) on decisions related to consumption is clear.

To meet these challenges, it would appear necessary to gain a better understanding of the cerebral mechanisms involved in obesity, since recent studies reveal the major role of the brain and its reward system The hedonistic hypothesis for obesity states that obese people need more food in order to sense the pleasure of eating. This **"pleasure dimension" of obesity needs to be built into prevention strategies**, which currently emphasize health aspects above all else. We need to fight the idea that a diet product is less pleasurable to eat.

Thus, to have any impact on the people most concerned, we need to **enhance the look of diet products, make them more palatable and develop food and cookery education** to enable people to appreciate the flavour fully. Moreover, in communication campaigns, we need to **choose the vocabulary with care to avoid dogmatic language that points the finger of blame** or, quite the opposite, language that is too soft and fails to engender a sense of personal responsibility. Health banners at the bottom of food advertisements might be more effective if **their content, form and layout changed** during the ad. In addition to this, to avoid the message not being understood properly or having to compete in cognitive terms with the product being promoted, it should appear on the screen on its own and be read out by different voices.

Finally, studies show the extent to which information in advertising or on a food product label can change the appreciation of its flavour. With this in mind, **putting a label on recommended foods** could prove effective, as is already the case in the Scandinavian countries. The counter-productive effects identified (assumed lack of gustatory pleasure or feeling of being able to eat as much as you like of these products) might be avoided if this type of measure was associated with an effective information campaign.

On the necessity for preventive action at an early stage

Several major schools of thought emphasize the importance of **acting at as young an age as possible in the fight against obesity.** There is a strong correlation between body mass index (BMI) at the age of 6 and as an adult, which is due particularly to the strong capacity for forming adipose cells in early infancy. Moreover, there is a **progressive deregulation of the system of satiety**: moderating themselves spontaneously in their early years, children become increasingly sensitive to environmental signals emitted by products. This data cannot but make us encourage the **limitation of the size of portions** offered by the agri-foods industry and school restaurants, but also **impose a certain sober quality on packaging design**. We also need to act at an early stage because it is during childhood that **the process of learning about taste in a social environment** occurs. The simple act of putting a product in front of children regularly increases their preference for it, and it is during the first six years of life that appetence and taste can be modulated. We therefore need to widen the range of food available to children during this period.

Moreover, scientific studies are unequivocal: advertisements influence the brand choices of young people and change their perception of flavours and their preferences. This is more marked in **overweight children, as they are more sensitive to food ads** than non-food ones, and seeing an ad increases consumption by them more than it does in children whose BMI is below the obesity threshold -

hence the risk of a cumulative phenomenon. **Using the obvious attraction of children to brands** to encourage them to eat a more balanced diet would seem to be a good idea – perhaps building partnerships with the agri-foods industry, for example. However, faced with the extent of the problem, some people are calling for more ambitious measures, such as **limiting the exposure of young people to advertising, but also to promotional items** via restrictive legal provisions.

The considerable impact that images have on children likewise gives hope that an effective communication campaign will have greater influence on this particular population. With this in mind, we need to ensure that we **address the unsuitability of the messages currently aimed at younger people**, as they are less aware of written than graphic information, and are scarcely interested in health considerations.

Moreover, it would appear vital to fight not "with equal weapons" - given the gap between private sector budgets for advertising and those for public prevention – but at a minimum level with "the same type of weapons". The concept of **using the traditional elements of persuasive ads specifically for children**, including well-known characters, bright colours and humour, needs to be applied beyond campaigns strictly relating to health – in the **educational media**, for example. A recurrent cartoon character working as a cook and interacting with another character promoting physical and sports activity might have a positive effect **as a fun and non-prescriptive way of learning,** as has been the case in other sectors (e.g. ecology, learning about the human body).

Finally, **actions outside the family environment should also be supported, especially in schools.** Imposing a dietary balance on meals in the school canteen, whilst ensuring that this doesn't put up the cost, organising regular cookery workshops and highlighting nutritional principles at the core of lessons more widely devoted to health education are also promising avenues. All of these tools need to be organised in an entertaining way to keep the attention of young people and ensure greater retention.

* * *

Every public health initiative involves a major ethical challenge: that of evaluating the risk of drifting from a strategy of encouragement into more intrusive and compelling measures, which would prove incompatible with our democratic principles. Prevention must not, in the guise of a quest to improve people's health and well-being, become overly involved in the choices and decisions of the individual.

With these precautions on board, behavioural and brain sciences, without being a miracle solution could form a complementary methodology to the traditional tools used. This approach opens up serious avenues for improving public health prevention. This area needs updating – not just because of the limitations of current methods, but above all because we are faced with new risks that are all interconnected. New risks call for new measures.

> *Olivier Oullier and Sarah Sauneron, report coordinators and heads managers of the "Neuroscience and public policy" programme*

PART 1

Rethinking public health prevention: beyond the rational decision maker model

Prevention in public health is often presented as a universal solution (effective for all individuals) and inexpensive (savings might even be made). However, the usual preference for prevention needs to be tempered somewhat. Admittedly, taking into consideration the medical, social and economic consequences of chronic diseases and pathologies resulting from risk behaviours, prevention strategies are the preferred intervention tool. However, the results of these are not always on a par with the objectives and the efforts made, particularly in the absence of more realistic targeting of the various groups at risk (*Chapter 1*).

Thus, the goal of preventive strategies must not be "just" to inform, raise awareness or promote healthy behaviour, but to encourage the population to adopt it. Such an undertaking particularly leads us to question the myth of the rational decision maker (what the economists refer to as the rational agent or homo oeconomicus), employing a better understanding of the psychological and social biases characteristic of human beings. The prevention sector has the responsibility for integrating these new approaches, opening up to new areas of expertise, including the contributions of research in behavioural sciences. These approaches currently have links with international administrations and organizations. As a revealing example, the World Economic Forum considers these disciplines in the design of public policy strategies (*Chapter 2*).

Some representatives of behavioural sciences have achieved international recognition and notoriety, like Sendhil Mullainathan and Richard Thaler, behavioural economists. They are strong promoters of the "*nudge"* concept, which indicates simple but effective behavioural strategies, used in public policies to improve the health and wellbeing of individuals. This contribution of behavioural economics and social psychology, represented here by the leading light in influence mechanisms, Robert Cialdini, could provide support for the encouragement factor in public health strategies, and therefore increase their effectiveness (*Chapter 3*).

Moreover, neuroscience extend and complement the behavioural and social sciences, offering them a hitherto unknown window on the mental mechanisms involved underlying decision making processes. They make it possible to gain a better understanding of consumers attitudes, including the role of emotions in attention, memorizing and decision making (*Chapter 4*).

Lastly, among the tools at the disposal of the prevention sector, those contributed by the cognitive sciences might well optimize health information and education campaigns. A better knowledge of the various cognitive components of communication will make it possible to both develop innovative campaign evaluation techniques and find the appropriate balance between attention, emotion and memorizing (*Chapter 5*).

Box n°1

The Ottawa Charter for Health Promotion

Adopted on November 21, 1986 during the first international conference on health promotion, the Ottawa Charter sets shared objectives and commitments for the signatories in order to launch and pursue a process of health promotion. Its starting point was the progress made under the Alma-Ata Declaration on primary health care, and is part of the "Global strategy for health for all by 2000" project developed at the time by the WHO.

This Charter is one of the founding texts for modern public health, as it gives legitimacy to the vision of health promotion by clarifying key concepts, revealing the resources necessary to health and identifying the strategy and actions required. Health promotion is defined as "the process that gives populations the means to ensure greater control of their own health, and to improve it". Health is seen as a resource in our daily lives, meaning that a whole series of basic conditions needs to be met: peace, a proper place to live, education, food, a stable ecological system, wise use of the available natural resources, social equality and equal opportunity. It identifies five areas of action for health promotion: the formation of healthy public policy; the creation of favourable environments; support for community action; personal skills development through information and education; the redirection of care services towards disease prevention and health promotion.

The Charter therefore asks us to support individual and social development by supplying information, ensuring health education and perfecting vital life skills. Although dating back more than twenty years, the Ottawa Charter has lost none of its currency or relevance today.

CHAPTER 1

"Diseases of society" and the search for the most efficient prevention strategies

Sara-Lou Gerber[1]

France has positive general health condition indicators overall. However, two problems persist: premature mortality is among the highest in the European Union and health inequalities between social categories are significant. In view of these difficulties, and since the diseases known as "diseases of society" have become extensive, prevention is often presented both as a universal solution (effective for all individuals) and inexpensive (savings might even be made).

In fact prevention can certainly make it possible to improve public health at a reasonable cost, but on the condition of selecting the most efficient strategies, namely those that target the vulnerable groups more closely. From this point of view, a better understanding of behaviours in view of the risks is precondition of any action.

While the question of the behaviour of individuals towards prevention strategies will be discussed at greater length throughout the present report, this first chapter details the health and economic background behind premature deaths and chronic diseases and the "potential" for prevention. It then questions the limitations of traditional public health prevention strategies. Indeed, the description of the prevention initiatives most often implemented shows that they sometimes encounter obstacles likely to deteriorate their cost/effectiveness, which justifies optimization in some cases.

1. The medical and economic burden of risk behaviours

1.1. Effects on mortality and morbidity

With 110,000 deaths before the age of 65 years in 2005 (21 % of the total), the premature death rate in France is one of the highest in the European Union, this unfortunate statistic being mainly attributable to the significant premature death rate in men. This estimate bears testimony to **the impact of risk behaviours**, considered to be responsible for approximately 38 % of these deaths occurring before 65 (24 % among women). The study of the major causes of premature death reveals that a significant portion of these deaths could have been avoided, either by screening campaigns, or by behavioural changes (often referred to as **"avoidable" mortality**).

[1] Project manager at the Department of Social Affairs of the Centre for Strategic Analysis.

Thus, the causes of "avoidable" deaths, which include cancers of the upper aerodigestive tracts, oesophagus and lung, alcoholic psychoses, cirrhoses, traffic accidents, accidental falls, suicides and AIDS, were responsible for over 36,000 deaths in 2005.

Tobacco and obesity are among the most worrying problems in terms of public health. 14.5 % of the adult French population (that is, people over 18 years of age) suffers from obesity. This proportion has increased by 70 % since the end of 1990[1]. As far as addiction to nicotine is concerned, almost at 30 % in France, i.e. higher than the 20 % goal set by the World Health Organization (WHO).

The health issues related to these risk factors are widespread. Tobacco consumption is still the cause of a significant portion of morbidity: 13 % mortality before 65 years is attributable to cancers of the lung and upper aerodigestive tracts[2]. Obesity tends to be associated with many chronic diseases such as diabetes and cardiovascular disorders and its prevalence has grown significantly. To illustrate this, the ENTRED investigation (national test sample, representative of diabetic people) show that the increase in the number of people treated for diabetes in France has reached 110,000 per year[3].

1.2. Economic and financial consequences

These pathologies constitute an unquestionable burden on health insurance finances. Thus, the estimate for health insurance medical care refunds for diabetic patients during 2007 reaches €12.5 billion (€7.1 billion in 2001), representing an increase from 7 % to 9 % of health insurance (i.e. an 80 % increase). The increase in care refunds can be explained both by the aforementioned increase in the number of patients treated and the increase in the average costs of the treatments, that happens to be higher in the event of complications[4]. Overall, the direct medical costs due to obesity and related risk factors were estimated between €2.6 and €5.1 billion in 2002 (depending on whether a restricted or broad definition is taken). By including daily allowances, **the cost of obesity** for health insurance was estimated between €2.1 and €6.2 billion (that is **between 1.5 % and 4.6 % of the current health expenditure**)[5].

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[1] Data obtained from the 2009 Edition of the Obepi Investigation, carried out every three years since 1997. Since the investigation is carried out in a declaratory way, underestimation is probable.

[2] In 2005, according to the DREES, 29,300 deaths due to larynx, trachea, bronchial and lung tumours were recorded in France, 80 % of the cases being in men.

[3] This increase consists in particular of an increase in the rate of prevalence of diabetes treatment corrected for age and sex (+ 28.2 % of diabetics), due mainly to an increase in obesity and overweight.

[4] These 12.5 billion are divided into 4.7 billion for public and private hospitalization, 3.4 billion for medication, 1 billion for nursing care, 1 billion for medical equipment, 0.9 billion for medical fees, 0.4 billion for biological analyses, 0.4 billion for medical transport and 0.2 billion for kinesiotherapy. Progress in taking responsibility may have an impact on controlling the increase inexpenditure, but the latter is still above all due to the increase in obesity. See in particular "The number of diabetics increases by 110,000 people per year in France, according to the CNAMTS ", International APM dispatch, October 23rd, 2009.

[5] Emery C., Dinet J., Lafuma A., Sermet C. *et al.* (2007), "Cost of obesity in France", *Presse médicale*, 36.

As for tobacco addiction, while the State collects approximately €10 billion each year through tobacco-related taxes, the costs for fighting against nicotine addication and its consequences (health expenditure, campaigns, loss of productivity) is estimated at the same amount[1].

This economic burden weighs particularly heavily on **the French health insurance system, characterized in particular by dealing with the so-called "Affection de longue durée" (Long Term illnesses** LTI)[2], which presents **a matching strongly with the statistics of diseases known as "diseases of society"**. Indeed, more than three out of four people suffering a form of long-term illness are also affected by: cardiovascular diseases (25 %), diabetes (14 %) and cancers (15 %), psychiatric disorders constituting the fourth most significant category. These are also the pathologies which most strongly contribute to the increase in the number of people with LTI. However, LTI, by diverting 62 % of refunds to 15 % of the population, constitutes one of the most worrying problems for the sustainability and approval of health insurance financing.

Because of their medical impact and their cost to health insurance, these pathologies call for solutions. In the presence of risk factors that are, in theory, "avoidable", the assumption is generally made that prevention is therefore more efficient than the treatment of the diseases.

2. Given the pathologies resulting from risk behaviours, is an ounce of prevention always worth a pound of cure?

2.1. Prevention is not necessarily the most "economical" strategy

It is of common belief that prevention allows for improving health and saving money at the same time. In this respect, if more importance were ascribed to preventive strategies, France, with its well-known "curative prism", would have the means available, to the increase in its health expenditure to some extent, whilst also improving the health of its population[3]. "Diseases", the second focus of the Quality and Efficiency Programme (PQE), linked to the Social Security Financing bill (PLFSS) for 2010 is thus aimed at developing more efficient prevention policies, considering

[1] Pierre K. and Fenoglio P. (2000), "Le coût social des drogues licites (alcool et tabac) et illicites en France" ("Social costs of legal drugs (alcohol and tobacco) and illegal drugs in France"), French observatory for drugs and drug-addiction.

[2] The LTIs correspond to a list of 30 long and expensive illnesses established by the Social Security Code, added to which are serious and invalidating affections with a foreseeable duration of more than six months. These give the right to a 100 % care by the health insurance by exemption from the user fee for treatments related to the affection.

[3] Loriol M. (2003), " Hygiée contre Panacée, les blocages de la santé publique en France" ("Hygeia versus Panacea, public health obstacles in France", *Humanisme et Entrepris*e, n° 257. Health prevention expenditure only represents 2.7% of current health expenditure (DCS). Even after revaluation including the actions not covered under the classification, prevention expenditure would not exceed 6.4 % of t current health expenditure, that is, a little more than 0.6 % of GDP; *see* DREES (2006), "Les dépenses de prévention et les dépenses de soin par pathologie en France" "Prevention and care expenditure by pathology in France", *Études & Résultats*, n° 504

that "*these public health issues (tobacco, alcohol, nutrition, etc) are significant in terms of care expenditure for pathologies that arise from these risk factors*[1]."

However, while prevention improves health and saves lives, most health economists remain cautious with respect to prevention as a means to saving money[2]. Indeed, in the short term, prevention has a cost, and concerns more individuals than the care, so its development does not automatically involve savings on the financial level nor always represent the most optimal allocation of resources (*Box n° 2*)[3].

It is thus necessary to study preventive strategies on a case-by-case basis or at least within the framework of a reasonably narrow typology of health issues in order to appreciate their effectiveness. For this purpose, it is necessary to calculate cost/advantage ratios and, while doing this, it is useful to keep in mind that the **methodological choices inherent to the evaluation** – however relevant – will **necessarily control the calculation of the savings delivered by an initiative**[4].

1. Any evaluation of preventive action requires the choice of a deadline for a return on investment. Sometimes, prevention initiatives only show their benefit after a very long period that is not easy to identify. It is therefore necessary to bring both the costs *and the* benefits up to date[5].

2. The chosen point of view modifies the results. Studies looking into the effect of preventive measures on public finances tend to look from the point of view of health insurance. Another approach, adopting the point of view "of society", adds considerations of more qualitative or subjective results (pain, anxiety, etc.) to the tangible benefits (deaths and costs avoided). These cost/utility studies require an evaluation of the quality of the life. It is for this purpose that QALYs are used.

3. The measurement of the indirect costs and benefits (i.e. the non-medical costs and benefits attributable for example to sick leave) is more difficult (the daily allowances are known, but the possible loss of production and productivity is not). However, it is precisely the systemic character of prevention that makes it of economic interest: in the short term (avoiding sick leave) but also in the long term, with extensive repercussions on the job market (encouraging an active old age and good health).

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[1] The PQE, annexed as an appendix to the social security finance bills since 2007, presents the broad objectives aimed at by the social security policies and measure the progress made each year towards these objectives in a quantified way.

[2] Le Pen C. (2005), " La prévention : une solution pour réaliser des économies ? " , ("Prevention: a solution for making savings? ", *Concours médical*, 127(18) ; Loubière S. et *al.* (2003), "Prevention could be less cost-effective than cure: The case of hepatitis C screening policies in France ", *International Journal of Technology Assessment in Health Care*, 19(4).

[3] For example, the use of statins can eliminate or delay cardiovascular problems, but these molecules are expensive (the ratio could change if their price were to decrease significantly by making generic versions available).

[4] Health Economist Association, work group coordinated by Émile Lévy and Gérard de Pouvourville, "*Guide méthodologique pour l'évaluation économique des stratégies de santé " (Methodological guide for the economic evaluation of health strategies ;*
www.ces-asso.org/docs/Guide_Methodologique_CES_2003.pdf

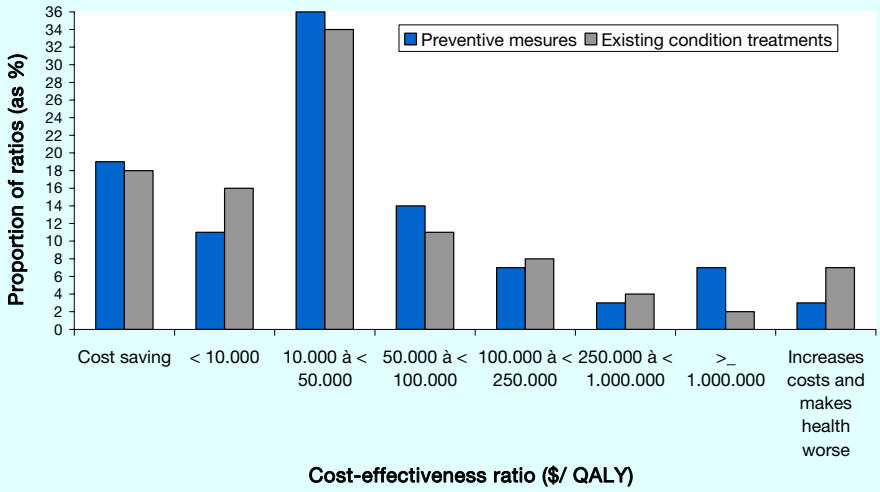
[5] Updating the costs is in general not a problem (the yields from long-term government bonds are used). On the other hand, the debate regarding the updating of rates for the benefits is not clear. For example, if benefits updated at rates higher than the costs, it might still be found beneficial to defer a preventive decision.

Box n° 2
Does preventive care save money?

The authors of an article published in 2008 by the *New England Journal of Medicine* (NEJM) reviewed 1,500 cost/effectiveness ratios for 599 initiatives presented in articles between the years 2000 and 2005[1]. The cost/effectiveness ratio is the cost of an intervention divided by the medical benefit, measured in years of life gained (corrected with respect to indices of the quality of life; QALYs, *Quality-Adjusted Life Year*).

The results are surprising: for 279 strategies that they classify as preventive, only approximately 20 % of them allow for savings to be made, while the others incur more expenditure. These money-saving strategies are in particular the vaccination of infants (for example against haemophilus B, the bacterium responsible for meningitis and pneumonia) or colorectal cancer screening in men between the ages of 60 and 64 years. On the contrary, diabetes screening in all 65 year olds (compared to screening that only targets hypertensive people) is an expensive strategy.

Figure n° 1 : Distribution of cost/effectiveness ratios for prevention and treatment interventions



Source : Cohen et al. (2008), New England Journal of Medicine – Massachusetts Medical Society©

By comparing the cost/effectiveness ratios of preventive and curative actions, the authors of the study have found a relative similarity between their respective distribution. The conclusions of this article do not mean that more prevention is not economically reasonable. Many preventive actions bring benefits that are considered to be sufficient in relation to the costs involved, but few of them are really *cost-saving*.

[1] Cohen J. T., Neumann P. J. and Weinstein M. C. (2008), " Does preventive care save money? Health Economics and the Presidential Candidates", *New England Journal of Medicine*, 358(7), p. 661-663.

2.2. Prevention is not necessarily easy to implement

"Prevention", at its more generic level, is thus not a miracle solution to the expenditure problem. Having said that, it can be shown that, **in most cases, preventive action produces a better cost /effectiveness ratio when it is targeted**[1]. Such a targeting strategy varies between types of action. Indeed, there are several types of prevention, depending on whether it is a question of current investment to avoid the occurrence of future risks (for example, regular physical activity to avoid cardiovascular complications) or to reduce the deleterious consequences of a risk that has already been observed (a mammography does not prevent breast cancer but it helps early diagnosis, allowing for more effective treatments).

A commonly accepted typology can be used as a first approach: primary prevention, that is all the actions that may reduce the onset or incidence of a disease (vaccination, environmental measures, etc.); secondary prevention, aimed at reducing the consequences of a disease once it has appeared by treating it at an early stage (breast cancer screening, encouraging hepatitis C screening etc.) and finally tertiary prevention, the aim of which is to reduce disability related to chronic diseases.

In the case of screening and some primary preventive actions (vaccination), targeting is to be understood primarily as defining an optimal population. After that, the important thing is to achieve the best rate of participation, which primarily concerns issued around the organization of the health system (role of GPs, organization of primary care)[2].

As of **prevention policies aimed at directly changing behaviours** (whether this means individuals reducing risky practices or becoming more involved in controlling their diseases), **the problems that arise are particularly complex.**

The need to fight social health inequalities in particular justifies *outreach* initiatives for vulnerable populations "at risk" or "in danger"[3]. These initiatives are inevitably to be taken at multiple levels, and require to involve multiple partners (i.e. health professionals, welfare workers, peers, etc.), making them relatively expensive and entailing detailed knowledge of the populations and the people who usually work with them.

With respect to the more traditional policies, aimed at modifying behaviours further from the "ground", through information campaigns or resorting to a price-signal, the

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[1] Gerber S.-L. (2010), " Vaut-il toujours mieux prévenir que guérir ? Arguments pour une prévention plus ciblée" ("Is prevention always better than cure? Arguments for more targeted prevention"), *La Note de Veille*, n° 167, Centre for Strategic Analysis, March 2010.

[2] Jusot F., Or Z., Marcoux L. and Yilmaz E. (2009), *Inégalités de recours à la prévention et inégalités de santé en Europe : quel rôle attribuable aux systèmes de santé ? Inequalities of recourse to prevention and health inequalities in Europe: what role do e health systems play?*, IRDES.

[3] Let us remember that Robert Gordon makes a distinction according to an approach centred on the population concerned, distinct from classification by level of prevention (primary, secondary and tertiary): universal prevention, which is aimed at the general population, however it is a question of providing all individuals with the information and/or skills needed to reduce the extent of the problem; selective prevention, which targets the groups at risk (the risk factors are biological, social and environmental); the prevention indicated (or identified), which is aimed at the people having already shown behaviours related to the problem (the intervention is on the level of the individual and his or her own risk factors).

barriers to efficiency are no less apparent: certain limitations have been pointed out by recent work.

3. Limitations of traditional preventive approaches to public health

3.1. Effective economic tools that could penalize the most vulnerable ones

Economic tools (tax/grants) have traditionally constituted an **important means for the policies employed in the fight against harmful substances** in France. While price increases (cf. Tobacco) lead to beneficial effects on global consumption level, they **still constitute a heavy drain on the budget of smokers unable to reduce their consumption**. Such persistent smokers are have low-income (if not facing poverty) in a significant number of the cases[1]. Particularly for people in a situation of serious financial uncertainty, cigarettes constitute a way to kill time, reduce anxiety and can lead to sacrificing other kinds of consumption (especially food). In spite of campaigns, anti-smoking legislation and measure taken on pricing, there still remains a vast amount of hardcore smokers. While cigarette smoking by the French has decreased since the 1990s, nicotine addiction was still affecting 33 % of men and 26 % of women in France in 2008.

Penalization of the poor could possibly be compensated if the tax income collected over tobacco products were used to support the policies for helping people to stop smoking, but this second stage is far from being reached. While it is true that the Second French Cancer Plan aims at tripling the amounts paid by health insurance in 2010 (increasing from €50 to €150) for the purchase of treatments to help quit smoking for those benefiting from the *couverture maladie universelle* (CMU) and expectant mothers, the effectiveness of such a measure in the absence of other support initiatives (psychological support behavioural assistance) has not been proven, even less so for disadvantaged populations[2].

Likewise, tax on food products with respect to its nutritional quality, in addition to being much more complex to implement than for tobacco ones (since the harmful substance is clearly identified), tend to reinforce social inequalities[3]. The halt noted to a decrease would lead to **abandoning a "price-signal" approach -which might not be the optimal solution for most low-income households- in favour of a more sensitive approach to psychosocial and environmental factors.**

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[1] Peretti-Watel P. and Constance J. (2009), "It's all we got left". Why poor smokers are less sensitive to cigarette price increases", *International Journal of Environmental Research and Public Health*, 6(2), p. 608-621

[2] The opinion of the French National Authority for Health (HAS) regarding therapeutic strategies to help people to quit smoking (2006) ruled that subsidizing efforts to quit smoking is part of an optimal strategy in terms of the cost /effectiveness ratio, but that an optimal strategy requires somewhat intensive support by a health professional; www.has-ante.fr/portail/upload/docs/application/pdf/strategies_therapeutiques_daide_au_sevrage_tabagique__avis_de_la_has.pdf.

[3] Lacroix A., Muller L. and Ruffieux B. (2009), "Impact des politiques de prix sur les choix de consommation des populations à faibles revenus. Une approche expérimentale " ("Impact of t pricing policies on the consumption choices of low-income populations . An experimental approach"), *INRA Sciences Sociales*, n° 2.

3.2. Informing people is not enough

Information campaigns are based on the belief, frequently found in public health, that if individuals behave "badly", it is because they do not have the proper information that will allow them to make good decisions. Many public health initiatives are therefore part of a scheme where the rational individual, close to *homo œconomicus*, will make the best choices if (s)he has all the information. They also have the advantage of being non-intrusive for the individual. However, a number of reports lead to the conclusion that **good information, while essential, is not enough to bring about a behavioural change**. While the promotion of health by information campaigns has the beneficial effect of providing a minimal level of knowledge to the population, it does come up against "thresholds". Indeed, in certain sectors of the population, awareness of health messages is not enough to cause a behavioural change.

Thus, even when they are aware of which products are good for their helath, consumers do not always make rational choices [1]. Progressing from the integration of a medical message to a behavioural change is not a given. For example, the INPES carried out a study on the impact of health messages included in food advertising. The results showed that 71 % of the people interviewed had remembered the messages, even a few months after they made public in February 2007. However, 64 % of those interviewed report that this new strategy did not change anything for them, but nearly a quarter (23 %) indicated that they had become aware of certain bad dietary practices. Only 9 % stated that they had started to modify their eating habits subsequently and 4 % that they had changed their approach to buying the brands and products involved[2].

Beyond these general difficulties, the major difficulty of all nonspecific primary health prevention campaigns is that they **generally reach the populations that have already adopted healthy behaviours** and miss the target of people at risk who may be in denial about their health problem. This is particularly the case for teenagers, some of whom consider drugs as a way to socialise and constitute some kind of of freedom. It is also of the case of the most disadvantaged populations, who have a tendency to be wary of health campaigns, which are perceived as a form of an "external" authority which would tend to point the finger at them, patronize at the same time as they stigmatize them[3].

Any increase in the scope of the campaigns already implemented and the sums allocated to them without any discussing targeting or methodology, would therefore have no more effect on harmful behaviour and would just be a waste of resources. It

[1] Sauneron S., Gimbert V. and Oullier O. (2010), "Lutte contre l'obésité : repenser les stratégies préventives en matière d'information et d'éducation" ("The fight against obesity: rethinking preventiion strategies for information and education", *La Note de Veille*, n° 166, Centre for Strategic Analysis, March 2010.

[2] INPES (2008), "Post-test des messages sanitaires apposés sur les publicités alimentaires auprès des 8 ans et plus". ("Post-testing of health messages included in food advertising in children aged 8 years and above". The chapters in parts 2 and 3 provide a more thorough analysis of the differences that may exist between what individuals say and what they do.

[3] Peretti-Watel P. and Constance J. (2009), « Comment les fumeurs pauvres justifient-ils leur pratique et jugent-ils la prévention ? « ("How do poor smokers justify their habit and what do they think of prevention?"), *Déviance et société*, 33(2).

would even be likely to lead to an undesirable increase in social health inequalities.

3.3. Prospects of therapeutic education for chronic diseases

Another example is the HPST law, which introduced a legal definition of therapeutic education for patients [34]. The idea behind this approach is that **reinforcing the knowledge and therapeutic support to patients** would make it possible to **prevent the aggravation of chronic diseases** and thus to **avoid certain complications and hospitalizations**. The objective is thus conceived in terms of quality of life but also of economizing. The law specifies that the evaluation of these programmes is to be entrusted to the French National Authority for Health (HAS)[35]. The medico-economic commission of the HAS has already issued a report on this topic [36], concluding that, in light of medico-economic studies, the clinical and economic results were "dubious". This is due partly to the shortcomings of the existing studies but also to the fact that the impact would be positive for certain strategies (paediatric asthma, type 1 diabetes and cardiology) whereas the impact would be much less obvious for others (adult asthma, type 2 diabetes).

The effectiveness of recent therapeutic education programmes, such as Sophia (*Box n° 3*), depends on at least two main factors: the multi-methodology of the programmes implemented and positive response the support provided to the recipients. This second aspect can, following the example of public health campaigns, justify a discussion on the selection of those that are likely to make the patient take action.

Box n° 3
The "Sophia" support programme for diabetic patients

In January 2010, nearly 53,000 diabetic patients with a Long Term illness (LTI) were included in the therapeutic support programme of the National Health Insurance Fund for Salaried Employees (CNAMTS). Launched in March 2008 with ten pilot departments[37], this programme aims to help patients to control their diabetes on a daily basis to avoid complications, while creating regular and durable contact with the volunteers. Sophia could be extended to all of France by 2012.

In practice, Sophia is based on information teaching tools (reference cards, the magazine *Sophia & vous (Sophia and you)*), telephone support by health insurance paramedical personnel (mainly nurses) and Internet services.

[34] According to Article L .1161-1: "Therapeutic education is part of the treatment of the patient. It is aimed at making the patient more independent by facilitating his or her adherence to the prescribed treatments and by improving quality of life. It may not be forced on the patient".
[35] The government wanted to entrust this evaluation to a commission from the National Institute for Health Prevention and Education (INPES) but this proposal was not adopted by the Senate.
[36] HAS (2008), Orienting report, *" L'éducation thérapeutique dans la prise en charge des maladies chroniques. Analyse économique et organisationnelle " (" Therapeutic education in caring for chronic diseases. Economic and organisational analysis ")* ;
[37] Sophia was extended to the 2009 Meeting.

In the start-up phase, the device costs 20 Euros per month per patient. It should only cost 10 Euros when in full swing, once all the tool costs have been amortized[1]. The experimental phase is due to end in June 2010 and will be evaluated which must make it possible to measure the results of the service precisely en terms of public health, medico-economic effectiveness and the satisfaction of the insured persons and the doctors.

* * *

This thinking is essential so that the political decisions for resource allocation comply with the dual objective of controlled health expenditure management and maximization of people's health and wellbeing. **A better understanding of risk behaviour is vital before any action is taken**.

While it is generally a matter of promoting initiatives on several levels, the purpose of the following chapters is to estimate the degree to which behavioural and brain sciences can contribute to reinforcing effectiveness of prevention strategies in public health.

Contributions from new disciplines could be more specifically aimed at adapting the prevention strategies to populations that are generally not very responsive to existing messages, for example by a better evaluation of the effect of the various messages on different audiences especially young people. Modelling decision-making behaviours of a "prevention subject", which simplifies less than models from standard economic theory, could make it possible to tailor public health campaigns to make them more efficient.

[1] "Le dispositif d'accompagnement des diabétiques Sophia a séduit 53 000 patients" ("The Sophia diabetic support tool worked with 53,000 patients", *International APM dispatch*, January 26th, 2010.

CHAPTER 2

Changing behaviours at various levels in chronic disease prevention

The Global Agenda Council on Chronic Diseases and Conditions of the World Economic Forum
represented by its chair **Cary L. Cooper**[1,2]

The measures taken for public health prevention cannot be limited to actions at an individual level, all the more so when they relate to chronic diseases. To be effective, they must establish the link between the individual and society on a national and international scale, as all countries are implicated.

The main work on chronic diseases by the *Global Agenda Council* of the *World Economic Forum*[3] WEF) is reported in this chapter, as well as the way in which these contributions fit in the *Global Risk Report 2010* that this institution has just published, and from which most of the data and figures presented here comes.

Indeed, the Forum has classified chronic diseases among the most important risks, because their medical importance and their consequences for the economy are still underestimated on a worldwide scale. The objective is to raise awareness amongst the people in charge of international and national institutions, as well as smaller ones, such as companies, so that they will help to develop environments that will encourage individuals to change and adopt behaviours that are more favourable to all. Based on mutually beneficial work between organizations and countries, it is possible to encourage research and the application of innovative ideas in public health, and to create favourable conditions for health and wellbeing. In attempting to achieve this, some areas of expertise have been neglected for too long, such as the contribution of the behavioural sciences.

1. Chronic diseases: a constantly increasing interdependent risk

1.1. A pandemic that affects the entire world

The World Health Organization (WHO)[4] defines chronic diseases **as long-term illnesses where progression is generally slow.** These diseases, such as **chronic cardiopathies, cancer, respiratory diseases and diabetes**, are by far the **primary**

[1] Professor of organizational psychology at the University of Lancaster (Great Britain).
[2] www.weforum.org/.
[3] World Economic Forum (2010), *Global Agenda Council Report – Chronic Diseases and Conditions*, Geneva, p. 192-194; www.weforum.org/pdf/globalagenda2010.pdf.
[4] www.who.int/fr/.

cause of mortality in the world, accounting for 60 % of total deaths [1]. In 2005, the global number of deaths from chronic disease is estimated at 35 million[2], of which **four fifths are in countries with low average incomes.**

The high rate of prevalence of chronic diseases is due to the far-reaching socio-demographic changes that have touched wide sections of the world population, in particular the change in eating habits and physical activity.

Moreover, when funds are limited, governments tend to concentrate on basic health services, as recommended by the *United Nation's Millennium Development Goals*[3], which is to the detriment of the prevention and treatment of chronic diseases.

Most developing countries, with some exceptions, will undergo a historical change over the next few decades. Thus, deaths from infectious diseases, maternal and perinatal diseases and nutritional deficiencies, all combined, are set to decrease by 3 % over the next ten years. However, over the same period, deaths from chronic diseases are set to increase by 71 %. It is estimated that, if nothing is done to counter the current trend over this new decade, **the prevalence of chronic diseases will increase by 27 % in Africa, 25 % in the Middle East and 21 % in Asia and the Pacific.**

1.2. Colossal economic consequences

Beyond the human factor**, chronic diseases represent a very high level of economic losses**, with an increase in the costs of health, and a negative effect on productivity and economic growth. With the serious deterioration of the financial situation on a worldwide scale, the increase in unemployment and the ageing of populations, the economies of countries are sometimes affected disproportionately by the costs and social impact of chronic diseases. Current trends do not give cause for optimism in this field. For example, the total health expenditure in the United States today represents 16 % of gross domestic product. A third of this expenditure is devoted to chronic diseases related to obesity.

2. What can be done to act against the further spread of chronic diseases?

2.1. Small changes for major benefits?

Whereas the pressures on public finances and health insurance expenditure increase, the risks and costs related to chronic diseases show how it would be more effective for health care institutions, governments and companies to concentrate on prevention rather than on treatment. In view of the rapid development and the related human and economic risks, chronic diseases must be global priorities from now on in terms of health management. The measures to be developed are both on a collective and individual scale.

[1] www.who.int/mediacentre/news/releases/2008/pr14/fr/index.html.
[2] www.who.int/topics/chronic_diseases/fr/.
[3] www.un.org/millenniumgoals/.

Some examples show all the benefits that could be obtained from effective prevention policies. **Thus, simulations show that a modest reduction of certain chronic disease risk factors**, such as tobacco and alcohol consumption and a healthier diet, **could result in substantial benefits for health and the economy.** In several countries, the application of new precautionary measures has led to significant improvements in people's life expectancy and quality of life. For example, by means of public awareness campaigns and better education about the risks and how to deal with them, death rates from cardiac disease have dropped to 70 % over the three last decades in Australia, Canada, the United Kingdom and in the United States. This reduction represents 14 million deaths from cardiovascular disease avoided in the United States alone. Countries with intermediate incomes, such as Poland, were also able to make significant improvements over the last few years, by making the population aware of the benefits of a healthy diet.

2.2. How do we convince people of the health and economic benefits of better chronic disease management?

The above-mentioned examples should give scope for some optimism regarding the consequences of effective actions to combat chronic diseases. However, they remain relatively marginal. Although one may think one knows what to do, actually, there are very few examples of where it has been possible to turn such knowledge into concrete effective action. This is all the more unfortunate as, **despite their strong prevalence, most chronic diseases are avoidable. In theory, we should be able to halt any further spread.** Why can't we be more effective in this field at the current time?

This is mainly due to problems of governance. First of all, the contribution made by health and wellbeing to human and economic prosperity is clearly underestimated on a global scale. Next, there are no mechanisms aimed at bringing the various sectors and actors concerned together. We have an urgent priority therefore to devise tools to **coordinate the work of international organizations and public and private sector initiatives.**

The results of such collaborations will be used as a support system for the "Coalition for Action" (a high level group uniting interested parties, from both the health and business sectors), whichis currently being set up. The Coalition will enable dialogue; facilitate relationships of trust between the business community, the public sector and civil society for sustained, integrated and coordinated action, which we hope will be more effective. It will work in close cooperation with the WHO, in particular with its non-communicable disease monitoring programme (WHO NCD)[1].

The goal of these collaborations is to manage to develop strategies and incentives that will make it possible to convince global leaders of the benefits of social entrepreneurship, but also changes in the workplace environment, both for the employee and for the institution, whether in the public or private sector. Moreover, it is necessary to encourage governments to use new approaches and technologies, and the behavioural sciences, to develop tailored portable information tools that will enable people to receive constant support for their daily decisions and their actions for improving their health and wellbeing.

[1] www.who.int/ncd_surveillance/fr/index.html.

However, such a company can succeed only if gobal leaders of institutions (whatever their size), and governments are **convinced of the human and economic relevance of the measures to be taken to halt the further spread of these diseases.** However, standard economic models, based on rational models, has proven their limitations in this type of exercise.

A better understanding of human behaviour is necessary if we can even hope to obtain results. To achieve this, any scientific contributions that will bring a better understanding of human and occupational psychology, and the mechanisms of supporting decision-making, will not only be welcomed, but in fact unavoidable in the years to come.

For example, behavioural sciences may help to support the development of relationships of trust between employees, leaders, and the institutions recommending the changes. This is why, through the exchanges that the various national summits have made possible, the World Economic Forum has begun to work with **experts in organization and complexity theory, social psychology, behavioural economics and brain science.**

* * *

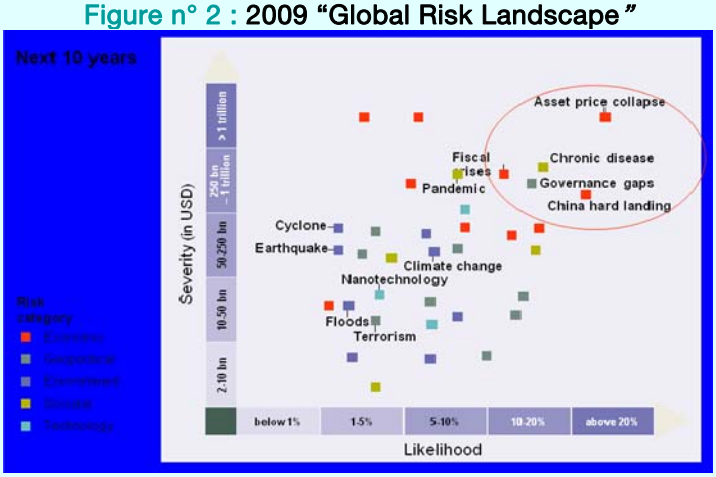
Taking the inexorable increase in health expenditure, and the ageing of the population into account, governments must reconsider their public health prevention strategies in order to make them more effective. Even in the best cases, current methods are not appropriate,, and even ineffective. In response to this report, the Council[1] is now interested in contributions from neuroscience and the behavioural sciences in the matter, and is thus encouraging innovative initiatives.

[1] Members of the council: S. Nishtar, Founder and President, Heartfile, Pakistan ; A. Alwan, Deputy CEO, Non-communicable Diseases and Mental Health, World Health Organization (WHO), Switzerland ; E. Jané-Llopis, manager, Chronic Diseases and Wellbeing, World Economic Forum, Switzerland ; P. Anderson, Editor, *Europe, Drug and Alcohol Review*, Netherlands ; G. Averbuj, PDG, Ketchum, Argentine ; C. Cooper, Chair of the GAC, Distinguished Professor of Organizational Psychology and Health, Lancaster University Management School (LUMS), United Kingdom; O. Harrison, Director, Public Health and Health Policy, Government of Abu Dhabi, United Arab Emirates; Helen Herrman, publications manager, World Psychiatric Association, Australia; M. R. J. Knapp, Director, Personal Social Services Research Unit, London School of Economics and Political Science, United Kingdom ; P. Litchfield, manager, Health and Safety, BT, United Kingdom; Rachel Nugent, Director, Global Health, Center for Global Development, United States ; M.P. O'Donnell, Chief Editor, *American Journal of Health Promotion*, United States ; V. Patel, Professor of Mental Health, Sangath, India; S. Ratzan, Vice President, Total Health, Government Affairs and Policy, Johnson & Johnson, United States; K. Srinath Reddy, President, Public Health Foundation of India (PHFI), India. These opinions and recommendations are the result of meetings held by the Council and do not necessarily reflect the opinions of the World Economic Forum or of all the members of the Council.

Box n° 4
Chronic diseases: a global priority

Chronic diseases hold a high position among all the risks to which the world's population is exposed. Their occurrence and associated cost place them at the top of the "*Global Risk Landscape* " drafted by the WEF (*Figure n° 2*).

Figure n° 2 : 2009 "Global Risk Landscape"



Source : The World Economic Forum©[1]

Moreover, as shown by the risk interconnection chart, chronic diseases are closely related to a number of other factors that affect the planet, the first of which are financial crises, underinvestment in the infrastructures, and the problems related to food, water and energy[2]. One of the main consequences of this interdependence in terms of dealing with chronic diseases effectively is the need for dialogue and co-operation between disciplines. In view of such reports, work on chronic diseases is one of the priorities of the Global Risk Network[3] (GRN) of the WEF, whose goal is to understand and research over a period of 10 years into how the risks are not only inter-connected but also interdependent on a worldwide scale. As a result of this work, a global mechanism must be created in the months to come in order to chart and monitor chronic diseases. It will make it possible to determine **what the solutions really implemented are and what the effects are**. From this perspective, the World Economic Forum proposed the development of the "Health and well-being footprint"[4], an index which could be used as a reference to evaluate the progress made by governments, public and private sector stakeholders and service providers as regards health. Such an evaluation will be coordinated within the United Nations "Objectives of the Millennium for Development" process[5].

[1] www.weforum.org/pdf/globalrisk/globalrisks09/print_the_global.htm.
[2] Godard O., Henry C., Lagadec P. and Michel-Kerjan E. (2002), *Traité des nouveaux risques: précaution, crise, assurance (New Risk Treaty: precaution, crisis, insurance)*, Paris, Gallimard.
[3] www.weforum.org/en/initiatives/globalrisk/index.htm.
[4] The Abou Dhabi Health Authority agreed to lead the "Health and well-being footprint" initiative and will host its inaugural conference in September 2010. This conference will provide international visibility for the Coalition action for the first time and will make it possible to present and discuss the results of the first year of work. A call to action will be launched there to encourage even more involved commitment towards global governance for health and wellbeing.
[5] For an interactive version of this, see: www.weforum.org/documents/riskbrowser2010/risks/#/5.

CHAPTER 3

Improving public health prevention with a nudge

Olivier Oullier[1], **Robert Cialdini**[2],
Richard H. Thaler[3] and **Sendhil Mullainathan**[4]

By equating market development and some individual decisions, economists inform world leaders on the trends to come and the decisions to be taken. They are therefore at the heart of policy-making, both public and private, which they have controlled for several decades.

However, **standard economic theorists (or neo-classical theory) and their rationality models have thrown up some "anomalies"**: individual behaviours that these models are unable to predict. In order to understand them better, new alternative disciplines emerged. It is to one of these, **behavioural economics**[5], which combines social psychology and economics, that this chapter is devoted.

1. Behavioural economics

When in the presence of their friends, it is not uncommon for someone to announce in the middle of the conversation that they want to stop smoking, eat balanced meals or start (or resume) regular physical activity. However, during the next meeting, he or she will still be smoking and eating unlheathy food, and his or her new pair of running shoes will still be carefully packed away. These everyday life situations have at least two things in common: they are all incredibly ordinary and, above all, they all violate the axioms of the standard economic theory.

1.1. The unbearable rationality of being

Standard economic theory studies the decisions of an individual equipped with many straenghts (from an economics point of view that is to say). He or she is intelligent,

[1] Scientific adviser, Department of Social Affairs, Centre for Strategic Analysis and Associate Professor of Neuroscience, Cognitive Psychology Laboratory (UMR 6146), University of Provence (France).
[2] Professor of Social Psychology, Arizona State University (United States).
[3] Professor of Behavioral Sciences and Economics, Chicago Booth School of Business, University of Chicago (United States).
[4] Professor of Economics, Harvard University and Director of Ideas 42 (www.ideas42.org; United States).
[5] Camerer C. F., Loewenstein G. and Rabin M. (2003), *Advances in Behavioral Economics*, Princeton, Princeton University Press.

logical, patient, analytical, with unfailing self-control, has unlimited knowledge and willpower and rationality in the face of any test, making it possible for him to avoid being influenced by their emotions. Add on top of selfishness that makes him or her totally impermeable to social influences, and you have *homo œconomicus*.

All these features enable him to make only "optimal" decisions informed his purely utilitarian approach. Such a vision of human beings is very practical for the development of economic models because it standardizes individuals by fixing their personality. However that might be, the economic sciences cannot escape a sizeable problem. **Despite all of his virtues, this (economically) ideal being has a crippling defect: he does not exist!**[1]

Who can say that they are not emotional, impulsive, distracted, altruistic, prone to procrastination and decision making guided by instant gain? The optimal economic result is not really a major issue for human beings. **Having the relevant information regarding risky behaviour, for example, is not enough to make an individual give it up: quite the contrary.**

All of these characteristics specific to humans have been studied and integrated for years in the decision-making models of psychologists, while the dominating trend in economics has been unaware of them or, best case scenario, underestimated them.

However, it has not always been like this.

1.2. From mathematics to psychology …

Before this galloping mathematical and rationalising approach to economics arose, certain economists, more than two centuries ago, had already described the role of emotional factors in economic decision-making[2]. Among them, Adam Smith, known for his "invisible hand" concept, published his work called "*Theory of Moral Sentiments* "[3], which laid the foundations for certain concepts of behavioural economics[4] from as early as the XVIII century.

Not much later, Jeremy Bentham, the father of utilitarianism – keystone of neo-classic economics –, also addressed certain psychological biases.

What transpired in the meantime, meaning that psychology was put in the same category as economics? **The desire to strengthen a field considered as less rigorous than other disciplines had its founding in the Humanities**. At the end of last century, the physicist's approach to economics triumphed and held sway for several decades, still being the dominating trend, even today.

Notwithstanding, work was carried out and made it possible to update, in a systematic way, certain behaviours contrary to current rationality hypotheses for

[1] Kirman A. P. (1992), "Whom or what does the representative individual represent?", *Journal of Economic Perspectives*, 6(2), p. 117-36.
[2] They were to some extent the "psychologists of their time", to use the expression of Camerer and Loewenstein, insofar as psychology as a field of study did not yet exist in their time.
[3] Smith A. (1759), *Theory of Moral Sentiment*.
[4] Aversion to risk, for example.

decision making . The two articles co-written in the 1970s by Amos Tversky and Daniel Kahneman (who would later become the winner of the Nobel Prize for Economics in 2002) are regarded by many as key elements in the development of behavioural economics.

The first, published in 1974[1], showed that the probabilistic judgments put forward do not fulfil statistical criteria. The second, dating back to 1979[2], is certainly one of the most influential articles of the end of the last century. It describes the asymmetry between the pain caused by loss and the pleasure felt from gain. It offers a theory for loss aversion more than two centuries after the first intuitions of Adam Smith.

1.3. … and application for public policies

Since these seminal contributions, behavioural economics has continued to develop, fed by observations of the behaviour of real human beings, in their daily life as well as in laboratory experiments, making it possible to obtain statistics on famous **economic anomalies**[3] (decisional or behavioural).

This approach is totally different from standard economics. It does not consist of developing abstract models with which you might try to predict the behaviour of hypothetical (non realistic) individuals. This discipline observes and analyzes the characteristics of very real human behaviour to then try to work out models starting from certain non-variable factors.

As stated by Colin Camerer and George Loewenstein : *"At the core of behavioral economics is the conviction that increasing the realism of the psychological underpinnings of economic analysis will improve economics on its own terms -- generating theoretical insights, making better predictions of field phenomena, and suggestingbetter policy*"[4].

Accordingly, would it not be possible to use knowledge resulting from the experiments and observations in behavioural sciences in order to help individuals to adopt practices that are less risky for their health? **These strategies have already been used successfully in areas such as financial[5] and energy savings**[6]. Working with framing or anchoring effects or the tendency towards inertia when faced by change and compliance to social norms, to name but a few examples, could make it possible to improve the wellbeing of individuals without depriving them of their freedom of choice.

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[1] Tversky A. and Kahneman D. (1974), "Judgment in uncertainty: Heuristics and biases", *Science*, 185, p. 1124-1131.
[2] Kahneman D. and Tversky A. (1979), "Prospect theory: An analysis of decision subject to risk", *Econometrica*, XLVII, p. 263-291.
[3] See in particular the articles devoted to these anomalies published in *Journal of Economic Perspectives* : http://faculty.chicagobooth.edu/richard.thaler/research/Anomalies.htm.
[4] Camerer C. F. and Lowenstein G. (2003), "Behavioural economics: Past, present, future", *Advances in Behavioral Economics*, p. 3-51.
[5] Thaler R. H. and Bernatzi S. (2004), "Save more tomorrow", *Journal of Political Economics, 112*, S164-S187.
[6] Hallcot H. and Mullainathan S. (2010), "Behavior and energy policy", *Science,* 237, p. 1204-1205.

2. Libertarian paternalism

The idea of making deliberate use of behavioural biases in order to improve the wellbeing of people is based on three concepts. The first is *libertarian paternalism* which defines the approach itself. The second is represented by the *influence* strategies to be implemented to achieve it, the latter being fed by both the results of behavioural economics and those of social psychology. The third is that of *nudge*: the implementation of these strategies.

2.1. Libertarian paternalism

The authors of the concept of libertarian paternalism, Cass Sunstein and Richard Thaler[1], refute the contradiction that some may see in the association of these two terms[2]. **With paternalism, they call for a policy to guide the choices of individuals with the purpose of improving their wellbeing. In its libertarian character, they refer to the need to respect the freedom of each person to act, or to even decide to change their opinion as they see fit.** In this sense, the approach is different from a regulation which would leave no other alternative but to comply.

In their most recent book, the two authors admit that this approach does not just consist of anticipating the decisions of individuals but rather of directing them in a deliberate way. They add, however, that "*libertarian paternalism is a relatively weak, soft, nonintrusive type of paternalism because choices are not blocked, fenced of, or significantly burdened. If people want to smoke cigarettes, to eat a lot of candy, to choose an unsuitable health care plan, or to fail to save for retirement, libertarian partnalists will not force them to do otherwise –or even make things hard for them"*[3].

2.2. Influence and *nudge*

In order to be able to practice a libertarian paternalism policy, it is thus advisable to develop strategies that will direct the choices of individuals in order to improve their wellbeing. These strategies will add to behavioural economics results but also those of social psychology, developed in the influence theory by Robert Cialdini[4].

Starting from this theoretical knowledge and empirical results, it will be possible to **implement suitable means to induce behavioural changes and influence the**

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[1] Sunstein C. and Thaler R. H. (2003), "Libertarian Paternalism", *The American Economics Review*, 93(2), p. 175-179.
[2] Sunstein C. and Thaler R. H. (2003), "Libertarian paternalism is not an oxymoron", *University of Chicago Law Review*, 70(4), p. 1159-1202.
[3] Thaler R. H. and Sunstein C. (2008), *Nudge. Improving Decisions about Health, Wealth and Happiness*, Londres, Penguin Books.
[4] The latter is based on six major principles: Reciprocity, sympathy, adherence to social norms, commitment and associated coherence, authority and scarcity; Cialdini R. (2004), *Influence et manipulation. Comprendre et maîtriser les mécanismes et les techniques de persuasion (Influence and handling. Understanding and controlling the mechanisms and techniques of persuasion)*, First Editions : Paris ; Cialdini R. (2008), *Influence:Science and practice* (5th edition), New York, Allyn & Bacon.

choices of individuals, while leaving the possibility of not following the suggested direction. The latter thus remain the "architects of their own choices"[1].

This is what Richard Thaler and Cass Sunstein call a "***nudge*** ", cognitive strategies to make a person **do something … And especially to make good choices for herself**.

Let us consider the example of a *nudge* based on the principle of compliance to social norms. In a hotel bathroom, if you display information on the percentage of people who, having occupied the room previously, used their towels several times instead of having them changed every day, customers are encouraged (without however being forced) to refrain from using the towels just once[2]. Because the statistics they were given were high, it becomes the social norm for them to re-use the towels. This inexpensive strategy has led to an increase in the re-use of the towels, which at the same time brought obvious ecological benefits, and also economic ones for the owners of the hotels that applied it.

3. Some *nudges* for public health prevention[3]

This section includes a brief illustration of some examples of *nudges* that have led to behavioural changes in various sectors of public health prevention [4].

Organ donation

A strategy often employed for commercial subscriptions is to offer a free service to consumers for a few months specifying that they can suspend it simply by mail before it becomes a service that has to be paid for. However, many people forget or then balk at taking the administrative steps, however simple they may be, and spend money for a service that they did not initially want. This is known as a "default subscription" strategy.

Although the stakes are very different, a similar method can be used for organ donation. What would happen if a person was a donor by default? Such an initiative forces individuals to take steps to stop being a donor, contrary to what is done in countries where it is necessary to go through certain formalities to become a donor. Work published in 2003[5] compared the consequences of the two strategies: in the end, less than 20% of the population is a potential donor when it is necessary to take steps to become one, against more than 80% when organ donation is by the default strategy. To go to an institution and officially state that one does not want to be an organ donor firstly involves filling out the administrative forms and then (to a certain extent) going against a strong influence: that of social norms, such a position being likely to be regarded as selfish.

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[1] Thaler R. H. and Sunstein C. (2008), *Nudge. Improving Decisions about Health, Wealth and Happiness*, Londres, Penguin Books.
[2] Cialdini R. (2005), "Don't throw in the towel, use social influence research", *Observer*, 18, 4-4; www.psychologicalscience.org/observer/getArticle.cfm?id=1762.
[3] Most of the examples of *nudges* presented in this section have been taken from the work *Nudge* by Richard Thaler and Cass Sunstein.
[4] The *nudges* more particularly directed towards the fight against obesity and nicotine addiction were developed in parts 2 and 3 of this work.
[5] Johnson E. J. and Goldstein D. G. (2003), " Do defaults save lives? ", *Science*, *302,* 1, p. 338-1339

This example may raise ethical questions as to its nonlibertarian aspect. However, in fact, in the vast majority of countries where such a method is implemented, application is far from being rigid. Let us remember that, in France, the law considers that everyone is an organ donor by default. However, in reality, before harvesting the organ the transplant teams always consult the close relatives of the deceased to make sure that (s)he had not expressed any opposition to organ donation, or that he or she had confirmed agreement.

Hygiene

A very simple idea made it possible to make men's toilets cleaner. It was enough to **place a sticker representing a fly in a strategic place on the urinal**. Wherever the fly is, it becomes a target that men will always aim at[1]. This example, which may appear commonplace or even laughable, nevertheless had far from negligible consequences on the cleanliness of the toilets. Indeed, this simple approach alone made it possible to decrease urine being sprayed on the wall or the ground by almost 80%.

Still within the framework of maintaining cleanliness, several experiments have shown that a clean smell in a room encourages people to behave more respectfully. Thus, during an experiment, subjects were asked to sit at a clean table and to eat cookies from this table. These had been especially selected to be extremely brittle so that crumbs would fall systematically on the table. Two conditions were tested. One group carried out the task when no smell was present in the room. For the other group, a cleaning product smell was sprayed around. The results showed that a much greater proportion of individuals spontaneously cleaned the table before leaving the room when the ambient air had been scented[2]. This result, reproduced several times, might be one of the resons why cleaning products with strong smells are used in large canteens.

Keeping to commitments

To try to encourage individuals to follow a good diet or quit smoking, the site stickk.com, developed from an idea by two professors of Yale University, Dean Karlan and Ian Ayres. It offers to let them pay an amount of money and commit to a result over a given period. The process is carried out in partnership with a doctor who will weigh the person regularly or will make her take urine tests to be sure that she have not smoked again. Money is refunded to any person who keeps to her commitments. On the other hand, if the person does not reach the goal, the sum is used for charity. This *nudge* that exploits the aversion to losses has an unquestionable advantage, and voluntary take-up is part of the approach.

Nutrition

A simple strategy makes it possible to encourage people to vary their diet. A study compared two types of choice of food. For one month, a group chose the menu to be

[1] People familiar with James Gibson's work will certainly see here the concept of affordance (or possibility of action), a key concept in his ecological approach to perception and action in psychology. He had certainly not imagined such an application!

[2] Holland R. W., Hendricks M. and Aarts H. (2005), "Smells like clean spirit: Non-conscious effects of scent on cognition and behaviour ", *Psychological Science*, 16, 689-693.

eaten for that day's lunch every morning. Another group, on the other hand, had to plan its menus for all of the following month. The results show that the group that plans varies its menus more than the group that makes its decisions from day to day. **The act of visualizing the sequence of the meals in a meal plan encourages the person to avoid choosing the same combination on several consecutive days** and also to **diversify his or her food choices**.

Decreasing the variety of food offered in a cafeteria encourages people to eat less. A 2005 study showed that if people can serve themselves yoghurt in a bowl and they are offered three varieties, they will tend to consume 23% more than if only one flavour is available. This is due to the fact that the reduction in the appetence and acceptability of a food that has been eaten until reaching satiety is specific to this food. In fact, "there is room left" for another type of food. Research on specific sensory satiety thus suggests that meals made up of food with similar sensory qualities (for example, similar taste, shape and colour) might reduce the amounts ingested[1]. It remains to be seen whether the pleasure of eating, which is essential, would also decrease.

This last following fully illustrates the goals of Pierre Chandon – a French specialist in food psychology – when he declares that one *"eats with the eyes, not with the stomach*"[2]. In an experiment, a red *crisp* was inserted at regular intervals in cardboard packing in the shape of tubes[3]. Compared to a tube in which all the crisps are identical, the use of visual markers made it possible to decrease average consumption by approximately 50%[4]. In fact, these colour separators **draw the attention of the eater, provide him or her reference marks with regard to consumption and make him or her pause during eating.**

Wastage

The Alfred University in New York conducted an experiment in which people lunching at a *self-service* restaurant on the campus **no longer had plates available to them**. This measure immediately caused the portions that they served themselves to decrease. While no data is available regarding the possible consequences on the body mass of the students, it is interesting to notice that the needless waste of food decreased significantly. This measure was then implemented by several universities in the United States, with an average of 50 % less waste being recorded.

Road safety

It is also possible to use *nudges* in the field of road safety to force drivers to slow down. On a very busy road on the outskirts of Philadelphia, **the public authorities decided to paint fake speed bumps on the ground** that would look like real ones from the perspective of the drivers. Over a period of one month, the speed radars set

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[1] Heshmat S. (2006), "Applying behavioral economics to changing health behaviour: The case of weight loss management", *Californian Journal of Health Promotion*, 4, p. 21-29

[2] Interview given at Rue 89 on March 5th, 2009.

[3] Wansink B., Geier A. B. and Rozin P. (2009), " Packaging cues that frame portion size: The case of the red potato chip ", *Advances in Consumer Research*, 36, 1p. 95-195;

[4] In a control experiment, researchers showed that consumers ate the crisps without discrimination if all in the same box were beige in colour (natural for crisps) or red.

out on the road in question showed that the average velocity had decreased from 38 to 23 miles per hour[1]. An interesting effect for a strategy three times less expensive than putting real speed bumps. The second benefit, is that this optical illusion allows health vehicles, such as fire trucks or ambulances, to pass over them quickly without damages.

Another strategy, implemented in Australia, was to remove the centre line of a two-way road. This not only resulted in decreasing the average speed on this road but also increased the distance between the cars travelling in each direction. **With the road no longer having any surface markers, it became less safe in the eye of the drivers, who adopted more careful behaviour**.

A different measure that is well-known in the United States for reducing speed is the implementation of detectors that display the speed of passing vehicles on large screens. Drivers are thus informed of their speed and are more respectful of the driving rules. In Italy, these information panels show a smile when the driver respects the speed limit and an angry face when the limit is exceeded. **The use of these facial expressions improved the effectiveness of this measure still further in terms of respecting the speed limits**.

Lastly, a town in Australia noted that panels requiring drivers to slow down when approaching schools did not have the desired effect. Not being able to dispatch policemen with radars for all the establishments, various methods were tested (meters displaying speed on a large screen, false radars). The one that proved to be the most effective was the installation of **cardboard silhouettes of children at the edge of the road**, with a significant reduction of speed noted at school entrances.

4. What is the future of behavioural sciences in public policy?

The power of behavioural sciences lies in that they have put human beings, their body, their moods, their desires and their propensity to be influenced by others at the heart of economic concerns. The few examples presented in the previous section illustrate how small changes in the environment can lead to major positive effects on health and economics, and that it would be a shame to not take them into account in public health prevention strategies.

However, the goal of this chapter is not to recommend a systematic application of the strategies developed all over the world to our own country, but rather to inform people in charge of their existence and nurture the debate on their potential effectiveness and ethical implications. Moreover, even if it were to be considered, reviewing, developing and using behavioural sciences in public policies is no easy undertaking.

An initial problem lies in the fact that, while taking account of many human factors, **behavioural economics can only provide such clear cut answers as standard models. This careful behavioural approach is better from a scientific point of view, but both public authorities and citizens prefer to hear firm solutions (even if**

[1] It may be that this effect is temporary for residents who frequently travel through and quickly understand the stratagem. On the other hand, for people not living in the area, this measure could prove to be effective in the long-term.

those or not realistic), at least in order to be reassured. Hence, the context dependence approach ("it depends") of public health prevention by behavioural economics although more realistic and honest, turns not to be always seductive, if not perceived as weak, on the political front.

The second difficulty concerns **going from the individual to the aggregate level**. While initiatives for individuals are essential, those on a broader scale are also necessary. Admittedly, work on behavioural economics has been directed at group dynamics and the rapid transfer of information and emotion ("contagion") within a community[1]. Collective changes have been observed due to the use of *nudges* to increase the rate of participation in voting [2] or fundraising[3]. But, for the moment, with rare exceptions, the care used in the application of behavioural sciences does not allow them to propose viable alternatives or equivalence to the macro-economic models on the markets, however imperfect or wrong those might be.

Finally, we have the ethical concerns libertarian paternalism can raise. **Do we have the right to influence the behaviour of our citizens?** It is necessary to remain vigilant, so that the wish to encourage for the good of the individual does not become a desire to constrain. As long as citizens remain the free to choose, we think this policy is good. In other words, as long as a person has the possibility of choosing a way that is not the one towards which she is being directed by the *nudge*, this policy can be legitimately applied. Moreover, since this work is devoted to public health prevention, it is difficult to ignore strategies that would make it possible to improve the wellbeing of individuals.

* * *

But the truth is that before being able to face such difficulties, the behavioural sciences have a primary task to fulfil**: to find the *nudges* that will convince administrations to consider them** in public policy, such as is already the case in the United States and Great Britain.

[1] Oullier O., Kirman A. P. and Kelso J. A. S. (2008), "The coordination dynamics of economic decision-making: A multi-level approach to social neuroeconomics", *IEEE Transactions on Neural and Rehabilitation Systems Engineering*, 16(6), p. 557-571.

[2] See for example a ruling issued by the municipal council of Los Angeles, stipulating that if a person is absent from voting at the poll, his or her vote will be taken as "yes" by default: http://nudges.org/2010/03/11/at-the-los-angeles-city-council-yea-is-the-default-rule/ ; or the use of the social constraint that the behaviour of a neighbor constitutes in inciting people to go to the ballot boxes; http://nudges.org/neighborly-nudges-to-do-your-civic-duty/.

[3] http://nudges.org/2009/04/06/the-behavioral-science-behind-barack-obamas-fundraising-strategy/.

CHAPTER 4

Consumer neuroscience a new tool for prevention in public health

Olivier Oullier[1] and **Sarah Sauneron**[2]

As an extension of behavioural economics and social psychology, *neuroeconomics*[3] offers a better understanding of the neural dynamics underlying economic and financial decision making. This field of research gave rise to a sub-field: consumer neuroscience, which studies the actions that govern the daily life of *homo consommatus,* from his domestic practices to his purchase decisions, opening a hitherto new "window" on certain mental processes that come into play when making consumer decisions.

Thus, among the novel methods and theories explored by publicity and marketing specialists with the purpose of improving the effectiveness of their communication strategies, **consumer neuroscience have undergone an exponential growth.** In fact, while brain sciences do not constitute a miraculous formula making it possible to guarantee the optimal impact of a campaign as some claim, it constitutes nevertheless **a complementary methodology to the traditional tools used in communication**. In view of the development of consumer neuroscience and the unceasingly increasing use of behavioural and brain sciences by the private sector, it is advisable today to consider the use of this discipline for public health prevention strategies.

1. Inside the customer's head?

1.1. The appeal of neuroimaging should not hide its limitations

Consumer neuroscience only started to advance with true great strides at the end of the 1990s when neuroimaging methods were developed (and mediatised), especially **magnetic resonance imagering** (MRI). This technique makes it possible, in its anatomical version, to map the structures of the brain with precision. Its functional

[1] Scientific adviser, Department of Social Affairs, Centre for Strategic Analysis and Associate Professor of Neuroscience, Cognitive Psychology Laboratory (UMR 6146), University of Provence (France).
[2] Project manager, Department of Social Affairs, Centre for Strategic Analysis.
[3] Gironde S. (2008), *La Neuroeconomie: comment le cerveau gère mes intérêts (Neuroeconomics: how the brain manages my interests),* Paris, Plon ; Zweig J. (2007), *Your Money and your Brain*, New-York Simon & Schuters; Schmidt C. (2010), *Neuroéconomie: comment les neurosciences transforment l'analyse économique*, (*Neuroeconomics: how neuroscience transforms economic analysis)*, Paris, Odile Jacob.

variation, or fMRI, is aimed at estimating the variations of blood flow in brain areas. Whether or not carrying out a task is accompanied by a significant increase in the activity in certain cerebral parts can be deduced from this. However, the colouring of one area does not mean that the remainder of the brain is not functioning [1]. This only means that the part in question has reached the statistical threshold of change of activity in relation to a control condition, contrary to the others.

This technique is the best known today by the general public, in particular because it offers fancy 3D images which scientists, the media and the public love. But neuroscience are not limited to fMRI. For example, **positron emission tomography** (PET scan)[2] makes it possible to explore the pathway followed by certain substances in the brain with a high degree of spatial accuracy. **Electro-encephalography and magneto-encephalography**, EEG and MEG respectively, for their part record the activity of groups of neurons in the cerebral cortex with a lower spatial definition but a much better temporal resolution [3].

However, **the potential of cerebral imagery still encounters certain technical and methodological constraints**. It is thus advisable to combine these various tools (for example to carry out fMRI with EEG) to overcome their respective deficiencies and obtain a better spatial and temporal resolution [4]. Moreover, the lack of mobility and portability of the equipment confine the experiments to the laboratory [5]. This not only limits the ecological validity of the results but also the industrial use of these techniques.

Lastly, the extreme sensitivity of the data to the movement of the head makes it currently impossible to carry out a neuroimaging experiment without the consent of an individual. Total co-operation of the subject is necessary, with the need for obtaining the agreement of ethics committees, this being likely to reassure those who are concerned about the risks of "cerebral intrusion" or of "mind manipulation"[6].

It is possible to be freed from some of the constraints of neuroimagery **by focusing** not only on brain activity *per se* but also on **its peripheral manifestations**: the trajectory of a glance, eye movements, heartbeats, electrodermal response (also known as skin conductance measure) or changes in hormonal concentration thanks to saliva samples [7].

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[1] Actually, the brain as a whole functions all the time.

[2] This technique requires the injection of radioactive isotopes into the body.

[3] This resolution is in the order of a millisecond, which is much more realistic with regard to the transmission speed of neural messages than the half-second offered by fMRI for example.

[4] For a detailed presentation of the imagery and cerebral stimulation techniques within the framework of neuroeconomy experiments, see Charron S., Fuchs A. and Oullier O. (2008), "Exploring brain dynamics in neuroeconomics", *Revue d'Économie Politique*, n° 118, p. 97-124.

[5] And this despite the claims of certain self-proclaimed neuromarketing specialists who claim to record the cerebral activity of consumers in supermarket alleys. Admittedly, they obtain recordings by EEG in particular, but their data makes little sense because it is affected by a lot of "noise" from the electromagnetic environment (neon signs for example) and the movement of the customer.

[6] Experiments on humans (in particular cerebral imagery, but not only this) cannot be carried out in our country without prior agreement by a People Protection Committee (CPP) and of the French Agency for the Safety of Health Products (AFSSAPS). They are similar to local and national IRBs in the US for example.

[7] This technique was used on traders in the City of London to study and correlate their endocrine reactions with the volatility of the market and their financial decisions. Coates J. M. and Herbert J.

Another method for doing research on the central nervous system consists in **temporarily modifying the activity by administering hormones externally** (intravenous or nasal). The latter will be transported by the blood, to go and act upon specific receptors in the body, including the brain. For example, during experiments in neuroeconomics, oxytocin [1] diffused in the nose lead to a modification of the behaviour of an investor by making him more trustful [2] and more generous [3] towards a person with whom he was participating to an economic exchange.

Lastly, another way of modifying the functioning of the brain is to **excite or inhibit certain parts by electromagnetic impulses thanks to transcranial magnetic stimulation (TMS)**. This technique makes it possible to temporarily simulate the effects of cerebral lesions and constitutes an experimental version of neuropsychology that links brain leasions to behavioural changes.

However, these methods should not be interpreted in a reductive and deterministic way. If the functions of an area of the cortex are disturbed and a behavioural modification ensues, that does not mean therefore that this particular brain area is "responsible" for the altered behaviour. At the most, one can conclude that this portion of the brain plays a part within the complex network that underlies the aforementioned behaviour[4].

This constitutes the major challenge for work in functional connectivity, whose goal is to better understand how areas of the brain "communicate" among each other. As frequently stated in neuroscience books and talks "neurons that fire together wire together". Functional connectivity makes it possible to go beyond just locating areas of the brain and to better understand the complex dynamics of information exchanges within the brain.

1.2. Going beyond verbalisation to access emotions

Neuroimaging techniques have been employed not only to study the cerebral mechanisms taking part in visual, olfactive and gustatory perception, *etc.*, but also to try to **better understand the way in which consumers think, what influences them** and, more generally, how their brain responds to the environmental signals to which they are exposed[5]. One of the major contributions of behavioural sciences as regards public health prevention is to make it possible to take into account the cognitive and emotional biases that intervene in decision making. Indeed, **far from *homo œconomicus*, the "cold-calculator" whose choices are always optimal, *homo***

(2008), "Endogenous steroids and financial risk taking on a London trading floor", *Proceedings of the National Academy of Science of the United States of America*, 105, p. 6167-6172.

[1] Oxytocin is a nanopeptide formed in the hypothalamus and transported, and then stored, by the posthypophysis, which releases it into the blood stream. In particular produced by expectant mothers, it is often called the "love hormone".

[2] Kosfeld M., Heinrichs M., Zak P. J., Fischbacher U. and Fehr E. (2005), "Oxytocin increases trust in humans", *Nature*, 435, p. 673-676.

[3] Zak P. J., Stanton A. A. and Ahmadi S. (2007), "Oxytocin increases generosity in humans", *PLoS One*, 2, e1128.

[4] Camus M., Halelamien N., Plassmann H., Shimojo S., O'Doherty J., Camerer, C. *et al.* (2009), "Repetitive transcranial magnetic stimulation over the right dorsolateral prefrontal cortex decreases valuations during food choices", *European Journal of Neuroscience,* 30, p. 1980-1988.

[5] It is advisable however to clearly distinguish what one expects (both on an academic and industrial level) from the use of these techniques and from the information that they really provide. There is generally a great difference between the two.

consumerus **is the result of histories, emotions, desires, and constant interactions with his or her environment**.

Behaviours are the fruit of processes that take place below the threshold of conscious detection. If this were not the case, the brain would be overwhelmed by the amount of information received simultaneously from each sense. Rather than deal with this massive flow of data consciously, "attention focusing" makes it possible to "sort" and to concentrate on the environmental events that are the most important in regard to the task being accomplished or goals set. This treatment of sensory information from various sources (visual, auditive, tactile, gustatory, olfactive, proprioceptive or even semantic) which one does not notice, is no less essential. In fact, to ask people why they act in such a manner, or to try to predict their reactions, is a simplistic approach that often gives rise to unreliable or even erroneous data. **An individual does not have access to all the parameters and influences that determine his or her decisions** [1].

However, for years public institutions have called upon traditional marketing techniques[2] based on verbalisation and some forms of introspection (surveys, discussion groups, interviews), whereas specialists in the communication, such as Gerald Zaltman, agree in denouncing the limitations of these or even their obsolescence: "*The world has changed, but our methods for understanding consumers have not. We keep relying on familiar but ineffective research techniques and consequently misread consumers' actions and thoughts. The products we create based on those techniques simply aren't connecting with consumers"* [3].

As shown by Nisbett and Wilson in a seminal paper, when a person is asked, he or she will always tend to say more than what he or she actually does or know [4]. To explain this phenomenon, it has been proposed that all the information given regarding the determinants of his or her decisions is nothing but post-hoc **justifications and rationalizations** and is thus in fact distorted [5]. There is also a bias that consists in **wanting to present oneself in a favourable light to interlocutors: it is thus a case of "social desirability".**

Lastly, the formulation of the questions and the coding of the answers can influence the conclusions. Asking *"Does this image frighten you? If so at what point?*" or *"At what point does this image frighten you?*" is thus not equivalent, the second question making a negative answer more difficult.

All these arguments invite one to reconsider the traditional communications tools. From this point of view, **consumer neuroscience can help today to better understand the consumer by offering data that is sometimes less subjective than verbalisation and that allows a new form of quantification.**

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[1] And also, there always remains the possibility of lying, which many people do when answering surveys, in particular when they are accompanied and their true behaviour or reason is not in agreement with the dominant thought (social norm).
[2] These techniques generally result from experimental and social psychology.
[3] Zaltman G. (2003), *How Customers Think: Essential Insights into the Mind of the Market*, Harvard Business Press, Cambridge..
[4] Nisbett R. and Wilson T. (1977), "Telling more than we can know: Verbal reports on mental processes", *Psychological Review,* 84*,* p. 231-259.
[5] Bertrand M. and Mullainathan S. (2001), «Do people mean what they say? Implications for subjective survey data", *American Economic Review*, 91(2), p. 67-72.

1.3. The neuroscience of marketing versus the marketing of neuroscience

Many communication and marketing specialists, aware of the potential advantages of resorting to **neuroscience, have developed a private interest in them** [1]. **An industrial sector emerged: that known as "neuromarketing** ". Despite the prudence generally observed by scientists in regard to the effectiveness of this method [2], some media and marketing experts seized the subject, attributing exaggerated capacities to the neuroscience in "decoding the intentions of the consumer" [3].

The companies that offer this kind of services all over the world (more than a hundred today) contribute to this phenomenon by "overselling" their expertise. Many of these companies do not even have recourse to neuroscience but are recycling their traditional marketing speeches decorating them with some concepts – often erroneous – of neuroscience.

Moreover, **the image of a brain gives the illusion of understanding of its functioning both for the specialist and for the layman**. The "neuro" affixed before "marketing" has thus become a modern version of "scientifically tested" that is put on products for them to sell better. This impact has been experimentally tested in two studies in experimental psychology during which more or less extravagant facts were presented, supported (or not) either by cerebral images [4], or by neuroscientific explanations [5]. In both cases, "playing the neuroscience card" proved to be a paying strategy because the subjects (including some having a background in cognitive neuroscience) were convinced when the image of the brain or the scientific explanation accompanied the remarks; a phenomenon qualified by some as *" explanatory neurophilia "*[6] thanks to the "aura of the brain ". Some professionals did not hesitate to "use this trick" and "market neuromarketing" in their turn![7]

It is thus appropriate to **differentiate between private sector neuromarketing and its promises and consumer neuroscience that are a rigorous and careful scientific academic field.** This point is not trivial. It may prove to be harmful for academic research if neuroscience are perceived by public opinion as just neuromarketing, one of its mediatic variations, often promoted without reserve by certain industrialists. The subject is sensitive and has been discussed on several occasions at the French Parliament within the framework of the preparation for the bioethical law revision[8].

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[1] Zaltman G. (2003), "How customers think: Essential insights into the mind of the market", *Harvard Business School Press.*

[2] Oullier O. (2003), "Le neuromarketing est-il l'avenir de la publicité ?" "Is neuromarketing the future of publicity?", *Le Monde*, edition of October 25th ; Valo M. (2009), "Les neurosciences au secours de la pub" "Neuroscience to the rescue of advertising", *Le Monde 2*, edition of March 28th.

[3] In particular see Lindstrom M. (2008), "Buyology: Truth and lies about why we buy*"*, *Broadway Business.*

[4] McCabe D. P. et Castel A. D. (2008), "Seeing is believing: The effect of brain images on judgments of scientific reasoning", *Cognition*, 107(1), p. 343-352.

[5] Weisberg D. S., Keil F. C., Goodstein J., Rawson, E. and Gray J. R. (2008), "The seductive allure of neuroscience explanations", *Journal of Cognitive Neuroscience*, 20(3), p. 470-477.

[6] Trout J. D. (2008), "Seduction without cause: Uncovering explanatory neurophilia", *Trends in Cognitive Science*, 12, p. 281-282.

[7] Oullier, O. (2008), "Neuroéconomie et neuroéthique", "Neuroeconomics and neuroethics", *in* A. Claeys and J.-S. Vialatte (editors), *La loi bioéthique de demain (Tomorrow's bioethics law),* volume 2 Paris, National Assembly, p. 196-202.

[8] Hearing of March 26th, 2008 by the Parliamentary Office of the scientific and technological choices: www.assemblee-nationale.fr/13/rap-off/i1325-tII.asp#P1263_431843 and hearing of

2. Reconsidering public health prevention in the light of "emorationality" [1]

2.1. Theoretical progress: towards an "emorational" model of decision making

Among the recent contributions of neuroscience to the understanding of economic behaviour, the results show that the **dichotomy traditionally established between emotion and rationality is not as distinct** at the neurobiological level as it can be found in philosophy, psychology or moral cognition.

This result has been put forward by coupling neuroscientific experiments with game theory and in particular with that of the so-called "ultimatum game". This experiment, which is well known in experimental economics, consists in giving an individual A (the proposer) an amount of money and asking him to share it with another individual B (the receiver) who he does not know. The rule is the following: if B accepts the division, A and B each gain their respective share of the money as proposed by A; if, on the other hand, B refuses the offer, A and B will leave without anything.

Generally, if A offers less than 25% of the capital, B does not accept the division. This result goes against the "homo œconomicus" model. If the latter were true, B should accept any offer, however negligible, since it would always be better than receiving nothing. This experiment has been conducted hundreds of times throughout the world with the most varied social groups. The reported result has appeared consistently, even when the equivalent of several months of wages has been at stake [2].

Refusal by B would tend to show that his emotions took precedence over a purely rational and utilitarian computation of gain. This assumption seems to be confirmed by an experiment using functional MRI, which shows that the variations in the insula[3], which belongs to a part of the brain often referred to as "emotional", make it possible to know whether B will accept a non-equitable offer or not. However, if the functioning of another part of the brain (the right prefrontal dorsolateral cortex), which is involved in "reason", is inhibited by repetitive transcranial magnetic stimulation (rTMS), B accepts lower offers (normally refused due to emotion). And this despite that his judgment of the equity of the offer has not changed [4].

This counter-intuitive result, that is, that of the dysfunction of a brain known as "rational", which economically speaking involves a more rational behaviour, indicates that **the opposition between emotion and rationality "does not hold" on the**

September 22nd, 2009 by the parliamentary mission for the preparation of the bioethical law revisions: www.assemblee-nationale.fr/13/rap-info/i2235-t2.asp#P8198_3647635.

[1] In neuroscience, to our knowledge the term "emorationality'" was first coined in Oullier O. (2010), «The useful brain: Why neuroeconomics might change our views on rationality and a couple of other things", *in* E. Michel-Kerjan and P. Slovic (eds), *The Irrational Economist: Making decisions in a dangerous world*, New York: Public Affairs, p. 88-96.

[2] Camerer C. F. (2003), *Behavioral Game Theory: Experiments in strategic interaction*, Princeton, Princeton University Press.

[3] Sanfey A. G., Rilling J. K., Aronson J. A., Nystrom L. E. and Cohen J. D. (2003), "The neural basis of economic decision-making in the Ultimatum Game", *Science*, 300(5626), p. 1755-1758.

[4] Knoch D., Pascual-Leone A., Meyer K., Treyer V. and Fehr E. (2006), "Diminishing reciprocal fairness by disrupting the right prefrontal cortex", *Science*, 314(5800), p. 829-832.

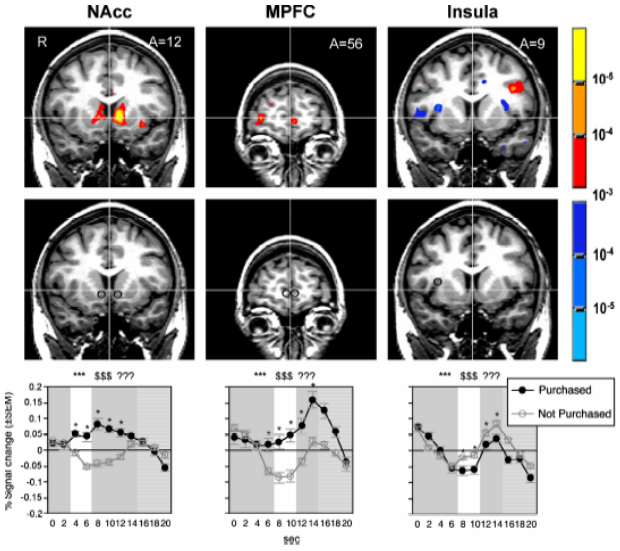
neurobiological level [1]. The parts of the brain involved are connected by dense and complex networks and function in a largely interdependent way. **The brain would function in a hybrid way, that is to say, with a sort of "emorationality"**[2]. In other words, reason and emotions need each other in order to exist and function.

2.2. Practical progress for public health prevention?

Consumer neuroscience makes it possible to obtain **new data with high application potential, in particular with respect to prevention** (see Parts 2 and 3 of the present book). Brain sciences have progressed a lot in their understanding of decision mechanisms over these past fifteen years. Thus, a hurdle was recently overcome thanks to the work of a research team from Stanford University[3]. In an experiment, subjects, placed in a context close to that of online shopping, could purchase (or not) products displayed on a screen. Researchers succeeded in "predicting" subsequent purchase decisions[4], thanks to fMRI and to co-variations of brain activity observed in a particular cerebral network (*Figure n°3*).

Figure n°3

Simultaneous changes in the activity of three areas of the brain make it possible to predict the purchase decision



Source : Knutson et al. (2007) Neuron - Cell Press©

[1] It is necessary to specify in this paragraph the qualities of a "rational" brain, " emotions" and/or "reason" are simplifications and inaccurate reductions from a scientific point of view of which the only goal is to not confuse (too much) the reader who is not familiar with neuroscience.

[2] The term "emorationality'" in the neuroscience was first coined in Oullier O. (2010), «The useful brain: Why neuroeconomics might change our views on rationality and a couple of other things", *in* E. Michel-Kerjan and P. Slovic (eds), *The Irrational Economist: Making decisions in a dangerous world*, New York: Public Affairs, p. 88-96.

[3] Knutson B., Rick S., Wirnmer G. E., Prelec D. and Loewenstein G. (2007), "Neural predictors of purchases", *Neuron*, 53, p. 147-156.

[4] Let it be noted that at the same time, Omnicom, a world leader in communication, turned to neuroscience. Source: Girard L. (2007), "Les publicitaires s'intéressent à notre cerveau" ("Advertising executives are interested in our brain"), *Le Monde*, March 28th edition.

Box n°5
Towards mind reading?

Data that make it possible "to predict" whether a person will buy or consume, is brought closer to recent work on what the general public knows by the name of **"mind reading"** or **"thought decoding"**[1].

Recent German and American work has paved the way, following many repetitions, to neurologically decode partially whether a person is looking at an image of a dog or that of a house. To arrive at this result, many repetitions of the same images are shown to a person to then try to extract a recurring cerebral activity pattern from the MRI data, which would be specific to each. Then, the experimenter and/or an algorithm tries to determine, with a double blind system, the reappearance of the one of these patterns: when it is the case, it will deduce the nature of the image presented.

The most recent progress in this field was made by American researchers who, after having flashed a thousand different images on two subjects in a brain imaging scanner, afterwards showed them visually different images representing the same type of objects. The algorithm that allowed for analyzing the patterns of brain activity succeeded in recognizing whether the person is seeing a dog, a balloon or another image with a high rate of recognition[2].

This result was not possible a few years ago. However promising, it remains quite limited as the experiments relate only to the decoding of a state of sensory perception, far from the matter of memories, intentions and intimacy[3].

This result constitutes notable progress and opens the way for new research (*Box n° 5*). For example, in relation to work on the trademarks, this could make it possible to better understand the circumstances that lead certain people to refuse to buy generic medicines. An experimental track is currently exploring.

As another example, recent studies showed how environmental factors may bias sensory perception during food intake. Thus, Samuel McClure and his team from Baylor College of Medicine in Houston showed that preference for two sodas of relatively equivalent chemical composition but of different makes, was not translated just into a sensory perception on the cerebral level[4]. Simply by seeing the make of the drink that is the leader on the worldwide market, researchers noted a higher activation of the hippocampus, an area of the brain related to memorizing and emotional biases.

Another experiment undertaken by Hilke Plassmann of the INSEAD consisted in making people placed in an MRI scanner taste the same wine though the price shown

[1] Haynes J.-D. and Rees G. (2006), "Deconding mental states from brain activity in humans", *Nature Reviews Neuroscience*, 7, p. 523-534
[2] Nay K. NR. and Gallant J.L. (2009), "I can see what you see", *Natural Neuroscience*, 12, p. 245-246.
[3] It is possible to determine for example how a flavour will "trigger" the reward cycle but not the origin of the taste for the same.
[4] McClure S. M., Li J., Tomlin D., Cypert K. S., Montague L. M. and Montague P. R. (2004), "Neural correlates of behavioral preference for culturally familiar drinks", *Neuron*, 44, p. 379-387.

on it varied [1]. Thus, as had already been observed before in various contexts, consumers declared that they preferred the expensive wine. More astonishing, this declared preference was positively correlated to the activity of the orbitofrontal cortex, which is part of the secondary gustatory brain, among other functions.

These two examples show to what extent the information contained in an advertisement or those given by the price of a food product may modify the appreciation of its taste. They are thus of unquestionable interest for public health prevention and the development of campaigns against obesity, in particular for promoting a balanced diet.

2.3. Towards social consumer neuroscience

Consumer neuroscience are being developed today mainly around the themes of decision making and the underlying cerebral processes. However, **the importance of the social context is also considered**.

This work opens the way for social cognitive neuroscience whose goal is to better understand how individuals interact, and how their body and brain dynamics evolve according to the exchanges between them [2].

Recent progress regarding the **mirror function of the brain**, that is to say, the fact that some of its areas are activated in similar ways whether one is experiencing an emotion, or whether one is observing somebody living this emotion, are of an high interest [3]. Indeed, **the question of confidence and mutual understanding lies at the centre of interpersonal relationships.** In prevention, such data could help to understand and favour patient-doctor interactions, salesman-consumer interactions or public authorities-population interactions.

More largely, research in social cognitive neuroscience covers **cerebral correlates of empathy, confidence, co-operation or altruism**. These topics have not yet been exploited, either on a private level or on a public policy level. However, to grasp the decision making mechanisms in a social context could bring new elements, for example the question of knowing how to favour organ donation, or even how to go about counselling or accompanying patients.

Lastly, work on moral cognition would be likely to **better define the cognitive constraints and functioning of the brain in view of social norms** [4].

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[1] Plassmann H., O'Doherty J., Shiv B. and Rangel A. (2008), "Marketing actions can modulate neural representations of experienced pleasantness", *Proceedings of the NationalAcademy of Sciences of the United States of America*, 105, p. 1050-1054.

[2] Oullier O. and Basso F. (2010), "Embodied economics: How bodily information shapes the social coordination dynamics of decision making", *Philosophical Transactions of the Royal Society, B: Biological Sciences*, 365, p. 291-301.

[3] Wicker B., Keysers C., Plailly J., Royet J. P., Gallese V. and Rizzolatti G. (2003), "Both of us disgusted in My insula: The common neural basis of seeing and feeling disgust", *Neuron*, 40, p. 655-664.

[4] Tassy S., Oullier O. and Wicker B. (2007), "Beyond the classical nature dual nature of moral behavior", *Science*, e-letter, 13 août ; Tassy S., Oullier O., Cermolacce M. and Wicker B. (2009), "Don't psychopathic patients use their DLPFC when making decisions in moral dilemmas?», *Molecular Psychiatry*, 14, p. 908-909.

* * *

For years public institutions have called upon communication specialists who mostly use traditional marketing techniques based on verbalisation (surveys, discussion groups, interviews). The results of the interviews carried out are thus exposed to the biases of this methodology. Neuroscience can supplement this work today by making it possible to have, to a certain extent, better access to the emotional component of consumer behaviour. However, the work of neuroscience towards constituting a significant contribution must be carried out jointly with rigorous behavioural experiments, as the study of the isolated brain would be use. What also needs to be kept in mind is that one cannot read minds, all that is possible at the moment is "mindguessing" based on several tools that allow to estimate brain activity and to interpret it -but not to record it directly as claimed too often.

These possibilities offered by brain sciences must not make us forget the ethical stakes [1] involved in the prevention strategies. It is a question of evaluating well the risks of drifting from inciting prevention into intrusive and constraining measures, which would prove to be incompatible with democratic principles.

[1] Sauneron S. (2009), «Impacts des neurosciences: quels enjeux éthiques pour quelles régulations ?" ("Impact of neuroscience: what ethical stakes for which regulations?", *La Note de veille*, n° 128, Centre for Strategic Analysis, March 2009 ; www.strategie.gouv.fr/article.php3?id_article=948.

CHAPTER 5

Effectiveness of the prevention campaigns: evaluation by cognitive sciences

Dorothée Rieu[1]

Over the past few years, advertisers have expressed increased interest in "cognitive" tools to assess the effectiveness of their communication campaigns. Ideally, they would like to have access to the black box that is the brain, or in other words, to know precisely how the response to a stimulus is formed, with a "*behaviourist approach*". To have a better understanding of mental, cognitive functions, when advertising are processed by the human brain, the contribution of cognitive sciences[2] is paramount, offering both knowledge and technologies that are "transferable" out of the laboratories. Indeed, the knowledge resulting from research in Cognitive Sciences makes it possible to better understand and assess the reaction of a person confronted with an advertising message and to determine the solutions likely to improve its effectiveness. Moreover, technologies and the scientific tools resulting from research can be used in the marketing studies sector and be adapted to more standardized tools, such as advertising effectiveness tests.

In view of the often mitigated outcome of public health prevention campaigns and the observation that the results are not always on a par with the announced objectives and the authorized investments, these could benefit from the cognitive science research contributions.

1. Good communication: a balance between attention, memory and emotion

1.1. Establishing a footbridge between cognitive science research and the world of communication

When an individual is exposed to an advertising message, **many cognitive components are involved.** The latter are very intricate, embedded, which can be observed at the cerebral level in the form of an inter-connected neural network.

[1] Founder and C.E.O. of Mediamento.

[2] Cognitive sciences are defined as a collection of scientific disciplines aimed at the study and understanding of the mechanisms of human, animal or artificial thought, and more generally of any cognitive system, that is to say, any complex data processing system capable of acquiring, preserving, and transmitting knowledge. They are thus based on the study and modelling of phenomena as varied as perception, intelligence, language, calculation, reasoning or even conscience. As an interdisciplinary field, cognitive sciences jointly use data resulting from linguistics, anthropology, psychology, neuroscience, philosophy and artificial intelligence.

For example, given a poster, the sensory organ (the eye), enters into action. In a way that may be sequential or not, various cerebral and cognitive activities intervene next: **initially perception, then attention**. Thus, "I see before I look at ", because to look implies that attention is focused on various elements.

Some of these elements may **then be stored in memory or may not**. Two types of memory systems may be involved: on the one hand, episodic memory, which relates to personal events and episodes that we "remember", on the other hand, semantic memory, which relates to public events that we "know", conceptual and encyclopaedic knowledge, that makes it possible to understand the advertising message.

Lastly, when one is exposed to this poster, **emotions may be generated or felt.** It remains difficult to measure the emotional component, since it often occurs in an unconscious way. It is thus complicated to ask interviewed people if they feel concerned or touched or if they adhere to the message, simply by declaring it, i.e. explicitly and consciously answering the question.

This above-described schematization of the cognitive components thus implies that **improving the effectiveness and impact of an advertising message** must necessarily take into account **visual and/or auditive perception**, **attention**, **comprehension**, **memory and the emotion caused.**

1.2. Attention and memory, a complex relationship

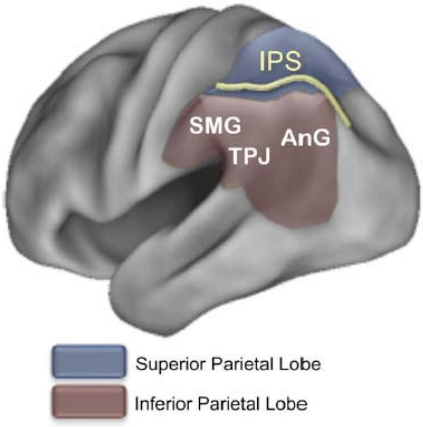
Scientific literature has highlighted two attention systems. The first, called " *top-down* ", is cerebrally localized in the dorso-fronto-parietal system (or "dorsal stream"). **It is endogenous and goal-directed: it is assimilated as voluntary attention**.

The second, "*bottom-up* ", starts with the stimuli and then addresses the superior areas of the brain, by means of the ventro-fronto-temporo-parietal system, which is simply called the "ventral stream" (*Figure n°4*). **This exogenous system is involved in the automatic capture of attention by salient and unexpected sensory stimuli (stimuli-driven system): it is thus an involuntary attention**.

The relationship between attention and memory has been described by Melina Uncapher and Anthony Wagner[1]. These authors showed that the activation of the "dorsal stream" during the memory encoding is associated with later memory success, contrary to the case of the "ventral stream" activation which is associated with later memory failure. The authors suggest that **the "ventral stream" mechanisms appear to reflect an attentional** shift **from to-be-encoded information to memory-irrelevant information, thus resulting in negative subsequent memory.**

[1] Uncapher M. R. and Wagner A. D. (2009), "Posterior parietal cortex and episodic encoding: Insights from fMRI subsequent effects and dual-attention theory", *Neurobiology of Learning and Memory*, vol. 91(2), p. 139-154.

Figure n°4 : **Posterior parietal anatomy**



Source : Uncapher and Wagner (2009) Neurobiology of Learning and Memory – Elsevier©

Moreover, any human being exposed to several hundreds of advertisements every day, does not inevitably– *and fortunately* – pay attention to all this environment stimulation (named by marketers "ambient advertising"). **Forgetting is necessary for the brain**. In this context, **the attentional resources allocated to the messages to be memorized are essential**: if attention is divided, for example when a car-driver is simultaneously listening to the radio, the memorizing of the message will be less.

1.3. Good communication in prevention: the right proportion of emotion

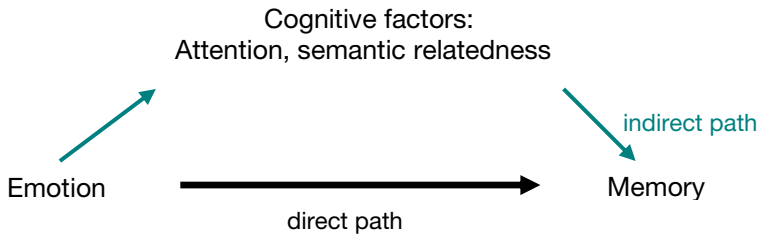
Research in psychology and neuroscience shows that emotionally arousing words, pictures, events and stories **are often remembered better than neutral items** (that is to say, both better recalled and better recognized). This phenomenon, called EEM by researchers, for " *Emotionally Enhanced Memory* "[1,2], can induce prolonged effects because of the influence of emotion on modulating neurobiological processes involved in the consolidation of the memory traces (amygdala, a cerebral structure largely involved in emotional and memory processing, is activated during this consolidation processes).

However, other research studies highlight the role of attention and semantic relatedness, largely involved as well as mediators in this EEM mechanism[3]. In other words, effects of the emotion on the memory would also be indirect *through* intermediate mediation mechanisms, which are the "increased" attention (emotional items are more attended, attractive) and "solidified" relatedness (emotional items are more semantically interrelated) (*Figure n°5).*

Within the framework of pulic health prevention campaigns, **the goal is above all for the message to be remembered, understood and followed by behavioural effects**, and not for only the emotion conveyed by the message and its setting to be memorized.

[1] Cahill L. and McGaugh J. L. (1995), "A novel demonstration of enhanced memory associated with emotional arousal", *Consciousness and Cognition,* vol. 4, p. 410–421.
[2] Dolan R. J. (2002), "Emotion, cognition, and behavior", *Science*, 298, p. 1191–1194.
[3] Talmi D., Schimmack U., Patterson T. and Moscovitch M. (2007), "The role of attention and relatedness in emotionally enhanced memory", *Emotion,* vol. 7, p. 89-102.

Figure n°5 : **Cognitive mediation mechanisms as an explanation of the EEM phenomena**



Source : Adapted from Talmi et al. (2007), Emotion – The American Psychological Association©

Two opposite theories exist in the literature regarding the balance between memory impact and emotional impact. First of all, some authors suggest that messages with high "sensation value" brings increased attention, leading to higher ad memory impact. On the contrary, a second theory establishes that **the emotional intensity competes with the ad's message to be memorized.** In this sense, a study published in 2009[1] showed that prevention message, PSA (Public Service Announcement) with high emotional value, grab more the attention, but were finally less recognized, whereas prevention messages with low emotional value were better recognized.

The two contradictory assumptions could actually prove to be correct. Recent articles show that the cognitive-emotional interactions are centralized in areas of the brain with a very high degree of connectivity[2,3]. Thus, the relationship between emotion and cognition could just as easily result in enhanced or altered executive functions and memory. From this point of view, it appears necessary that **the emotion conveyed by the prevention message be *just in the middle*** between shocking pictures or words and suitable semantics for the target population, so that it is identified and recognized.

2. Assessment of communication campaigns thanks to cognitive sciences

2.1. Importance of cognitive techniques in measuring attention and memory

While focusing on the most involved and most relevant cognitive components, it is possible to establish a "diagnosis" of the advertising effectiveness. Thus, any evaluation must **couple attention measure and memory measure**. In order to decipher attentional processes, **the *eyetracking* technique**, or measure of ocular movements, makes it possible to determine the scan path of the eye gaze, where it is fixed, for how long, and in which order and thus *finally* to **which elements visual attention is paid**. For this purpose, the *eyetracker* screen has infra-red light emitting diodes that detect the movement of the pupil of each eye in a non-invasive way.

[1] Langleben *et al.* (2009). "Reduced prefrontal and temporal processing and recall of high sensation value ads", *NeuroImage*, 46, p. 219-225.
[2] Pessoa L. (2008), "On the relationship between emotion and cognition", *Nature Reviews Neuroscience*, Feb(9), p. 148-158.
[3] Pessoa L. (2009), "How do emotion and motivation direct executive control ?", *Trends in Cognitive Sciences*, vol. 13(4), p. 160-166.

Moreover, to evaluate **how much elements** of an advertising message **are stored in memory**, as well as the generated emotion, specific **questionnaires gathering explicit and implicit measures could be worked out**.

Especially, but not just, in the field of prevention messages, which mixe emotion (evoking dangers) and understanding (recommendations regarding behaviours to be adopted), the method known as interview in the "declarative mode" is not sufficient. Indeed, there exists always a difference between what some say they have memorized, have liked or have understood, and what they really memorized, liked, or understood… It is on the other hand possible to evaluate what was really retained by the people exposed to the message, by means of "diverted" questions and peripheric measures.

2.2. Examples of health campaign assessment

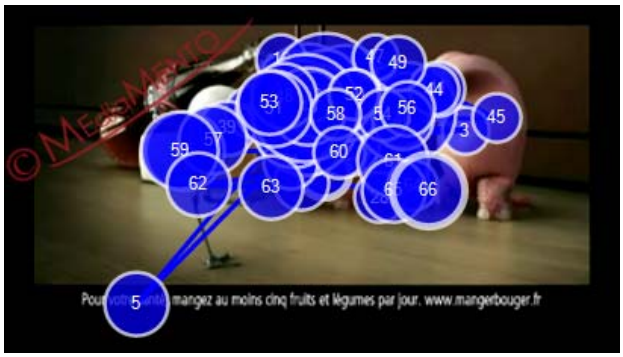
Work completed by the Mediamento institute in September 2008 attempted to measure the impact of health messages on the bottom of visual advertising messages (poster or TV spot) for sweetened or fatty food. The study related to six advertising TV spots of sweetened drinks of which three had a health message, like: *"For your health, eat at least five fresh fruits or vegetables per day"*.

Tools for data analysis in *eyetracking* make it possible to draw areas of interest, in order to compare the impact of these areas according to the ocular movements of participants. In this study, two areas vave been split inside the TV spot: the advertising area and that of the health message text (on the lower part of the screen).

As expected, for all the participants studied, their attention was definitely focused more on the first area (ad) than on the second (health text), as well in terms of number of gaze fixations, as in terms of duration of gaze fixation. It was showed (*Figure n°6)* that **some participants never fix their gaze on the health messages (for none of the three spots), while others look at them briefly but without really giving them attention.**

Figure n°6 : Example of gaze plot in eyetracking study for one participant, showing one a the spots TV.

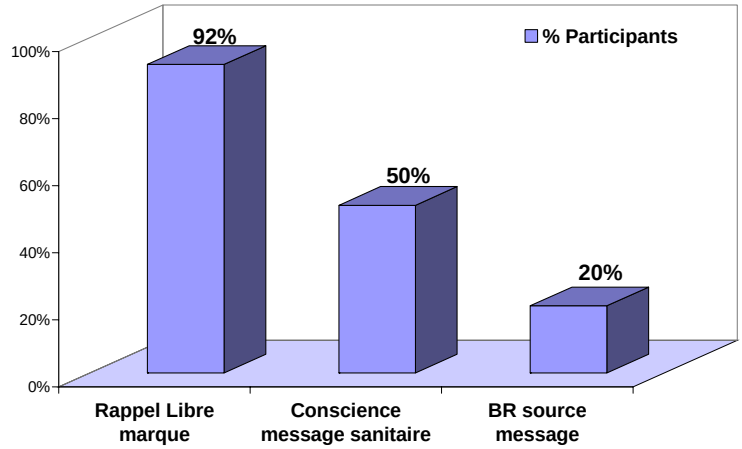
Reading: each circle represents the location where the participant has fixed his attention. The number indicates the order of his ocular fixations during the video spot, and the diameter of each circle is correlated with the fixation duration. On this recording, the participant has looked at the health message only one time (n° fixation 5).



Source : Mediamento©

A questionnaire was then submitted to the participants of the study. The results (*Figure n°7*) showed that 92 % of the participants could recollect the six brands of the products visualized (free recall). However, only 50 % were awareness of having seen the health messages at the bottom of the advertising spot and only **20 % were able to recall which spots presented one**.

Figure n°7 : Results for health and ad messages memory test (Rappel libre: free recall ; Conscience message sanitaire: awareness of the health message ; BR: good response in regard to the source of the message)



Source : Mediamento©

These results leads person in charge of this study to assume that at the date of the study (*September 2008),* the health messages were already largely learned and known by the french televiewers (since 2007). We conclude that in fact, **as recurring and familiar elements**, **these health messages do not attract anymore the attention of the televiewers**, because these messages are categorized by the brain as non-relevant in terms of novelty. One of the recommendations of this study would be to change the text overlay of the health messages into a dynamic design, in order to provoke more attractiveness and so more effectiveness (coloured forms, animated cues, and varied content would engage more attention of televiewers).

On the Internet, this capacity to obliterate elements that have already been detected before and are thus known is called " *banner blindness*" (that is, "blindness to the advertising banner"). Thus, there is a kind of cognitive learning that enable to detect the areas on an Internet site where advertising is usually placed in order to not be constrained in reading the contents of the site. This attentional filter makes it possible for our eye gaze to avoid certain advertising areas that may appear and feel intrusive.

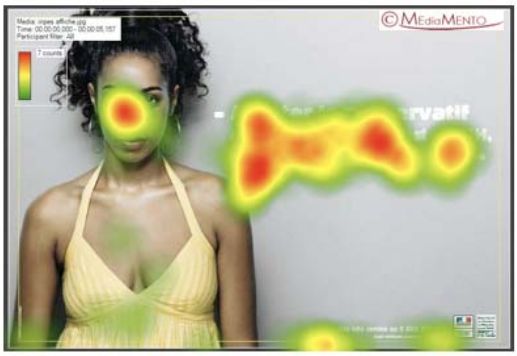
Another example, an INPES poster *"Stopping the use of the condom before having had an HIV test: don't even consider it"* was the subject of an *eyetracking* study run by the Mediamento Institute in 2008.

Heat maps were established showing the places where the visual attention of the participants was attracted most in terms of duration and number of times that they fixed their gaze on the poster. These tests show that the gaze of the participants was indeed attracted by the visual images but also by the text: all the participants have read the written message (*Figures n°8 and n°9*). And more important, taking into

consideration the number of ocular fixations and their duration, one can assume that the message was well memorized.

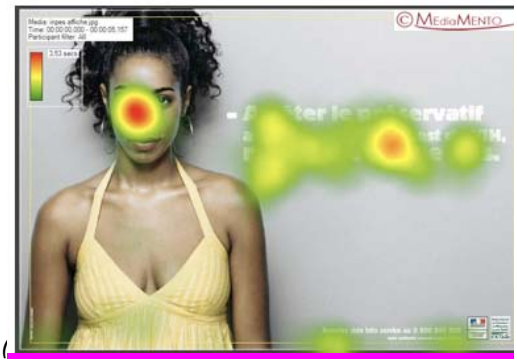
The results of the study also show that time between the appearance of the poster on the *eyetracker* screen and the first time the gaze of the participants was fixed on the text area is often smaller than for others areas, which suggests that the text catches their attention quickly, and thus that the INPES message was indeed transmitted.
One can thus conclude that this campaign was well designed from the point of view of the balance between the emotion and the attention generated.

Figure n°8 : Eyetracking heatmap of fixation count for an INPES posting campaign
Reading: the red areas show particularly high focus of attention



Source: Mediamento©

Figure n°9: Eyetracking heatmap of fixation duration for an INPES posting campaign
Reading: : the red areas show particularly longer focus of attention



Source : Mediamento©

* * *

Thus, a good message is judged by two main criteria: its capacity to draw attention and its capacity to be memorized. Cognitive theories put forward the importance of emotions. Moreover, methods in Cognitive Sciences offer a technological potential that can be mobilized for public health communication campaign assessment purposes.

PART 2

Fighting toxic substances with efficient packaging

The harmfulness of tobacco and the chemical substances contained in certain household products has been recognised for a long time. However, every year these toxic substances are important sources of public health problems.

On the one hand, tobacco has remained the leading cause of avoidable mortality in France, with 66,000 deaths per year. One regular smoker in two dies prematurely from the consequences of their smoking, with 50 % before the age of 65[1]. Tobacco is responsible for over 33 % of cancers in men and 10 % in women. In addition, passive smoking kills 3,000 to 5,000 non-smokers every year, with two thirds succumbing to cardiovascular illnesses. Even though these figures are known to the majority of the public, nearly 50 % of people aged between 18 and 34 years old still smoke today, notably due to the addictive character of nicotine.

On the other hand, poisoning by household products is accidental in over 80 % of cases[2]. In 2008, the Poisons and Toxicity Monitoring Centres in France counted 200,000 cases of human exposure to a toxic substance, with 'half due to medicines or domestic products', according to Dr Antoine Villa, a toxicologist at the Paris Poisons Centre. *"In almost one out of two cases, they concern children from 1 to 4 years old"*, whose desire to explore their familiar environment by putting objects in their mouth is well known. However, these accidents do not spare adults, who can confuse products in similar packages.

Both these public health problems, with very different causes and consequences, have the common factor of a frequency that requires unceasing renewal of preventive measures. Classic preventive strategies, using information campaigns, awareness programmes and actions on the ground have developed over the years. The National Public Health Institute (INPES - Institut National de Prévention en Santé Publique) is thus a major actor that is notably committed to the fight against smoking (*Chapter 6*). Moreover, preventive models developed directly on the packaging of the products concerned are offered as a complement to get closer to consumers. These classic strategies could benefit from improvement due to new scientific data, whether in the fight against smoking (*Chapter 7*) or the prevention of domestic poisoning (*Chapter 8*).

[1] Source: OFDT.
[2] Source: Educnet.

CHAPTER 6

The National Institute for Health Prevention and Education (INPES), a leading institution in the fight against smoking

Aurélie Martzel[1] and Jean-Louis Wilquin[2]

INPES (The National Institute for Health Prevention and Education)[3] is a public establishment supervised by the Ministry of Health and Sports. Within the public health guidelines defined by the ministry its activity is divided into twelve programmes, including dependencies/addictions (tobacco, alcohol, drugs) but also AIDS, nutrition, chronic diseases and domestic accidents. Tobacco represents an important part of this activity in both financial and human resources terms. The emphasis placed on this problem is explained by the fact that it is the leading cause of avoidable mortality in France, with 60,000 deaths every year, including 3,000 to 5,000 linked to second-hand smoking. Even if the prevalence has markedly declined in recent years, it is still 30 %[4], which remains significantly greater than the figures recorded in comparable countries.

Faced with the size of the problem, INPES undertakes communication campaigns which are a vector for the fight among others, and which must be evaluated and optimised by performing pre and post-tests.

1. Smoking prevention campaigns

The INPES strategy for fighting tobacco is based on social norms. This means making tobacco a socially unacceptable product. More and more offensive, the campaigns stigmatise the product, the behaviour and the industry. The tone has hardened and the risks are explicitly denounced.

INPES particularly emphasises three themes: **it denounces the risk of active smoking, the risks of passive smoking and finally the manipulative behaviour of the tobacco industry.** All the countries that are actively fighting smoking have adopted the same themes, which have demonstrated their effectiveness.

In 2002, INPES launched a first campaign marking a turn towards a more aggressive tone. Entitled *'Revelation'*, it set out the list of toxic components in cigarette smoke.

[1] Head of the communication department of the 'Institut National de Prévention et d'Education pour la Santé' (INPES ~ National Institute for Health Education and Prevention).
[2] Project manager for tobacco at the Institut National de Prévention et d'Education pour la Santé.
[3] www.inpes-sante.fr
[4] 29.9 % of 12-75 year olds; Health Barometer 2005.

One Sunday evening at 2030 this message was broadcast: *'Advice to consumers: Traces of hydrogen cyanide, mercury, acetone and ammonia have been discovered in an everyday consumer product. To find out more call free on 0800 404 404'*. That evening, INPES received over a million calls.

In 2004, another campaign, called '*The burn*', aimed to transmit the message that each cigarette did harm. Finally, a recent campaign emphasised this statistic: one smoker in two dies of tobacco (*Box n°6*).

Box n°6

Combating smoking, the new INPES communication campaign

On the occasion of the World No Tobacco Day (WNTD) of 31 May 2009, INPES launched, in collaboration with the Ministry of Health and Sports, a new communication campaign against smoking. The strategy employed consists in putting the accent on a particularly striking statistic: '**A smoker has 1 chance in 2 of dying from tobacco'.** The advertisement and the TV spot compare improbable risks that are often feared, like being eaten by a shark, and the much more real risk linked to active smoking. In parallel the campaign promotes help in stopping smoking by passing on the new **Tobacco Info Service** number, **3989**, and publishing a practical guide, *J'arrête de fumer (~I stop smoking)*, distributed in certain strategic locations. This campaign aims to make smokers aware of the nearness and importance of smoking related risks while offering solutions.

"A man has one chance in 650 million of being eaten by a shark"

As far as manipulation by the industry is concerned, two campaigns have been broadcast. The first, *'ToxicCorp'*, dates from 2006, and the second, '*Ne laissez pas le tabac décider pour vous'(~Don't let tobacco decide for you)* from 2008. *ToxicCorp* showed young people visiting a factory where they were encouraged to smoke with the message: "the tobacco industry recruits young smokers to replace dead smokers". The second showed a man personifying the tobacco industry, who was taking control of young people and making them light a cigarette.

As far as the campaigns on the risks of passive smoking are concerned, these allow themselves to be addressed to both smokers and non-smokers (*Figure n°10*). The *'Les tas de cigarettes' (~The piles of cigarettes)* campaign notably showed a little girl exposed to her parents' smoking and to the thousands of cigarettes consumed in the family environment. In 2006, at the time when smoking in public places was forbidden, a second campaign *('Les années 70'(~The 1970s))* recalled the time when tobacco was considered a normal product.

The communication programme aimed at the general public includes several themes, because the smoking group is not monolithic. Consequently certain actions particularly target young people, or pregnant women, others concern stopping smoking before an operation.

Figure n°10: **Example of an INPES campaign against passive smoking (2005)**

Source: INPES

Translation: (left) "Here a non smoker has smoked 14,757 cigarettes", (right) "Here a non smoker has already smoked 19,540 cigarettes" and (both) when you smoke beside a non-smoker he or she smokes too

These different campaigns have allowed:

- tobacco to be made a public health priority in the eyes of the general public, the media and health professionals;
- action on knowledge in terms of risks and product composition;
- modification of perceptions of the smoker and the industry;
- the acceptability of legislative change to be facilitated.

On this last point, a synergy has been set up, with the campaigns legitimating the legislative changes and vice versa. Beyond these campaigns, more general programmes have been set up, like the 'Tabac Info Service' line, that responds to smokers to help them stop. In parallel, calls for projects and training for doctors have been launched to mobilise health professionals and associations. Finally, legislative change has allowed the creation of a favourable environment: price increases, smoking prohibited in public places, sales to minors forbidden, the appearance of health warnings on cigarette packets.

Whereas 60 % of the French population smoked in the 1960s, this figure has fallen to 30 % today, a proof of the effectiveness of prevention.

2. The other vectors in the fight against smoking

Communication is only one of the vectors mobilised to reduce the consumption of tobacco, and it is difficult to isolate the contribution or each one. From a questionnaire sent to correspondents of the *European Network for Smoking*

Prevention (ENSP)[1] in 28 European countries, and referring the contribution of all the measures in the fight against smoking to a base of 100, experts have made an estimate of the influence of each factor:

- **the price of a packet: 30**;
- prohibiting smoking in public places: 22 ;
- government expenditure on awareness campaigns: 15 ;
- forbidding all tobacco advertising and promotion: 13 ;
- health warnings: 10 ;
- helping dependent smokers to stop: 10.

In the last ranking, **France was placed seventh in the fight against smoking, but this was before smoking was forbidden in public meeting places**.

In Great Britain, there was a study to evaluate the 'practical' effectiveness of an anti-smoking campaign, by estimating the number of smokers stopping and ex-smokers not starting again. One population had been exposed to the campaign, whereas the other was not, due to the existence of independent local television networks in Great Britain. Two follow-ups were done at six and eighteen months, the last covering 2,400 people. Despite the limits (essentially the sample size, large but insufficient to guarantee the significance of certain differences), the study concluded in favour of the usefulness of the campaign, by observing a higher stopping or not restarting rate in the regions exposed to the preventive messages.

3. Evaluation methods for INPES' anti-smoking campaigns

Performing such large studies cannot be envisaged for every campaign. **INPES has therefore made use of the classic post-tests method** to evaluate different indicators: spontaneous recollection of the campaign (without suggestion) and recognition (showing the campaign to the persons tested); understanding of the message; involvement (feeling concerned); encouragement (to modify their smoking behaviour) and agreement. INPES undertakes face-to-face interviews for television campaigns and telephone interviews for radio campaigns, based on samples of 1,000 people representing the population over 15 years old, applying the quota method. For some targeted campaigns, INPES studies a smaller age range. For smoking, the Institute has a sufficient number of post-tests to prepare graphs comparing one campaign with another.

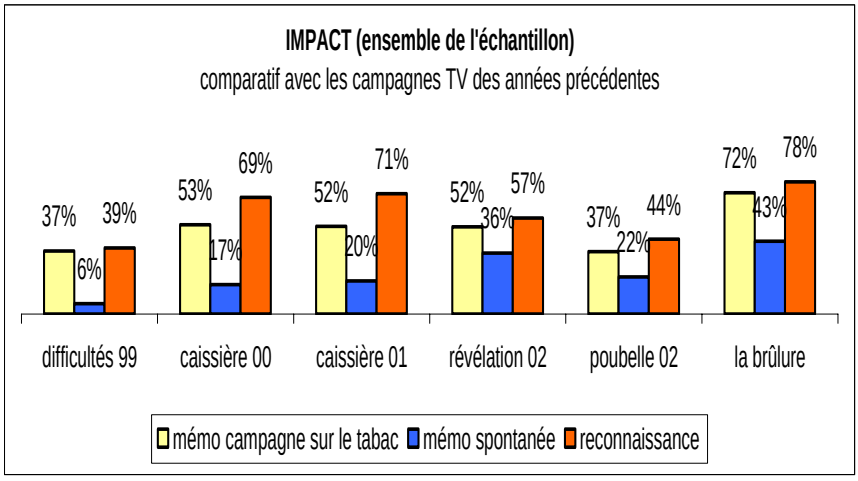
Qualitative pre-tests (group meetings or interviews) allow the identification of the characteristics and defects that the public could perceive, without prejudging the general reception.

For the *'The burn'* campaign, one of the first to harden the tone, INPES performed a **quantitative pre-test** for the first time. The spot showed a young woman and a young man who were lighting a cigarette: a curl of smoke was escaping through a hole in their throat. The pre-test asked the people questioned how they would describe the

[1] www.ensp.org.

film to a friend. Three quarters answered that the film showed that tobacco causes illnesses. Half related the different items shown factually. A third mentioned the tone of the campaign, with half of them judging the campaign to be strong, the other half banal. INPES therefore concluded that **the offensive tone was not a hindrance to launching the campaign.** In the post-test, this same campaign obtained the best spontaneous recollection score (43 %), beating the '*Revelations'* campaign (36 %), which had held the record until then, as a result of the enormous media hype caused by its broadcast (*Figure n°11*).

Figure n°11: **Recollection and recognition rates for INPES anti-smoking campaign**



Source: INPES

In the post-test, 89 % of people questioned declared that the aim of the film was to show that every cigarette is harmful, against 85 % in pre-test. Similarly, 91 % of people questioned in post-test judged that the campaign created awareness of the damage caused by cigarettes inside the body (83 % in pre-test). Globally, both evaluations showed that the campaign created fear but that only a small minority judged it to be pointlessly shocking. Finally, 56 % of smokers declared that it had encouraged them to think about their smoking. These different items of information allow a determination of whether the objectives of a campaign have been achieved or not.

More generally, studies have shown that a fear-based strategy could work for some people… and have counterproductive effects on others. Smokers who did not want to stop consequently found themselves strengthened in their intention, rather than dissuaded. These were often people in precarious situations. It was also observed that the emotion transmitted can be persistent but also contribute to a certain blindness regarding the message, which is obliterated. Moreover, **such campaigns must be accompanied by support and assistance messages.** There is no question of leaving someone alone with their anxiety. This lead to the creation of the Tabac Info Service telephone line, which often refers to doctors or to an Internet site listing practical advice.

CHAPTER 7

In the smoker's head: neuroscience and smoking prevention

Gemma Calvert[1], **Karine Gallopel-Morvan**[2], **Sarah Sauneron**[3] and **Olivier Oullier**[4]

"Tobacco is the leading cause of avoidable mortality in France (60,000 deaths per year) and the leading cause of cancer. One smoker in two will die of the consequences of smoking[5]*",* repeats the Ministry of Health and Sports, which has made the fight against smoking one of its priorities.

An article published on the 25th of February 2010 in the scientific magazine *Nature* calls for no slackening of efforts in the fight against smoking in the face of statistics that can appear encouraging[6]. In fact, the occurrence of some tobacco related illnesses has tended to fall for the first time for years in some industrialised countries[7]. There still remain 1.2 billion smokers in the world[8], for whom 6.3 trillion cigarettes were produced in 2010. This colossal figure represents a mean annual consumption of over 900 cigarettes for each man, woman and child on the planet.

According to the *Report on the Global Tobacco Epidemic* published in 2009 by the World Health Organisation (WHO)[9], **tobacco kills over 5 million people every year.** If current trends are maintained, this figure will reach 8 million by 2030. WHO estimates that a billion people will succumb to the direct or indirect consequences of smoking before the end of the century if nothing changes.

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[1] Professor of Neuroimaging and Chair of Applied Neuroimaging at the University of Warwick (Great Britain); founder of Neurosense Limited.

[2] Lecturer, researcher and accredited research director, Rennes Management Institute (University of Rennes 1), member of the Economics and Management Research Centre of the University of Rennes-1 (UMR CNRS 6211)

[3] Project Manager, Department of Social Affairs, Centre for Strategic Analysis.

[4] Scientific adviser, Department of Social Affairs, Centre for Strategic Analysis and Associate Professor of Neuroscience, Cognitive Psychology Laboratory (UMR 6146), University of Provence (France).

[5] Statistic from the Ministry of Health and Sports dating from 2007 ;.

[6] Samet J. M. and Wipfli H. L. (2010), 'Globe still in grip of addiction', *Nature*, vol. 25, p. 1020-2021 ;

[7] See Robinson S. and Bugler C. (2008), *General Lifestyle Survey: Smoking and drinking among adults*, UK Office for National Statistics, Crown, 74 p. To view this survey (in English):. Also see Wald N. and Nicolaides-Bouman A. (1991), *UK Smoking Statistics* (2nd edition), Oxford University Press, Oxford.

[8] Or about 40 % of men and 10 % of women. See Shafey O., Eriksen M., Ross H. and Mackay J. (2009), *The Tobacco Atlas* (3rd edition), American Cancer Association ; www.tobaccoatlas.org/. The latest figures published in March 2010 by the French Observatory for Drugs and Drug Addicts reveal that in France cigarette sales increased by 2.6 % in 2009. Pharmacists sales of stop smoking treatments fell by 21.5 % in the same year.

[9] World Health Organisation (2009), 'WHO Report on the Global Tobacco Epidemic, 2009: Implementing smoke -free environments- Executive summary', 5 pages.

Faced with the repeated failures of the various strategies introduced, public authorities must explore new options to improve the policies to prevent this plague. This chapter address the potential inputs from neuroscience, for a better understanding and prevention of smoking behaviour. Recourse to neuroscience for this purpose is not new because it has notably allowed a better understanding of the cerebral mechanisms of addiction to nicotine[1]. Also, many mechanisms prescribed to help smoking cessation act on the so-called cerebral 'reward' system.

Going beyond nicotine-associated addictive behaviour, the novelty of the approach introduced here resides in **the use of neuroscience to refine and prepare smoking prevention strategies.** The example of so-called 'shock' (often inane) campaigns, which are spreading on cigarette packets and in the media, highlights the necessity to mobilise all available scientific resources to optimise effective communications and avoid potential perverse effects. Among these inputs, the currently little used but very substantial resource offered by consumer neuroscience appears promising for future years.

1. Faced with the complexity of the problem, a diversity of solutions

1.1. Making people aware of the harmfulness of tobacco is not sufficient

If the need for information for better prevention of smoking suffers from little discussion, the strategy of simply informing people that tobacco is harmful is nevertheless vastly insufficient.

Anybody, once they have been informed of the danger that a habit can present for their health, should either not start, or alternatively stop as quickly as possible. Such reasoning, which is nevertheless so much contradicted in daily life, has been that of marketing specialists, who like some economists, have too often prepared models and strategies around the idea of a rational economic agent. This agent, the famous '*homo œconomicus*', will take decisions using all the information available to him and, having compared all the alternatives, will select the optimal outcome (economically and medically in the case that interests us).

Now, in reality, **the knowledge of the occurrence of a danger and the consequences that it could cause has never prevented human beings from exposing themselves to it**, rather the opposite. If this was the case, all car users would wear their safety belt and everyone would have protected sexual relations. In the case of tobacco, examples of such behavioural biases are often enlightening. For example the proportion of doctors and health personnel who smoke is almost the same as in the general population[2]. Awareness, however precise, thus does not lead

[1] Consequently the present chapter will not specifically consider cerebral correlations of cigarette addiction. The interested reader could refer to the numerous scientific works published on this subject. See, for example, volume 8(11) of the scientific periodical *Nature Neuroscience* published in November 2005, www.nature.com/neuro/journal/v8/n11/index.html.

[2] The 'Tabac & Liberté' (~Tobacco & Liberty) doctor's network estimates from Health Barometer data that in 2000 general practitioners reflected the general population in smoking. However, it remarked that in 2005 new doctors were less likely to smoke than previous generations, notably due to a feminisation of the profession.

to a brake on risky behaviour. Having access to statistics on the dangers of smoking, *via* information and prevention, is thus not the single solution to all its evils, far from it. Complementary strategies must therefore be envisaged, with not only different communication media, *via* fear or surprise, but also more restrictive measures.

1.2. Countries are implementing numerous preventive strategies[1]

Faced with the human catastrophe and the economic burden of smoking[2], governments, NGOs and other associations involved are working unflaggingly, often in concert, with the aim of finding new ways of fighting the damaging effects of tobacco. For this, WHO prepared a 'Framework Convention on Tobacco Control', which was adopted in 2003 and now has 168 signatory countries (including France) covering 86 % of the world population[3]. As stated in the WHO 2009 Report, this initiative denotes a *'worldwide political will to make the fight against tobacco more global and effective'*.

Among the preventive measures, taken in isolation or coordinated between countries, we cite **the increase in the price of cigarette packets, prohibiting smoking in workplaces[4] or in public places, regulation of advertising or sponsorship, the use of generic packets, or the prohibition of exposing cigarette packets to customer view at** sales points. The measure that will be of more particular interest to us here is the **placing of visual prevention messages (instead of the current text format)** on cigarette packets, to illustrate the dramatic consequences of tobacco addiction better. One of the outcomes sought by all strategic approaches is to make smoking socially unacceptable.

To make its action more effective, WHO has developed the MPOWER practical support programme, that allows it to follow the development of the epidemic and the worldwide efforts to fight it [5] with greater accuracy. One of the priorities of MPOWER is to prevent and inform about the dangers linked to the consumption of tobacco, for both smokers and non-smokers (passive smoking or *'second-hand smoking'*)[6].

The WHO report shows that only 10 % of the world's population is currently covered by one of the MPOWER measures (*Figure n°12*). Only 2 % live in countries that have adopted legislation forbidding smoking in public places that is well respected; and

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[1] The major part of the statistics and analyses presented in this section come from the R*eport on the Global Tobacco Epidemic* published in 2009 by the WHO (see *supra* for the link).

[2] According to the WHO, health expenditure and productivity losses due to smoking are now reaching record amounts (193 billion dollars per year in the United States).

[3] After its adoption by the 56th WHO assembly in 2003, the *Framework Convention on Tobacco Control*, FCTC, was opened for signature. The Framework Convention came into force on 27 February 2005, 90 days after the fortieth State had adhered, ratified, accepted or approved.
To read the Convention: http://whqlibdoc.who.int/publications/2003/9242591017.pdf. To consult the list of 168 signatories: www.who.int/fctc/signatories_parties/en/index.html.

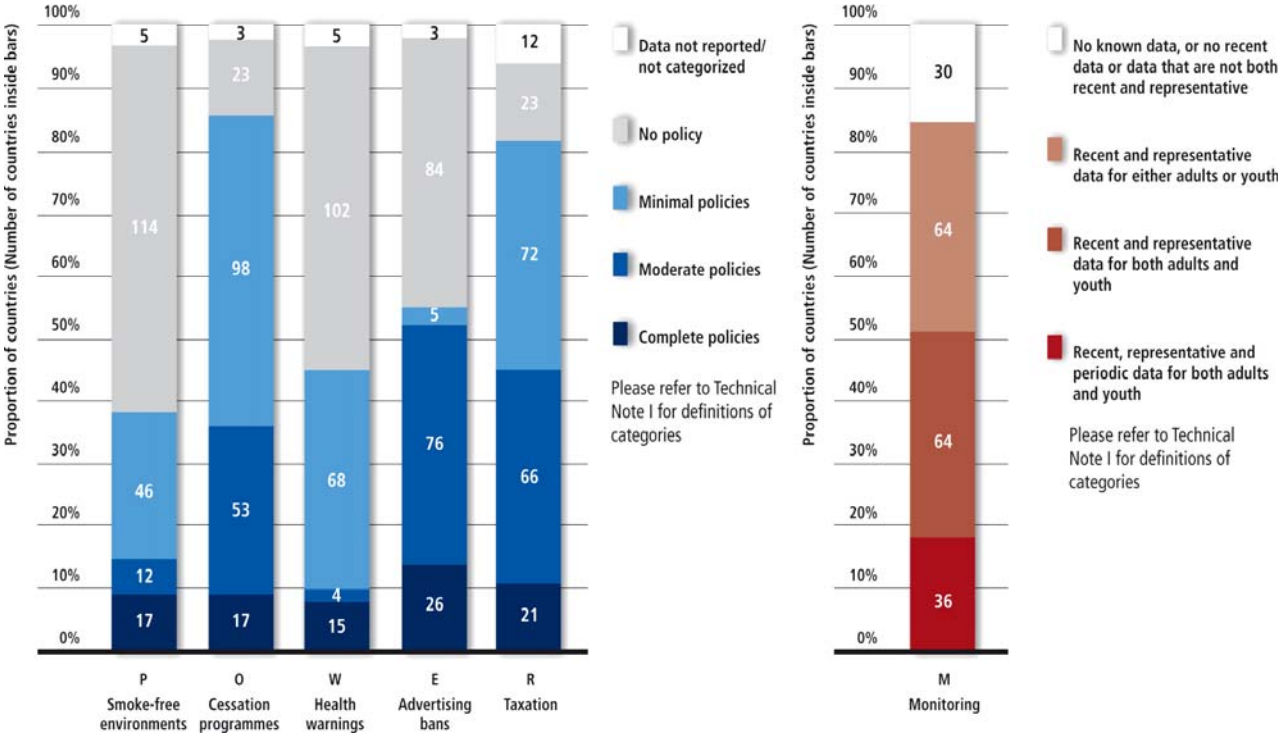
[4] Introduced for the first time by Ireland in Europe in 2004, the prohibition on smoking in work places was then adopted by numerous countries and often extended to all public places.

[5] MPOWER: Monitor Protect Offer Warn Enforce Raise. This programme is based around the following actions: monitoring tobacco consumption and prevention policies; protecting the population against tobacco smoke; offering help to those who want to renounce tobacco; warning about the dangers of smoking; ensuring the prohibition of tobacco advertising, promotion and sponsorship is respected, increasing taxes on tobacco.

[6] A third route for contamination is now being considered, *'Third-hand smoking',* which brings out the potential harmfulness of housing or offices that have been occupied by smokers for a long time.

5 % live in countries that tax the price of cigarettes by 75 % and over, as recommended by MPOWER.

Figure n° 12: **The state of selected tobacco control policies in the world**



Source: World Health Organisation © - 2008

2. On the usefulness of developing actions on the social environment

2.1. Suppressing all forms of advertising and sponsorship

The Evin Law (1991) prohibits any kind of tobacco advertising (TV, magazines, radio, posters, sponsorship, PR, Internet, etc.). It has not had the intended effect of changing the positive image of this product, as huge marketing efforts are being made by the tobacco industry to combat it and continue communicating the product via advertising tools reminding people of the brand universe. Proof of the existence of such illegal communication can be found in the internal documentation of cigarette manufacturers, but also by observing their activities out in the field (*Box n°7*)[1].

[1] Dubois G. (2003), "*Le rideau de fumée, les méthodes secrètes de l'industrie du tabac*", Seuil. Gallopel-Morvan K. (2009), "*Comment changer l'image du tabac en France?",* in *Rapport sur le tabagisme,* report coordinated by M. Tubiana, *Académie Nationale de Médecine*, May, p.5 and17-20

Box n°7
A powerful tobacco industry

One of the most redoubtable obstacles to the prevention of smoking remains the tobacco industry. Certain international brands continue to contest the scientific proof of the harm of passive smoking to non-smokers, and use their immense financial resources to influence the political process, by lobbying, indeed contesting certain anti-tobacco legislation.

An article published in 2008[1], and based on British American Tobacco internal documents (BAT, the second largest multinational in tobacco-derived product production), describes the attempts by this company to minimise public awareness of the harmful effects of passive smoking in the Chinese market. Besides promoting the benefits of 'resocialisation by tobacco', this multinational goes as far as offering training courses to industry, public and media employees aimed to convince them that the effects of passive smoking are negligible compared to that of air pollution.

In France, the National Anti-Tobacco Committee (a recognised public association) has implemented observation of illegal advertising practices within the tobacco industry. Amongst the infractions recorded (some of which attracted fines) were: cigarette packets targeting adolescents, a strong tobacco brand presence on the Internet, unauthorised advertising at over 30% of cigarette sales outlets visited by the association in 2007and the presence of tobacco brands in major competitions broadcast on TV stations in 2006 (27.6% of which are illegal), etc.

We present below the results of a study using functional Magnetic Resonance Imaging (fMRI) to estimate the cerebral activity of smokers when they are exposed to different types of cigarette brand advertising and cigarette packets (with or without a preventive message on them)[1].

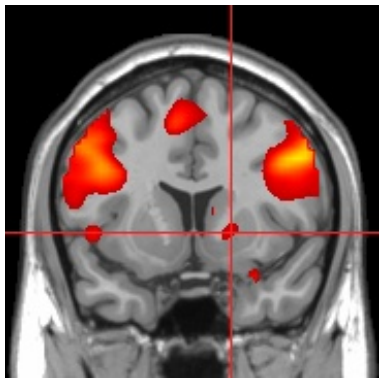
Previous neuroimaging studies undertaken by Neurosense Limited showed that when exposed to smoking related stimuli, the cerebral activity of smokers increases significantly, notably in the prefrontal cortex, the anterior cingular cortex, the ventral striatum and the accumbens nucleus – a part of the brain that is rich in dopamine, a pleasure neurotransmitter that participates, among others, in the desire to smoke and more generally in cerebral addiction mechanisms (*Figure n°13*).

For this new study, smokers aged between 18 and 50 years old had to refrain from smoking for four hours before the experiment. Their brain activity was then estimated using fMRI while they looked at cigarette packets with and without warning messages. They were also shown promotional objects distributed by cigarette manufacturers – lighters, clothing – as well as advertising posters or even vehicles in the colours of these brands, as seen in the context of sponsored sporting events (rallies, Formula 1)[2].

[1] Muggli M. E., Lee K., Gan Q., Ebbert J. O. and Hurt R. D. (2008), 'Efforts to reprioritise the agenda' in China: British American Tobacco's efforts to influence public policy on second-hand smoke in China', *Public Library of Science Medicine*, vol. 5(12): e251 ;

[2] During this experiment, the subjects must: (1) Look at a packet of cigarettes without preventive message; (2) look at a packet of cigarettes with warning; (3) look at photos of sporting events sponsored by brand of cigarettes; (4) look at cigarette advertising; (5) look at advertising products (lighters, tee-shirts, etc.) in the colours of a brand of cigarettes; (6) look at images having nothing to do with the world of tobacco ('control condition').

Figure n° 13: **Activation of the accumbens nucleus (in the cross hair) of smokers viewing stimuli linked to cigarettes or tobacco brands (packets, advertising, sponsorship, derived objects)**



Source: Neurosense Limited©, www.neurosense.co.uk

After an exposure of several minutes to packets or cigarette brand advertising, all the volunteers unsurprisingly reported a strong desire to smoke.

All the tobacco-related visual stimuli used in the experience lead to a significant change in activity in the accumbens nucleus. In addition, **the activity in this nucleus was highest for the sponsorship images.** So, it appears that the strategy of applying brand-related colours on objects at public leisure events, without the brand being explicitly mentioned and which has been employed by several tobacco manufacturers, works because it triggers an association in smoker's brains equivalent to or even greater than that of a potential nicotine reward.

Such results demonstrate **the relevance of measures forbidding tobacco advertising** such as the Evin Law in France[1]. In addition they invite questions on the **means of regulating all indirect forms of advertising and the nature of the mechanisms that can be put in place to control illegal communications by the tobacco industry.**

2.2. Forbidding the display of packets at point-of-sale (POS)

The above experiments demonstrate that simply viewing a branded cigarette packet can lead to a desire to smoke. Going into a tobacconists for any purchase whatsoever, will thus expose people to temptation.

In 2000, the county of Montgomery in Maryland in the United States voted for a law obliging stores selling cigarettes to hide the packets behind the counter so that they were not in view of children[2]. Inspired by this example, at the end of 2008, the British government adopted an unprecedented law to **force shopkeepers not to exhibit cigarettes.** After increasing the minimum legal age to buy cigarettes from 16 to 18 years old, these new restrictions were decided upon following a wide consultation on measures aiming to reduce the number of children tempted by cigarettes and to help those who are already dependent to stop. They were notably able to base it on a study done in California, which showed that the risks of smoking for a child between

[1] www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000006077071&dateTexte=20100304.
[2] http://no-smoking.org/sept00/09-20-00-1.html.

11 and 14 years old increased by 50 % if packets of cigarettes were exhibited in a shop near their home[1]. New restrictions on cigarette vending machines should come into force to complete this measure.

2.3. Optimising media communication campaigns: moderation *versus* over-stimulation

Mass awareness campaigns have experienced a progressive evolution of the message transmitted and the manner of transmitting it[2]. **Appealing to reason, fear, surprise, responsibility, embarrassment or disgust**, are strategies that all present advantages and limitations. Scientific experiments can contribute to evaluating their impact.

Some one hundred psychological and social marketing studies have been carried out on the subject of negative emotion and persuasion. The majority of these studies show a positive relationship between negative emotions felt, the ability of a message to attract attention, retention and the associated intentions of individuals to change their behaviour.[3] Researchers explain this positive impact of negative emotions on persuasion by the motivation they trigger. Thus, when individuals are exposed to a shock advert, they feel an unpleasant emotion that they will try to rid themselves of to rebalance their psychological state. One way of doing this is to adopt the behaviour promoted by the message. Even if we see a positive impact of negative emotions on persuasion in a majority of cases, there are still limits on their use. In fact, we sometimes observe the opposite reactions to what was expected. Here, rather than adopting the behaviour promoted by the sender of the advertising message, individuals develop a defence or rejection strategy of repressing the advert content, doubting its credibility and underestimating the risks shown – avoidance and denial. In the worst cases, a shock campaign creates a boomerang effect: the incriminated behaviour is reinforced instead of being reduced or stopped.

This kind of situation occurs when the target audience does not feel able to adopt the recommended behaviour (they see themselves as weak). If so, it is advisable to provide information and advice along with the negative message in order to help individuals to adopt the desired behaviour more easily (telephone support number, information on how to stop smoking etc.). This is what the researchers Rogers (1983) and Witte (1998)[4] recommend in the motivation model for self-protection and the extended parallel processes model recording the rules for developing an effective shock prevention message, i.e. one that motivates individuals to change their behaviour in the desired way. Rogers and Witte also advise putting the emphasis of

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[1] Smith R. (2008), 'Cigarettes to be sold 'under the counter", *The Telegraph*, edition of 8 December.
[2] See Chapter 5.
[3] For a summary of these studies, see, Gallopel-Morvan K. (2006), "*L'utilisation de la peur dans un contexte de marketing social : état de l'art, limites et voies de recherche*", *Recherches et Applications en Marketing,* vol. 21 (4), p. 41-60 or Gallopel-Morvan K. (2008), "*Comment réaliser des communications publicitaires efficaces ?"* in *Le marketing et la communication des associations*, 2008, Dunod.
[4] Rogers R.W. (1983), « Cognitive and physiological processes in fear appeal and attitude change : a revisited theory of protection motivation », *Social Psychophysiology*, eds. J. Cacioppo et R. Petty, New York : Guilford Press, p. 153-176. Witte K. (1998), « Fear as motivator, fear as inhibitor : using the extended parallel process model to explain fear appeal successes and failures », in *Handbook of Communication and Emotion : Research, Theory, Applications and Contexts*, Academic Press, p. 423-450.

the effectiveness of the solution proposed on escaping danger (stop smoking to significantly reduce the risk of cancer). Another limitation of these studies on negative emotions is that they are based on statements made by individuals. To remove the inherent bias in these methods (social desirability, under- and over-estimation in answers given etc), it would be a good idea to observe directly what happens in the brains of people exposed to the shock message.

The most recent study to have used neuroscience to test the effectiveness of prevention messages as part of the fight against smoking was published in May 2009 by scientists at the University of Pennsylvania[1]. Daniel Langleben and his team used fMRI to estimate the cerebral activity of smokers exposed to different prevention messages. The study was financed by the National Institute on Drug Abuse[2] (NIDA) and by the National Cancer Institute[3] (NCI), two components of the National Institutes of Health[4] (NIH), which is the largest public health research institution in the United States.

The scientists presented several types of televised public service announcements (PSA) classified according to the sensations that they produced, i.e. the '*message sensation value*' or MSV. Television advertisements with a high MSV were rich in information that intensely stimulated several sensory channels: the production was rhythmic, with frequent cutaway shots and sound effects. Messages identified as having a low MSV were characterised by a steadier rhythm, a more linear discourse keeping to the facts, without wanting to dramatise and not excessively stimulating the different sensory channels. Finally, a 'control condition' consisted of viewing neutral video clips which conveyed messages with no connection to the fight against smoking.

The results show that the spots having a high MSV lead to higher occipital activity in the primary visual cortex than the others (*Figure n°14*, centre column). The authors explained that this activity reflects both the surprise and attention of the spectator, and that this sensory and information influx had a clearly discernible and distinctive reaction on the brain.

For spots with a lower MSV, significantly higher activity was observed in the frontal and temporal cortices in regions notably associated with memory encoding (*Figure n°14*, right hand column).

The conclusion that was drawn by the authors of this study was that while shocking the smoker might attract his attention, informing him 'without shocking him too much' could ensure he retains the message better. Subsequent retention tests confirmed this hypothesis: smokers retain messages set out in low MSV spots better.

This study shows that **recourse to the emotions triggered by prevention messages in large scale awareness campaigns must be stimulated to the correct dosage, so that the interest aroused is not temporary and solely due to surprise** (*Box n°8*).

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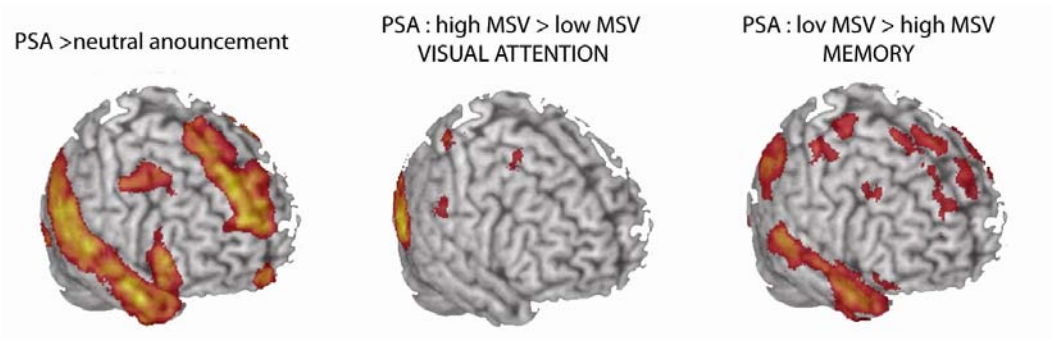
[1] Langleben D. *et al*. (2009), 'Reduced prefrontal and temporal processing and recall of high 'sensation value' ads', *Neuroimage,* 46, p. 219-225;
[2] www.drugabuse.gov/.
[3] www.cancer.gov/.
[4] www.nih.gov/.

However, Daniel Langleben and his team recognise that they are unable to predict from these studies the long-term impact of these messages on smokers subsequent behaviour. Retaining information does not automatically imply that it will lead to a modification of habits or a desire to smoke. The team of researchers are currently continuing their work by collecting longitudinal data to analyse the behavioural consequences of viewing several types of prevention spots.

Figure n°14: Modulation of cerebral activity according to the intensity of the smoking prevention message



Source: Adapted from Langleben et al. *(2009), Neuroimage. Copyright Elsevier*©

Box n°8
Media tobacco, prevention flop

The study by Daniel Langleben illustrates the idea that poorly prepared shock communications can prove to be counter-productive.

One example was evident in France at the end of February 2010, in the commotion excited by the campaign run by the Droits des Non-Fumeurs association (DNF – Non Smokers Rights Association). To attract attention, DNF used a deliberately provocative and incongruous metaphor[1]: equating tobacco and cigarette manufacturers to paedophiles thus suggesting the innocent submission of smokers to tobacco[2]. This campaign ;provoked widespread anger, including from sources within the French government. The director of the Professional Advertising Regulation Agency (ARPP) therefore declared that the campaign *'manifestly contravened the rules of decency and dignity and the rules prohibiting submission and dependency'*[3]. The paradox is that this advertisement had only, so far, appeared in a very confidential way and was withdrawn by the DNF only three days after the start of the controversy. The same ARPP stated: *'There was no advertising campaign. The agency told us that it consisted of 15,000 cards distributed in night clubs and bars in the Île-de-France'*[4]. Instead it was the reiteration of the commotion in the media and the declarations of opponents that transformed a marginal initiative into a highly public world campaign, thus playing into the hands of the

[1] Cigarette in the mouth, kneeling in front of standing man, young people were forced to smoke, as though a paedophile was subjecting them to fellation. This visual image is accompanied by the message: 'Smoking means being a slave to tobacco'.
[2] Basso F. and Oullier O. (2010), 'Smokers are suckers: Should we use incongruent metaphors in public prevention?', *The American Journal of Public Health*, in press.
[3] *Le Monde* and AFP (2010), 'The Advertising Authority demands a stop to an anti-smoking campaign', *Le Monde*, edition of 24 February
[4] Girard L. (2010), 'Comment faire un tabac avec une campagne fantôme (~How to make a hit with a phantom campaign)', *Le Monde*, edition of 27 January

communication agency that had orchestrated the coup anticipating just this eventuality [1].

The final winner of such an enterprise is not the fight against smoking, but rather the agency, which, at minimal expense, obtained a worldwide echo in 48 hours. *Quid* for prevention? Certainly, DNF gained in notoriety. But no information on the nature of its action was forthcoming, nor any public advice on how to combat smoking. We can even question whether the communication reached its target audience. According to the President of the DNF, *'the campaign was developed after a survey among secondary school students', but the people shocked 'are the over 50s and we are not aiming at them'* [2].

3. The cigarette packet – another way of fighting against tobacco

The fight against tobacco is not limited to media campaigns, either televised or otherwise: it also applies to the cigarette packet itself, given the proximity of smokers to these health warnings, and the possibility of creating generic (or unbranded) cigarette packets. These tools are relevant to governments because they are free (unlike media campaigns) and they are seen around 7,000 times a year by regular smokers and the people around them.

3.1. The limitations of written health warnings

Since 2003, new EU rules require that at least 30% of the front surface of a packet of cigarettes must be devoted to one of the two written messages 'Smoking kills', or 'Smoking can seriously harm your health and that of your companions'. In addition, at least 40% of the rear surface must carry one of the 14 written health warnings made available to member countries, such as 'Lung cancer caused by smoking is fatal' or 'Smoking can cause a slow and painful death'. This is currently in place in France.

The experiment performed by Neurosense Limited (*supra*, section 2.1.) provides new information about the impact of such written messages. In fact, activity of smokers' nucleus accumbens – a part of the brain's reward circuit that takes part in the addiction process – was negatively correlated with their stated subjective reaction to these labels. The result highlights an important distinction between what people say and what's actually happening in their brain. .

Contrary to the government's intention, written warning messages failed to suppress brain activity in regions participating in the desire to smoke. In fact, it would have been very surprising for such a stimulus to instantaneously 'calm' the part of the brain playing a central role in the nicotine addiction process, a phenomenon that is fundamentally anchored at the neurophysiological level and generally results from an addiction going back months, even years.

More astonishing, **smokers who said that they were more affected by the prevention messages on cigarette packets** – and thus, in theory, the most likely to

[1] And in mentioning this affair we are playing the communication agency's game…
[2] *Le Monde* and AFP (2010), 'Sexe, outrage et cigarette (~Sex, outrage and cigarette)', *Le Monde*, edition of 23 February

take them into consideration – **showed greater activity of these nicotine addiction brain areas when the labels were present!**

In a similar vein, a study carried out by Crespo and his team (2007)[1] revealed the low level of effectiveness of a health warning message on an advert for a tobacco brand. Using the eye-tracking method, researchers were able to report that, in spite of its novelty value for the material tested (an advert), the written warning "smoking kills" does not make people remember the anti-smoking message any better or improve the cognitive processing of it.

In summary, the various research shows:
- the limited impact of such written health warnings;
- the low impact of certain types of health message (e.g. messages mentioning death such as "smoking kills"). This result is not that surprising. In fact, all you need to do is remember the success of the Death Cigarettes®, (*Figure n°15*) on the market in Great Britain, a brand that had a skull and crossbones as its logo[2] ;
- the limitations of studies on the impact of public health prevention that are solely based on questionnaires. In brief: the smoker says one thing and his brain says another. Thanks to neuroscience, we can see that some written health warnings **induce rather than suppress craving**, at a "cerebral" level at least.

This research, combined with that collated from studies on drug and alcohol addiction and health warnings in general, therefore tends to suggest that health warnings put on cigarette packets don't always have the intended effect, especially on smokers themselves. **However, this does not lead to the conclusion that governments should stop using warning messages, but rather use the growing body of neuroscientific and psychological information to refine their format and content**, whilst including restrictions on the environment as mentioned above. The research also shows that it is important to combine several methods when testing anti-smoking messages on individuals.

Figure n°15: The *Death Cigarettes*®
sold in Great Britain between 1995 and 1999

[1] Crespo A., Cabestrero R., Grzib G. and Quiros P. (2007), "Visual attention to health warnings in tobacco advertisements: en eye-tracking research between smokers and non-smokers", *Studia Psychologica*, 49, 39-51.
[2] Similarly, we should also mention the appearance of "funny" cards that mock the health warning messages. The pack of cards has become very popular, with smokers slipping them between the cellophane and the packet.

3.2. The WHO recommends graphic rather than written health warnings

Article 11[1] of the WHO Framework Convention on Tobacco Control and the Third Conference of Parties in November 2008 have emphasised the need to use graphic health warnings rather than written ones on cigarettes packets. In January 2009, the Minister of Health, Roselyne Bachelot, expressed a wish to introduce a preventive strategy in France, and this was integrated in cancer plan 2.

This measure was taken in 2001 in Canada, a pioneer country in the fight against tobacco, with images that occupied 50% of the front and rear faces of the packets. In 2010, around thirty countries put graphic health warnings in place (*Table n° 1*).

Numerous studies have shown the superiority of graphic warnings over written ones in the context of the fight against tobacco addiction. Graphic warnings are more visible, easier to understand (especially for illiterate people) and increase awareness of the dangers of tobacco.[2] Also, they are more effective in informing people on the unknown drawbacks of tobacco addiction (impotence, for example)[3].

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[1] www.fctc.org/dmdocuments/French%20Factsheet%202.pdf.

[2] Trasher J.F., Hammond D., Fong G.T., Arillo-Santillan E. (2007), "Smokers' reactions to cigarette package warnings with graphic imagery and with only text: a comparison between Mexico and Canada", *Salud Publica Mex,* 49, suppl 2, p. 233-240.

[2] Trasher J.F., Hammond D., Fong G.T., Arillo-Santillan E. (2007), "Smokers' reactions to cigarette package warnings with graphic imagery and with only text: a comparison between Mexico and Canada", *Salud Publica Mex,* 49, suppl 2, p. 233-240.

White V., Webster B., Wakefield M. (2008), "Do graphic health warning labels have an impact on adolescents' smoking-related beliefs and behaviours?", *Addiction*, 103, p. 1562-1571.

[2] Hammond D., Fong G.T., McNeill A., Borland R., Cummings K.M. (2006), "Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey", *Tobacco Control,* 15 (3), p. 19-25.

[2] Hammond D., Fong G.T., McDonald P.W., Cameron R., Brown S.K. (2003), "Impact of the graphic Canadian warning labels on adult smoking behaviour", *Tobacco Control,* 12, p. 391-395.

Hammond D. et al. (2004), *Op. Cit.*

Koval J.J., Aubut J.A., Pederson L.L., O'Hegarty M., Chan S.S. (2005), "The potential effectiveness of warning labels on cigarette packages: the perception of young adult Canadians", *Canadian Journal of Public Health*, 96 (5): 353-356.

[2] *WHO (2009), "Montrer la vérité. Les mises en garde illustrées sauvent des vies",* et Cunningham R. (2010), "Cigarette Package Warning Size and Use of Pictures: International Summary", Canadian Cancer Society, February 23 2010 et www.tobaccolabels.ca

Li J. et Grigg M. (2009), "New Zealand: new graphic warnings encourage registrations with the quitline", *Tobacco Control*, 18 (1), 72.

Borland R, Wilson N., Fong GT, Hammond D, Cummings KM, Yong HH, Hosking W, Hastings G, Trasher J and McNeill A (2009), "Impact of graphic and text warnings on Cigarette packs : findings from four countries over five years", *Tobacco Control*, 18, 358-364.

Miller C.L., Hill D.G., Quester P.G. and Hiller J.E (2009), "Impact of the Australian quitline of new graphic cigarette pack warnings including the quitline number", *Tobacco Control*, 18, 235-237.

Gallopel-Morvan K., Gabriel P., Le Gall-Ely M., Rieunier S. et Urien B. (2009), "*L'impact des paquets de cigarettes génériques et des avertissements sanitaires visuels sur des Français – résultats des études qualitatives et quantitative*", report for the *Institut National du Cancer*, December.

Graphic health warnings also generate negative emotional reactions (fear, disgust, anxiety etc), which have a positive effect on the intention to stop or not to start smoking.
Finally, warnings in the form of photos seem to be more effective than written messages in encouraging smokers to stop or reduce tobacco consumption, helping former smokers to stay off the habit and increasing the number of phone calls to the "tobacco information service."[1]

Also, the total lack of "glamour" of some graphic health warnings helps in the fight against making cigarette packets aesthetically attractive, which is the usual draw to young people and which the tobacco industry uses as a communication channel (*Figure n° 16*).

Figure n°16: Examples of graphic and written warnings proposed by the EU

http://ec.europa.eu/health/ph_determinants/life_style/Tobacco/pictorial_warnings_en.htm

One of the recurring reservations on the effectiveness of some graphic health messages is **that, consciously or not, they cause counter-productive defensive reactions**[2] of the denial type ("I know it exists, but it won't happen to me"). And, after a number of years, people habituate to the images and they become less effective[3].

[2] Stewart D. W. and Martin I. M. (1994), "Intended and unintended consequences of warning messages: A review synthesis of empirical research", *Journal of Public Policy & Marketing*, vol. 13(1), p. 1-19. Hammond D., Fong G.T., McDonald P.W., Brown K.S., Cameron R. (2004), "Graphic Canadian cigarette warning labels and adverse outcomes: evidence from Canadian smokers", *American Journal of Public Health*; 94 (8): 1442-1445

[3] Gallopel-Morvan K., Gabriel P., Le Gall-Ely M., Rieunier S. et Urien B. (to appear), "The use of visual warnings in social marketing: the case of tobacco", *Journal of Business Research.*

Table n°1: Countries where graphic health warnings appear on cigarette packets[1]

States	Year when illustrated warnings started to be used	Format of graphic warnings (pack front and back)
Canada	2001	50% and 50%
Brazil	2002	100% front or back
Singapore	2004	50% and 50%
Thailand	2005	50% and 50%
Venezuela	2005	100% front or back
Jordan	2005	33% one side only
Australia	2006	30% and 90%
Uruguay	2006	80% front and back
Panama	2006	50% and 50%
Belgium	2006	63% back
Chile	2006	50% and 50%
China (Hong Kong special administrative region)	2007	50% and 50%
New Zealand	2008	30% and 90%
Rumania	2008	53% back
United Kingdom	2008	53% back
Egypt	2008	50% and 50%
Brunei Dar es-Salaam	2008	50% and 50%
Cook Islands	2008	30% and 90%
Malaysia	2009	40% and 90%
Iran (Islamic Republic of)	2009	50% and 50%
Peru	2009	50% back
Taiwan	2009	35% and 35%
Djibouti	2009	50% and 50%
Mauritius	2009	60% and 70%
India	2009	40% front
Paraguay	2010	60% and 60%
Pakistan	2010	40% and 40%
Switzerland	2010	48% and 63%
Columbia	2010	30% and 30%
Turkey	2010	65% front
Mexico	2010	30% and 100%

This limitation seems to be confirmed by a Canadian study using fMRI to test the effectiveness of shock images. During an experiment financed by the Canadian Tobacco Control Initiative[1] (CTCRI), researchers at the University of Montreal analysed the cerebral reactions of smoking and non smoking women aged from 18 to 35[2], when exposed to shock images on cigarette packets.

When someone looks at shock images placed on cigarette packets, **the reaction of disgust is such that a significant increase in right hemisphere prefrontal cortex activity is observed**, this being a part of the brain that has been shown to take part in economic or moral decisions. Researchers have also observed a reaction in the amygdala, a structure that takes part in fear mechanisms. Moreover, **comparison of smokers and non-smokers reactions to these images shows that the former seem to have duller reactions.** This is consistent with the argument that non-smokers are by definition, less often exposed to shock images on packets than smokers who see them daily are are therefore likely to have habituated to their message. Data from neuroscience thus seems to corroborate and validate research carried out in other fields.

Finally, **the effect depends on the nature of the images**: those of a pregnant woman smoking, an ashtray filled with butts or an image of a man choking did not cause similar reactions in the brain. On the contrary, images portraying cigarette-stained yellow teeth, blackened lungs and other damaged organs caused a greater feeling of aversion, and most of all in non-smoking women.

The study by Canadian scientists tends to indicate not that shock health warnings are ineffective, as has sometimes been wrongly assumed, but rather that:

- messages provoking negative emotions must be used with care to avoid rejection. In accordance with the model of the motivation towards self-protection described before, the frightened person needs to be reassured and supported. Thus, if France decides to put shock health warnings on cigarette packets, it is important to put the phone number and web site details of the Tobacco Info Service on the pack, make the practical guide entitled “I’m going to stop smoking” available to the smoker and, if possible, insert leaflets detailing the various means of support for stopping smoking in cigarette packets. This has been implemented in Canada.

- graphic warnings need to be changed on a regular basis. In spite of recommendations by the WHO (article 11 of the Framework Agreement), countries rarely change health messages these days. Australia and New Zealand have two portfolios of images that are alternated each year. Switzerland, which put images on cigarette packets from January 2101, has developed three groups of images for rotation every 24 months.[3].

- not all graphic warnings are effective. It depends on the subject of the message and the target audience (men, women, smokers, non-smokers). So, messages

[1] http://ctcri.ca/en/.
[2] The population most likely to be a lifelong smoker in this country.
[3] Fong G. T., Hammond D. et Hitchman S. C. (2009), "The impact of pictures on the effectiveness of tobacco warnings"*, Bulletin of the World Health Organization*, 87, p. 640-643 ; www.scielosp.org/pdf/bwho/v87n8/v87n8a26.pdf.

that emphasize a marked change in visual appearance (yellowed teeth etc.) or show a child suffering passive smoking seem to be the most effective[1].

These different avenues can be explored through the neuroscience.

For example, it would be useful to carry out a brain imaging experiment in which smokers are repeatedly exposed to shock images to determine not only which have the weakest impact on the brain but also to calculate the frequency at which they need to be changed (evaluation of habituation in the brain). It would also be interesting to compare the different areas of the brain activated by each shock message shown (death, disease, passive smoking etc) and depending on individual characteristics (gender, smoker status). Finally, it is possible to evaluate the efficacy by which different messages designed to make smoking socially undesirable impact on the brain reward areas involved in processing social approval or social exclusion.

3.3. Putting health warnings on generic cigarette packets

Health warnings could have their effect increased if they were placed on neutral or 'generic' packets[2].On such packages, logos and other attractive designs would be prohibited. **The common, uniform packets would be distinguished only by the brand name written in small dark characters, without typography differing from one brand to another.**
So far, no other country has adopted the generic cigarette packet presumably because the challenges of implementing such packaging are numerous, as shown by the twenty or so reports from studies and research carried out on the subject [3] in Australia, Canada, New Zealand, the USA and France[4]:
- the generic packet makes redundant the packet as communication material and reduces the positive brand image: generic packets in weak colours appear dull, unattractive, uninteresting, ugly and boring,
- it increases the effectiveness of health warnings: it improves visibility, retention and credibility,
- it influences consumer perception: cigarettes in a generic packet are seen as being more dangerous, and consumers are prepared to pay less to buy them,
- in the end, the generic packet has a power to dissuade that will probably limit purchase by young people.

All of these results have come from declarative responses. It would be useful to follow this up with neuroscientific studies to circumvent the potential confounds associated with individual verbalisation. In fact, by looking at what happens at a neurophysiological level when desire, need, addiction and fear are simulated, this

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[1] For a summary of these studies, see Hastings G., Gallopel-Morvan K. and Rey J.M. (2008), "The plain truth about tobacco packaging", *Tobacco Control*, 17, p.361-362.
[2] Freeman B., Chapman S. and Rimmer R. (2008), 'The case for the plain packaging of tobacco products', *Addiction*, 103, p. 580-590.
[3] Gallopel-Morvan K., Gabriel P., LeGall-Ely M., Rieunier S. and Urien B. (2009), "*L'impact des paquets de cigarettes génériques et des avertissements sanitaires visuels sur des Français – résultats des études qualitatives et quantitative*", report for the *Institut National du Cancer*, December.
[4] Gallopel-Morvan K., Gabriel P., LeGall-Ely M., Rieunier S. et Urien B. (2009), « L'impact des paquets de cigarettes génériques et des avertissements sanitaires visuels sur des Français – résultats des études qualitatives et quantitatives », report for the Institut National du Cancer, December.

would enable us to observe the precise combined impact of generic cigarette packets and health warnings.

4. Stopping smoking despite stimulation from the world of smoking

We borrow this witty remark from Mark Twain: *'Giving up smoking is the easiest thing in the world. I know because I've done it thousands of times.'.* Stopping is harder because external stimulation, whether by advertising, the sight of a packet of cigarettes or an ash tray are capable of provoking the desire and need to smoke at any time in the smoker and in the person who has decide to stop smoking.

4.1. Can stopping be encouraged?

Anything that prompts the recall of cigarettes can excite the brain centres involved in nicotine addiction and so trigger the quest for and the use of cigarettes. Recent data suggests that these external stimuli have variable effects depending on their relationship with the ritualistic aspects associated with smoking: stimuli associated with the final phase of smoking a cigarette (a crushed stub, for example) will have different effects from those associated with the start of the ritual (sight of the packet of cigarettes or the lighter).

In an experiment published on 20 January 2010, researchers from the universities of Giessen and Würzburg in Germany used fMRI to compare the cerebral activity of non-smokers, deprived smokers (at least twelve hours without smoking) and smokers surfeited with nicotine when they were exposed to images associated with differences phases of the smoking ritual as well as images unrelated to smoking[1]. Before entering the fMRI scanner, subjects had to evaluate to what extent the different stimuli prompted a desire to smoke on a scale from 1 to 9 (*Figure n°17A*).

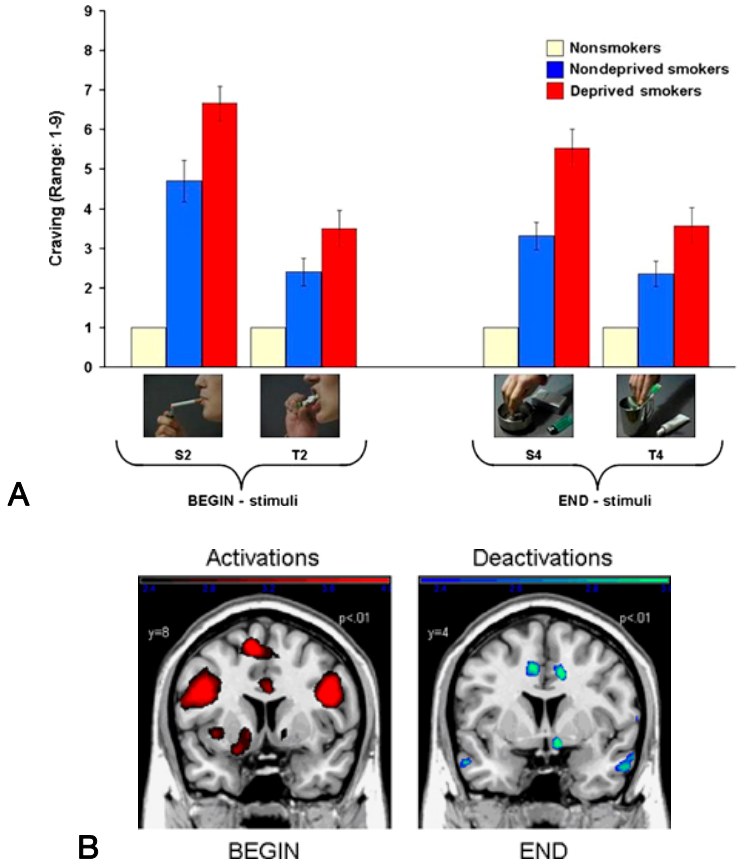
As expected, the subjective responses confirmed that tobacco-related images lead to higher desire scores in smokers than non-smokers, and had a greater effect than unrelated images. Importantly, the neuroscientific results revealed that **the cerebral activity of deprived smokers does not differ significantly from that of 'satisfied smokers' in response to images associated with the start of the smoking ritual, but are distinctly different when viewing end of ritual images**[2]. The difference is mainly located in the orbitofrontal cortex and the dorsolateral prefrontal cortex (*Figure n°17B*).

[1] Stippekohl B. *et al.* (2010), 'Neural responses to BEGIN -and END- stimuli of the smoking ritual in non-smokers, non-deprived smokers, and deprived smokers', *Neuropsychopharmacology*, in press.

[2] In 'smokers' who were not in a deprived state, the stimuli evoking the start of the ritual activated the cerebral network usually observed in 'addicts', meaning the ventral striatum, the orbitofrontal cortex and the anterior cingular cortex. In the same subjects, the end of smoking ritual stimuli lead to a different cerebral activity, notably a 'deactivation' of activity in the ventral striatum and the anterior cingular cortex.

Figure n°17: Comparison of effects of seeing images of the start and end of the cigarette ritual

(A) Behavioural responses to images of the start and end of the ritual compared with images unrelated to smoking. (B) Cerebral activity estimated by fMRI in smokers when they are exposed to start (left) and end of ritual (right) images.



Source: Adapted from Stippelkohl et al. (2010), Neuropsychopharmacology - Nature Publishing Group ©

The authors explain that smokers, when viewing end of ritual images, have less anticipation of a nicotine reward and so less desire for a cigarette. These results are interesting in the context of preparing messages for smokers' attention. For example, a brochure to accompany the process of giving up cigarettes would be that much more effective if it **did not show images evoking the start of the smoking ritual but only the end.**

4.2. Can relapse be predicted?

Could cerebral imaging techniques help support people trying to give up smoking? Data published in 2009 suggest that the brain activity generally associated with seeing images related to the world of tobacco can be significantly higher in people who have quit smoking. This could partly explain the propensity to relapse[1].

[1] Janes A. C. *et al.* (2009), 'Brain fMRI reactivity to smoking-related images before and during extended smoking abstinence', *Experimental and Clinical Psychopharmacology*, 17(6), p. 365-373.

In a study due to be published shortly, a team of researchers at the prestigious Harvard Medical School, have begun to shed new light on the matter.. People who had announced their decision to stop smoking were invited to view images invoking the world of tobacco, while their brains were scanned using fMRI [1]. The results are hugely promising as the combination of behavioural and neuroscientific data allowed the researchers to predict with 79 % accuracy those would subsequently relapse.

The subjects who did not 'stick it out' were those in whom the smoking related images led to high activity in the brain regions involved in emotion, interoceptive sensibility, planning and motor execution. In addition, the smokers who relapsed showed a reduction in functional connectivity (the way in which certain brain areas exchange information) between the prefrontal dorsolateral cortex and the areas affected when viewing tobacco related images, which suggests a reduction in the cognitive control needed to continue to quit smoking. If these results are confirmed in large populations, they could eventually be used to support those wanting to quit smoking to be better adapted to suit the expected difficulties (*Box n°9*).

Box n°9
Stopping smoking - a 'deep' problem

To treat certain pathologies, neuro-surgeons use deep cerebral stimulation, which consists of inserting micro-electrodes in patients' brains to stimulate parts of the brain.

These practices are not routine and require rare expertise and for the pathology to have had a severe effect in order to arrive at this stage. Scientists at the University of Cologne have shown that patients - in whom deep cerebral stimulation of the nucleus accumbens has been practised because they were affected by Tourette's syndrome, obsessive-compulsive disorders or anxiety problems – also stopped smoking as a result of this stimulation[2]. However scientists recognise that these patients were less dependent and more motivated than the rest of the sample at the start.

These results confirm the important role of the nucleus accumbens in nicotine addiction. However, in no way do they constitute a prompt to stimulate the brains of smokers who want to stop: the invasive character of such methods preclude their use in otherwise healthy individuals and raise a number of ethical challenges.

* * *

Neuroscience research is now providing us with new insights into the mechanisms of nicotine addiction and the impact of conscious and unconscious messages aimed at both encouraging smoking and attempts to prevent it. This growing dataset must prove of great benefit to anti-smoking organisations, complementing insights derived from traditional methods that analyse explicit responses and behaviour. These new brain imaging tools are opening a window on the unconscious responses to sensory information from multiple sensory modalities (visual, tactile, auditory, olfactory, gustatory, proprioceptive and even semantic) that shape and influence our behaviour. While neuroscience alone may not yet be able to provide the definitive solution to

[1] Janes A.C. *et al.* (2010), 'Brain reactivity to smoking cues prior to smoking cessation predicts ability to maintain tobacco abstinence', *Biological Psychiatry*, in press.
[2] Kuhn J. *et al.* (2009), 'Observations on unaided smoking cessation after deep brain stimulation of the nucleus accumbens', *European Addiction Research*, vol. 15(4), p. 196-201.

smoking cessation, it is clear that it has a large part to play in helping improve, refine and position large-scale practical strategies and communications.

We believe it is therefore vital to mobilise this discipline when preparing to analyse the impact of various tobacco advertisements **on the general public (cigarette packets, sponsorship, merchandising, POS advertisements, etc.). Neuroscientific studies are also required in order to gain a much better understanding of the influence and likely impact of anti-smoking campaigns (graphic health warnings, media campaigns inciting fear, neutral packets etc).**

CHAPTER 8

From marketing differentiation to household poisoning: are commercial practices on cleansing products a public health issue?

Frédéric Basso[1], **Olivier Oullier**[2], **Maryvonne Hayek-Lanthois**[3] and **Philippe Robert-Demontrond**[4]

"These products look like drinks beverages. They smell like beverages. And they have no child-resistant cap. A child might be tempted to drink them and that could be harmful," said Don Mays, the Director of Product Safety of Consumer Reports, an American association formed in 1936 to inform consumers, speaking in 2006 about the serious problems posed by certain household products[5].

And KFOX El Paso adds, given the poisonings with Fabuloso reported on the Internet by consumers that: "*The bottles do carry warnings: "Keep out of reach of children" and "Do not drink." But the warnings are small and no help for children who can not read.* […] *One poison Control center received calls from adults who have mistaken these cleaners as well.* […]*Consumer Reports said government standards do not prohibit cleaners from being packaged in this fashion. The safest bet they said is to not buy them*"[6]. Faced with increasing media awareness, the manufacturer of *Fabuloso*, Colgate-Palmolive, was forced to react, as Consumer Reports is pleased to point out on its web site: *"Although the bottle still resembles an energy drink, we are happy Colgate-Palmolive has redesigned Fabuloso's cap to make it safer for children, and hope other manufacturers will follow their lead*"[7].

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[1] On a doctoral fellowship at the IGR-IAE in Rennes and doing a doctoral thesis at the Center for Research in Economics and Management (CREM UMR CNRS 6211) of the university of Rennes-1.

[2] Scientific adviser, Department of Social Affairs, Centre for Strategic Analysis and Associate Professor of Neuroscience, Cognitive Psychology Laboratory (UMR 6146), University of Provence (France).

[3] An anaesthetist-intensive care specialist, responsible for the emergency telephone hotline of the Marseille poison control centre.

[4] Professor in marketing and management at the IGR-IAE in Rennes and a researcher at the Centre for Research in Economics and Management (CREM UMR CNRS 6211) of the university of Rennes-1.

[5] This chapter is based on current research conducted by Frédéric Basso, Philippe Robert-Demontrond, Olivier Oullier, Dr Maryvonne Hayek-Lanthois and her team from the Marseille poison control centre. Frédéric Basso presented this research at the Centre for Strategic Analysis during the seminar "Neuroscience et prévention en santé publique" (Neuroscience and prevention in public health), on 16 June 2009.

[6] "Consumer watch: Dangerous household cleaners look Like sports drinks", - KFOX El Paso, www.kfoxtv.com/money/9486211/detail.html.

[7] Consumer reports on safety, "Fabuloso's better bottle - thanks to you", 27 November 2006, http://blogs.consumerreports.org/safety/2006/11/fabulosos_bette.html.

A number of studies have been conducted by American poison control centres on this product. The retrospective review of cases of poisonings over three years by the Denver poison control centre[1] totals 21 unintentional ingestions of *Fabuloso*. The problem is said to be due to the fact that "*some manufacturers have resorted to ultra-modern designs of liquid cleaning agents in order to make them more attractive*". The conclusion is that these designs "*may be a source of unintentional exposures in children and adults",* the risk increasing as the population ages. Even more, the team at the Texas poison control centre has identified 104 poisonings, 94 unintentional, with *Fabuloso* during the first four months of 2006. What is most surprising is that 41 people over 20 were among the victims[2]. Once again, doctors outline the problem: **an appealing cleaning product which smells good enough to drink.**

It would be a mistake to think that this is an isolated case. A number of products implicated in unintentional poisonings challenge the aesthetic rationale at work in the area of toxic agents. *Mistolin* has been in the spotlight. The press also reports poisonings involving torch oil and, more recently, windshield wiper fluid . The former, mistaken for apple juice and accidentally ingested, led to six people being hospitalized in New Jersey, in June 2008. One of them, aged 84, died[3]. Around one hundred cases of accidental poisonings occur every year caused by torch oil and generally involve children and the elderly. According to Dr. Michael Wahl, a poison centre's medical director, "*Many lamp oils are colourful and fragranced, which makes it appealing to small children. The problem is, most containers are not child-resistant*." Plus the fact that this oil comes in plastic bottles which look like fruit juice bottles, which increases the possibility of accidental ingestion. More recently, a case has been reported of ten children aged between 2 and 7 who drank windshield wiper fluid which was given to them because it was put in the refrigerator by accident[4].

Making cleaning products appealing for marketing purposes somewhat changes the structure of calls involving cleaning product ingestions: reports are that unintentional poisonings with certain products no longer concern only children but **also a not insignificant percentage of adults**.

All these cases of poisoning raise the same question: why not prohibit toxic products from being confused with food?

1. Marketing versus health

The contradictions between marketing and health obviously lead to tensions[5]. Comments by Rick Kingston, an American toxicologist and consultant for a number of

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[1] Caraccio T. *et al.* (2006), Designs of Liquid Cleaning Agents (LCA) Resembling Food Supplement Drinks (FSD) May Lead to Unintentional Exposures, *Abstracts of the 2006 North American Congress of Clinical Toxicology Annual Meeting*, p.121.

[2] Miller M., Levsky M., Masneri M. and Borys D. (2006a), "Fabuloso: A cleaning product that tastes and smells good enough to drink"*, Annals of Emergency Medicine,* 48, 4, p. 81-81; Miller M., Levsky M., Masneri M. and Borys D. (2006b), "Fabuloso: A cleaning product that tastes and smells good enough to drink"*, Pediatrics*,118, 2, p. 848-849.

[3] Thomas M. (2008), *Torch Oil Looks Like Apple Juice - But it's Toxic*, Safety archives; http://list.uvm.edu/cgi-bin/wa?A2=ind0807a&L=SAFETY&P=42822.

[4] Gambrell J. (2009), "10 children sickened after drinking windshield fluid", WREG, 13 March, www.wreg.com/wreg-ar-windshieldfluid-sickness-story,0,727092.story.

[5] Wogalter M. S. et Cox E. P. (1998), "Guest editorial - Psychology, marketing and warnings research: Bridging the gap between consumer theory and warning practice", *Psychology &*

cosmetic companies, leave no doubt on this point. Recognizing that child-resistant caps save lives, he nevertheless considers that this solution also poses a problem. He says that products given a top like this could be perceived as excessively toxic, while they are not necessarily so[1].

From a marketing point of view, this argument is counterbalanced by the negative publicity arising from a consumer product which causes repeated poisonings, particularly if this information covered in the media leads to boycotts.

However, it must be recognized it is likely that this protection will be a restriction on use which consumers will find a way around. By making it more complicated to open products, the tamper-proof cap has the negative effect of making users deliberately not close products properly, or even to remove them from their bottles[2], i.e. pour them into another container, generally a drink bottle. In this case, there is no longer anything to prevent accidental ingestion. Despite its good points, **the child-resistant cap is therefore not an ideal solution**. In addition, this system is not suitable for all products liable to cause poisoning because of their appealing appearance.

Warning research in ergonomics aims to optimize the perception of risk related to the use of a potentially hazardous product by combining the colours, shapes, sizes and letters recommended to catch the user's attention, notably, on preventive messages, labels and logos[3]. The studies carried out in this area have listed other limits, mainly cognitive and conative:

- **Problems of understanding labels and the message** conveyed;
- the negative impact of the **reduction in packaging size** on the transmission of customary information;
- **familiarity with the product** which reduces vigilance;
- the **cost of conforming to the recommendations** given.

These studies show that the implementation of prevention solutions may sometimes increase exposure to danger. It was through this finding that the Children's Hospital of Pittsburgh created the "Mr. Yuk" logo (a green smiley expressing disgust), in 1971, to replace the traditional skull and crossbones on toxic products, which has the disadvantage of appealing to children by its association with the imaginary world of pirates.

Stemming the rise of unintentional ingestions is ultimately dependent only on the determination of sector professionals: as Consumer reports puts it, nothing in American law prevents them from making domestic cleaning products appealing. In France, the application of a statutory text covers a limited scope, only relating to

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Marketing, 15, 7, p. 615-619; Cox III E. P. (2006), "Marketing versus Warning", *in* M. S. Wogalter (coord.), *Handbook of Warnings*, London, Lawrence Erlbaum Associates Publishers.

[1] Levy S. (2001), "CPSC to require child-resistant packaging on some household products", *Drug Topics*, 22.

[2] Schneider K. C. (1977), "Prevention of accidental poisoning through package and label design", *Journal of Consumer Research*, 4, September, p. 67-74; Sherrard J. *et al.* (2005), *Barriers to Child Poisoning: Why does Child Resistant Packaging Fail?*, Accident Research Centre, Monash University, August, 84 p.

[3] Wogalter M. S. (2006) (coord.), *Handbook of Warnings*, London, Lawrence Erlbaum Associates Publishers.

products which are dangerous for the health (*Box n°10*). A reminder is merely given in a circular that "*receptacles containing dangerous preparations offered or sold to the public must not have a shape or graphic decoration such as to attract or encourage children's active curiosity or mislead consumers, nor a presentation and/or denomination used for foodstuffs, animal food or medical products or cosmetics*"[1].

Box n°10
Statutory and institutional positions

Point 2.2 of DRT circular number 13 of 24 May 2006 ensues from various provisions of EC law and national law.

At EC level, directive number 87-357 of the European Community Council was aimed at reconciling member state legislations on products which, appearing to be other than they are, endanger consumers' health or safety. The aim of this directive is to prohibit marketing practices which give the appearance, smell or packaging of foodstuffs to products which in fact are not edible and which therefore lead to poisonings. If a member state forbids such a product from being sold on its territory, it must inform the European Commission and provide sufficient details for the other member states to identify it and take appropriate measures to prevent any risk of poisoning. This directive has already been applied to a number of products (soap, candles, etc.[2]) on the domestic market, since they entail a risk of poisoning or perforation of the digestive tract.

Under national law, decree number 92-985 of 9 September 1992 on food imitating products transposed the provisions of directive number 87-357 into the French internal legal system. According to Article 1 of decree number 92-985 (which repeats in substance paragraph 2 of Article 1 of directive 87-357): products *"which, although not foodstuffs, possess a form, odour, colour, appearance, packaging, labelling, volume or size, such that it is likely that consumers, especially children, will confuse them with foodstuffs, should not entail any risks for their safety or health such as suffocation, poisoning, or the perforation or obstruction of the digestive tract"*.

Despite these provisions, cases continue of unintentional poisoning due to inedible food imitating products. This is demonstrated by the call by the European Commission's Directorate General for Health and Consumers in June 2009 and the proceedings of the Scientific Committee on Consumer Safety (SCCS) for additional data on the potential risks caused by consumer chemical products imitating the appearance of foodstuffs or appealing to children[3]. These products include shampoos and body lotions, as well as liquid soap, which by their colour, shape, consistency or packaging could lead consumers, especially children or the elderly, to ingest them and cause poisonings.

2. From appeal to poisoning

The aim here is not to blow the whistle on all the brands involved in unintentional poisonings but to identify a marketing approach which is increasingly dominating the market. To do this, we will emphasize not only the relations at a commercial level between foodstuffs and detergents, but also those between domestic cleaning products and cosmetics. For, while the question of hygiene is involved in both cases, personal hygiene on the one hand and environmental hygiene on the other, very often

[1] DRT circular 13 of 24 May 2006, point 2.2.
[2] For illustrations see: www.dolceta.eu/united-kingdom/Mod3/spip.php?article183.
[3] See: http://ec.europa.eu/health/ph_risk/committees/04_sccs/sccs_call_info_01_en.print.htm.

cosmetics enable us to identify future domestic cleaning trends. In this approach, the realms of aesthetics and play are therefore sometimes added to the world of foodstuffs. If the design of these products is becoming constantly more attractive, it is in order to more effectively differentiate the product from the competition on the shelf.

To make products more appealing, manufacturers now use differentiation techniques based on generating positive emotions through "emotional design", a concept introduced in 2004 with the publication of Donald Norman's book[1]. Since then, washing up liquid containers have been designed by fashion designers or based on toys in order to brighten up consumers' homes. In the past, form followed function. Nowadays, form follows the emotions. The design has to be empathic to attract consumers. Products have to be made appealing to arouse positive emotions in consumers. Of course, this does not mean strong emotions. Be that as it may, the evident aim of creating a positive valence in product evaluation[2] just by the sight of it, is frequently achieved.

Among the spheres which inspire marketing specialists is that of aesthetics. For example, a brand launched a competition on the internet for fashion designers to personalize and individualize its cleaning products. In 2008, they were identified according to the hobbies, age, level of education and backgrounds of the players which are represented on them. Storytelling and dramatization seem to be the new way of thinking product in point of sale[3]. **Through the positive emotions generated, the product on the shelf must be distinguished – differentiated –from the hundred others and the consumption experience memorized. Users must become attached to it as it is displayed at home and finally purchase it again because it has become familiar.**

Reading the comments of a marketing manager in the professional literature who praises the commercial advantages of products from the realm of play is enough to convince us of this: "*We always start with a consumer situation where there is an advantage in having a designer or "better looking" product. We found that female consumers were hiding their washing up liquid, although the proper place for it is on the sink. They wanted something different* (…) *This was a product visible to everyone, family or guests. A nice, original design comes into its own here, but it has to be in addition to the expected performance (here, cleaning and perfume)*"[4]. Nowadays, a cleaning product must be attractive and on display within the home. All in all, contrary to common health sense; for commercial reasons, there is no longer anything to dissuade a child from investigating a hazardous product. Nothing to discourage the brand Alessi, the player in the world of design which considerably influenced Donald Norman's work on emotional design, from taking part in the creation of a toilet block resembling a toy… In 2001, already, a washing product had been designed to look like a bath gel pearl, the sign of a trend towards "cosmetization", destined to incorporate the cosmetic aspect with cleaning products.

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[1] Norman D. A. (2005), *Emotional Design - Why we love (or hate) everyday things*, New York, Basic Books.
[2] Creusen M. E. H. and Schoormans J. P. L. (2005), "The different roles of product appearance in consumer choice", *The Journal of Product Innovation Management*, no. 22, p. 63-81.
[3] Filser M. (2002), "Marketing of experience production : theorical framework and managerial implications", *Décisions Marketing*, 28, Oct.-Dec., p. 13-22.
[4] Quoted by Cristofari J.-F. (2008), "Packaging et produits d'entretien font bon ménage", *Marketing magazine*, no. 122, p. 61-66.

Food codes, which convey "generosity" and "supreme indulgence", to refer to a vocabulary once again borrowed from the professional literature, are also extensively copied on all sides. This is demonstrated by the creation of soap shaped like macaroons, with the help of a well-known Parisian producer. Will someone one day perhaps try to eat them? Maybe this has already happened and we do not know. And maybe they will once again say that it is an accident, a mistake for which the poisoned person and not the producer is responsible.

Despite the statutory provisions we mentioned above, these elements are not hidden from the general public. On 15 June 2009, the magazine "*A nous Paris"* contained a feature with a full page collection of food-inspired cosmetics. Certainly, precautions are taken: on one product, it is clearly mentioned that the product is not for eating; on another (on the toilet block just referred to), it is expressly written "*this is not a toy*" although everything about its appearance is designed to make one think so.

A web site devoted to packaging recently mentioned, in the presentation of a cosmetic: *"Beware. Ladies who usually put some of their beauty products in the refrigerator should be careful at desert time. X exhilarating cleansing foam is not chantilly cream"*[1]. A strange launch for a cosmetic... Any marketing specialist knows that "Beware" should under no circumstances be used on a new product. However, it is still possible to confuse it with cream. The front of the pump bottle claims nothing other than a "chantilly texture".

3. From poison control centre to experimentation

Generally speaking, people who poison themselves with household products and call the emergency services (including poison control centres) feel guilty, blaming it on their carelessness rather than the product packaging.

It is not always those who create household products imitating the presentation of foodstuffs who are accused by patients. **However, research shows to what extent human error is generally caused by an object's poor design[2].** Are these products which are crying out to be eaten really likely to be eaten? As for the nine other French centres, the emergency telephone hotline of the Marseille poison control centre connects a patient with a doctor. All the information collected on these poisonings is then compiled in a national database, which gives access to the patient's name, their medical file, the incriminated product and the context of the poisoning.

As children have poor risk perception, of the calls received at the Marseilles poison control centre, only cases of poisoning involving adults are examined. It can be assumed that poisoning of adults by a particular product will invariably be repeated with children (and the elderly, who likewise have poorer risk perception).

The Marseille poison control centre treats some 25,000 cases every year. Analysis of the cases selected is based on their encoding as an everyday accident and their description in the medical file. Cases involving children and the very elderly and cases of defective risk perception affecting people with dementia or suffering from

[1] Emballagedigest.fr (2005), "L'hygiène beauté se fait mouser", 30 June; www.emballagedigest.fr/blog.php?2005/06/30/1181-hygiene
[2] Norman D. A. (2002), *The Design of Everyday Things*, New York, Basic Books.

psychiatric problems are excluded. Cases where a hazardous product is removed from its container and poured into another one (generally a drink bottle) are not used either.

The most relevant calls (around 1 file out of 100) are also listened to, transcribed and analysed in linguistic terms based on the analysis of FAKE in conceptual metaphor theory. In line with George Lakoff and Mark Johnson[1] work in the early 1980s, our approach examines whether domestic products or cosmetics, ingested or not, are considered as FAKE foodstuffs[2].

Let us take the example of the man who, according to the description in the medical file, bought a new fluorescent green shower gel with extracts of orange at the supermarket. His wife confused the product with orange juice and drank a mouthful of it. It remains to be determined whether the confusion is the result of the context or the packaging. If the product was ingested for the simple reason that it was inadvertently placed in the refrigerator, this would certainly reveal a problem of categorisation but the poisoning is perhaps due, above all, to a mistake when putting the product away. If it had been put somewhere else, the product would perhaps not have led to a poisoning.

Brain sciences prove useful in **trying to identify what is due to a fault in categorization and contextualization**. This involves firstly analysing consumers' emotional reactions[3], when they are shown products which may or may not have caused poisonings, through a series of experiments. These products were chosen precisely because they were involved in actual cases of ingestion resulting in the creation of a medical file by the Marseilles poison control centre. It is thus a matter of **identifying what, in consumers' behavioural reactions, distinguishes them from products with more neutral packaging, in particular, when it is not inspired by the realm of food.**

Thanks to functional Magnetic Resonance Imaging (fMRI) **any activation of gustatory processing areas** at the sight of these products[4] is brought to light (in the insula and the orbito-frontal cortex). It can thus be determined if individuals **have made inferences on a product's taste from the mere sight of its packaging**. fMRI results are not always "consistent" with what people say and their comments are often a retrospective rationalization of their behaviour. But fMRI can identify activation of the gustatory cortices, showing congruence between an individual's subjective experiences in the field, i.e. social science data, and laboratory data. This gives information on the cerebral correlates activated on presentation of a product implicated in a household poisoning.

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[1] Lakoff G. and Johnson M. (1985), *Les Métaphores dans la vie quotidienne*, Paris, Éditions de Minuit.

[2] Basso F., Robert-Demontrond P. and Oullier O. (2009), "De la théâtralisation du point de vente à la dramatisation du lieu de vie: une analyse métaphorique de l'expérience de consommation de produits d'hygiène", *in* Filser M. (coord.), *Actes des 14e Journées de recherche en marketing de Bourgogne*.

[3] These reactions are measured using the electrodermal response which measures changes in skin conductivity and represents a peripheral manifestation of the brain's "emotional" activity.

[4] Simmons W. K., Martin A. and Barsalou L. W. (2005), "Pictures of appetizing foods activate gustatory cortices for taste and Reward", *Cerebral Cortex*, 15(10), p. 1602-1608.

4. From the circumstances of an unintentional ingestion to a prevention solution

This approach corresponds to the definition of the emotional design of products implicated in accidental poisonings. According to Norman, there are three dimensions to emotional design: **visceral, behavioural and reflective.** The first is automatic and unconscious at the mere sight of the product. The second is also automatic and unconscious but it comes from interaction with the object, not just the sight of it. The last is, on the other hand, conscious and its judgement is subjective, that is, mainly dependent on the experience of each individual.

The behavioural manifestations of the emotional design of these products have been observed **retrospectively** by the study of the cases collected by the Marseille poison control centre. Electrodermal reactions and fMRI respectively complete this analysis from the point of view of visceral design and reflective design.

At visceral level, the analysis is confined to a statement by the individual on the positive or negative valence elicited immediately when the object is presented and lends itself, according to Norman, only to physiological measurement. Consequently, if subjects are exposed to photos of products implicated in poisonings, **electrodermal measurements**, under certain time conditions, **combined with a statement on the valence of items perceived,** are a means of identifying **subjects' visceral emotional reactions**.

Analysis of the reflective level, related to the subject's real life and conscious experience, is **based on cerebral imaging (fMRI) to observe whether the presentation of photographs of cleaning products implicated in poisonings activates subjects' sense of taste.** For a cleaning product ingested in a laboratory context, there may be an additional index of its categorization as a foodstuff.

After these experiments, it could be maintained that the aesthetic rationales of emotional design used in the commercial differentiation of cleaning products at the point of sale, are involved in unintentional ingestions.

And then what? What solution can be proposed? Try to **suggest, in children and adults, an intuitive perception of risk, not based on a purely "cognitive"** (or educative) **approach**, as a code to be learnt. The aim is not to put up a barrier against the marketing of appealing cleaning products but to know how to identify them and extend the practices used for hazardous chemicals to products which can potentially lead to poisoning. It is compulsory for there to be a little triangle, identifiable by touch, on the bottles of certain powerful detergents.

In ergonomic terms, touch would appear to be the appropriate solution, suggested by prevention ergonomics research[1]. This is also true in social terms, given the ageing population.

In the light of these points, this is an original solution using the role of multi-sensory coordination[1] in risk perception by the consumer, through a bimodal warning. It is in

[1] Kalsher M. J., Cote M. B., Champagne M. V. and Wogalter M. S. (1997), "The effects of a raised label border on warning effectiveness measures", *Proceedings of the Human Factors and Ergonomics Society 41st Annual Meeting*.

fact specified in DRT circular number 13 of 24 May 2006 that "*containers holding very toxic, toxic, corrosive or harmful preparations* […] *must have a danger warning detectable by touch"*.

With a **bimodal warning**, it could be possible to make use of visual-tactual incongruities[2] which indicate by touch the existence of a risk on products which could be considered as attractive to the eye and lead to confusion. In this way, attention is drawn to the product's conditions of use while bringing into play a non-cognitive aspect, by generating an emotion of surprise. There is thus no code to be learnt. This primary emotion is by definition shared by everyone, whatever their age.

A tactile warning would be placed on the bottle (on the handle or the gripping area) of a product liable to be ingested. This solution could be extended to the problems of removal from the original container using a container designed to enable everyone to safely pour their cleaning products into other containers.

This system would have the other advantage of developing corporate social responsibility, while allowing them to continue to make cleaning products appealing. In this way, an "accommodation solution" would be developed, preserving corporate interests while preventing poisonings.

To sum up, **the results of our product experiential approach would be used to prevent poisonings at home through mix-ups**. If these approaches are effective at selling, they can also be effective at protecting the consumer. Ultimately, social use of preventive results will be more fully adopted by companies themselves, if it is based on tools they are already aware of. The solution put forward here should enable firms to reconsider their social responsibility by applying the theoretical concepts they use for other purposes in addition to their commercial rationale.

Given the rapid dissemination of information on the internet and the organization of consumer resistance practices on the web, this opportunity is far from insignificant. Not unrelated to this research, Julien Bouillé experimentally tested the effect that media coverage of an appeal enhanced personal cleansing or household cleaning product implicated in an unintentional ingestion recorded by a poison control centre could have on internet surfers' boycott intentions[3].

These efforts combined under the umbrella of a multi-disciplinary approach should help achieve better understanding of the causes of unintentional household poisonings and demonstrate the risk sometimes associated with marketing practices which dismiss health problems (*Box n°11)*.

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[1] Multi-sensory integration describes the fact that the result obtained from the stimulation of at least two sensory sources differs from the result of individual stimulation of each sense. The resulting hypothesis is that the product of the interaction of these multiple sources is integrated (it forms a specific whole). See the reference work by Calvert G., Spence C. and Stein B. E. (2004), *The Handbook of Multisensory Processes*, Cambridge, MIT Press.

[2] Schifferstein H. N. J. and Spence C. (2008), "Multisensory product experience", *in* Schifferstein H. N. J. and Hekkert P. (coord.) (2008), *Product Experience,* Elsevier; Ludden G. D. S., Schifferstein H. N. J. and Hekkert P. (2009), "Visual - tactual incongruities in products as sources of surprise", *Empirical Studies of the Arts*, 27(1), p. 61-87.

[3] Bouillé J. and Robert-Demontrond P. (2009), "Meso-dynamiques de la résistance des consommateurs et Webactivisme: apports théoriques et méthodologiques de la psychologie sociale", *in* Filser M. (coord.), *Actes des 14e Journées de recherche en marketing de Bourgogne*.

Box n°11

Neuroscience, sensory congruence and household poisonings

During the "Neuroscience et prévention en santé publique" seminar, Gemma Calvert talked about other types of research linking the neuroscience, sensory congruence and household poisonings.

"During an experiment conducted with the members of my team, we worked on household cleaning or cosmetic products. We recorded the cerebral activity of consumers exposed to stimuli of different kinds (smell, colour and shapes) as well as to bimodal combinations, congruent or not, like the smell of strawberries associated with a red or blue object.

Our study, like several already carried out in different contexts, confirms that the orbito-frontal cortex is a region of the brain which encodes the pleasure associated with a stimulus in a linear manner. When people smelled only food odours, orbito-frontal cortex activation increased significantly, just like the degree of pleasure they stated that they felt). Combining one of these smells with congruent visual information (a strawberry smell and a red object, for example) caused an even higher level of activation of this region of the brain. On the other hand, we observed a decrease in activity when the colour did not correspond to the smell. In fact, cerebral activity in the orbito-frontal cortex under non-congruent visual-olfactory conditions was even below that recorded when the smell alone was present.

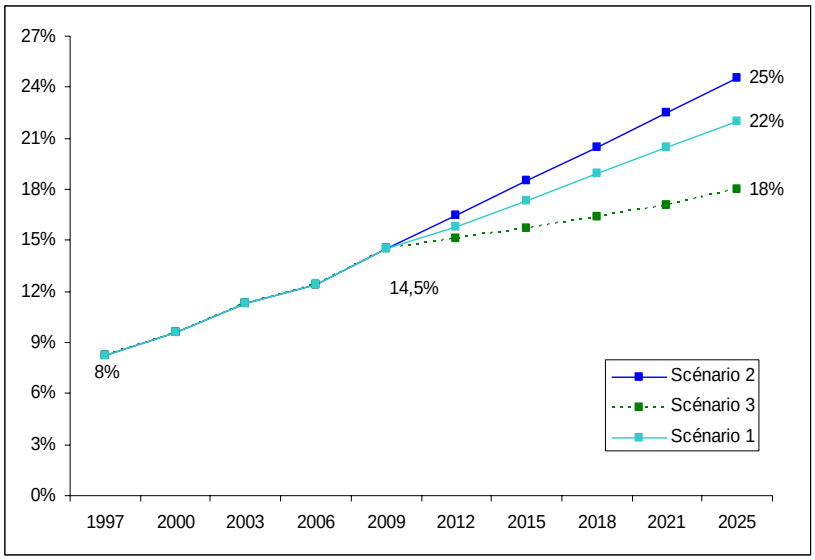
These results, published in the Journal of Neurophysiology, *were the starting point for studies that we conducted in partnership with the perfume industry and consumers' associations which wanted to understand how packaging could influence perception and what types of warning would be the most effective in avoiding ingestion of toxic products".*

PART 3

Fighting obesity differently: early prevention and education strategies

France might still be one of the OECD countries least affected by obesity[1], but the problem has been getting worse over the last twenty years. Having risen to a level of 14.5 % in adults today[2], **according to a trend scenario, the prevalence rate for obesity could reach 22% between now and 2025, meaning more than one person in five**. The inertia of such a phenomenon shows that, for the time being, all scenarios show an increase. **Only preventive policies that are particularly proactive and effective will be able to *arrest* this progression** (*Figure n° 18*). In the longer term, they might help to bring about a fundamental change to the related social behaviours and norms.

Figure n°18: Obesity: a considerable problem for the future



Interpretation: According to scenario 1, based on the hypothesis of a continuation of the average trend observed since 1997, obesity prevalence rates in adults would reach 22% by 2025, meaning more than one person in five. Based on the hypothesis of a rate of increase in the prevalence of obesity similar to that observed in the United States throughout the 1990s, scenario 2 shows that a quarter of the population of France could be obese by this point. Scenario 3, based on a proactive approach, presupposes ambitious prevention policies more effective than any implemented to date. This would be reflected by a very slight decrease in the trend between now and 2025, finally reaching a prevalence rate of 18%.

Sources: Centre for Strategic Analysis, (2008), France 2025, "Protection and risks" group, updated with *Obépi information from 2009*

Obesity has **major consequences potentially leading to a dicrease in the quality of life of the individuals concerned.** It is primarily a **major risk factor for the onset of certain diseases** (cardiovascular, type II diabetes, certain cancers, etc.). According to the WHO, nearly half of all cases of diabetes and almost half of all coronary problems can be traced to excess weight and obesity at a global level. Excess weight is reportedly the cause of 10% of deaths and periods of invalidity.

In addition to this, obesity is subject to fairly serious **discrimination**. This can have a negative effect on the adult job situation (difficulties with access to and maintaining a job) and child development, with a **risk of social stagnation** and even displacement

[1] Cf. OCDE (2009), *Panorama de la santé*.
[2] Information from Obépi, Roche (2009), "Enquête épidémiologique nationale sur le surpoids et l'obésité". [~"National epidemiological survey on excess weight and obesity"].

to a lower social class[1]. There can also be difficulties with daily life, in terms of mobility and access to certain types of care for example, because public transport and medical facilities are not sufficiently adapted to their needs.

At a collective level, obesity incurs **considerable costs:** today estimated at around 15 billion Euros on a global scale, and, according to the WHO[2], this figure could double between now and 2015 if the current progressive rate of prevalence continues. **In France**, the medical costs alone reported in 2002 to be directly connected with obesity and the associated risk factors ranged from **€2.6 to €5.1 billion**[3].

This public health problem, which the WHO calls the epidemic of the century, has now become a political imperative (*Chapter 9*). **Only integrated**[4] **coordinated strategies** involving multiple stakeholders have **demonstrated any real efficacy, which can only be measured across the long term**[5]. Traditionally, these have been based on three complementary elements: informing and educating the individual, making changes to their environment, and initiatives on the ground.[6] Communication campaigns are an **essential tool for raising public awareness** in the fight against obesity, and can be improved upon inexpensively, thanks to knowledge acquired in the behavioural sciences and neuroscience (*Chapter 10*). In the longer term, scientific research gives us hope for a better understanding of the cerebral mechanisms involved in the development of obesity, so that we can reshape and redesign our preventive strategies (*Chapter 11*).

[1] Centre for strategic analysis (2009), *La Mesure du déclassement (~Measuring falls in social class)*, report coordinated by Marine Boisson, Paris, La Documentation française.
http://www.strategie.gouv.fr/article.php3?id_article=1023
[2] www.who.int/features/factfiles/obesity/fr/index.html
[3] Emery C., Dinet J., Lafuma A., Sermet C. *et al.* (2007), "Cost of obesity in France", *Presse Médicale*, 36, p. 832-840 ; www.em-consulte.com/article/103325
[4] Cf. Gerber S.-L. (2010), "Vaut-il toujours mieux prévenir que guérir ? Arguments pour une prévention plus ciblée " (~ "Is it always better to prevent than to cure? Arguments for more targeted prevention"), *La Note de Veille*, n°167, Centre for strategic analysis, March.
[5] OECD (2009), "Improving lifestyles, tackling obesity: the health and economic impact of prevention strategies", *OECD health working papers,* n°48. The adoption of a "multi-party" approach is cited here as the most effective way to make progress in the prevention of chronic diseases linked to bad eating habits and a sedentary lifestyle.
[6] Read J. M. Borys when interviewed at OPECST, 4 March 2009, www.senat.fr/rap/r08-477/r08-477.html.

CHAPTER 9

Fighting obesity: a political priority

Valérie Boyer[1]

Parliament Member for the Bouches-du-Rhône (region of Marseille), Valérie Boyer is the author of a parliamentary report on the fight against obesity published in 2008. The Centre for Strategic Analysis invited her to share her expertise at the seminal workshop entitled "*Neuroscience and public health prevention*". Apart from the necessity to optimise information campaigns, two other challenges seem to be of prime importance: the fight against discrimination toward overweight and obese people and the promotion of education in nutrition, food and cooking for all[2].

1. Parliamentary report: *Turning the fight against obesity and overweight into a major national cause*

1.1. Presentation

As a basis for its work and the writing of the report, the parliamentary committee conducted around forty interviews and round table discussions involving 140 people and 75 organisations. In September 2008, Valérie Boyer submitted her information report entitled ***"Turning the fight against obesity into a major national cause"*** to the Commission for cultural, family and social affairs at the French Parliament (Assemblée Nationale). The report introduced **80 proposals**[3], some of which are not related to a legislative remit. These proposals can be divided into eight categories:

- improve early screening for obesity and management of obese and overweight people;
- improve the nutritional quality of foodstuffs;
- ensure the provision of good nutritional information and promote physical activity;
- improve nutritional labelling and the access of people with low income to healthy products, including fruit and vegetables;
- change the environment to make it less obesogenic;
- support health and nutrition education;
- develop training in nutrition and establish new occupations;
- respect the rights of obese persons.

[1] Member of the French Parliament for the Bouches-du-Rhône
[2] This chapter reproduces the core of Valérie Boyer's talk in 2009 with further addition and updates.
[3] www.assemblee-nationale.fr/13/rap-info/i1131.asp.

1.2. Making obesity a major national cause

Although a public health problem, **obesity is primarily a social one, which is often associated with financial precarity and requires us to consider the way we live**. In fact, quite apart from requiring a simple remedy in terms of nutrition, it requires us to reconsider all of our behaviour. Everyone knows that one needs to engage in regular physical activity, decide to walk instead of taking the car and – if possible – avoid snacking. That doesn't make it any easier to change on an individual basis, and it is even harder for us all to make a collective change.

The **obesity epidemic affects 8 million French people and costs €15 billion every year.** The proportion of the French population that is obese or overweight is over 50%, with children being the most affected category. According to Laurent Degos, President of the French High Authority for Health (*Collège de la Haute Autorité de Santé*), we will not be able to maintain our current system of social health and protection if we do not succeed in containing this epidemic.

Nevertheless, the resources made available for fighting overweight and obesity appear to be somewhat meagre. This can be explained by the fact that this is a challenge affecting our future, whereas periods of government are relatively brief. France opted for a social health system, and the French continue to support this to a great extent, but the authorities need to take this fully on board, mainly by running powerful campaigns on strategic topics such as obesity.

Thanks to the legislative tool that Valérie Boyer has had adopted in the form of the bill entitled "Hospital, Patients, Health, Region"[1], **from now on, the public health code will include a booklet devoted to the fight against problems related to eating behaviours and a section on the subject of preventing obesity and overweight.** This raises the prevention of obesity and overweight to the political level of public health, and stipulates that the State should organise and coordinate the prevention of, treatment for and fight against obesity and overweight, particularly via campaigns authorised by the National Institute for Health Prevention and Education (Institut National de Prévention et d'Education pour la Santé, INPES)[2].

According to the Member of the French Parliament for the Bouches-du-Rhône, this issue needs to be **viewed as a major national cause.** An aggravating factor in terms of chronic disease, obesity has a high rate of incidence. Obese persons should not be stigmatised, but we need to stand up and face the problem, like we have with the cancer and Alzheimer's disease Plans, organ donation and battered women.

2. The need to communicate and inform better

2.1. How can we improve nutritional information and training?

It is now urgent for us to use modern communication methods. Public communication needs to be even more effective precisely because resources are scarce. Several proposals in the present report refer to public health messages, which do not have

[1] www.assemblee-nationale.fr/13/dossiers/reforme_hopital.asp.
[2] www.inpes.sante.fr/.

enough exposure. They deserve enhancement via free rates or financial advantages. The agri-foods industry spends €2 billion every year on promoting its products. Compared to this, INPES' budget covering all campaigns is only €5 million. There is such an immense difference in scale that we can hardly hope to change behaviour in this way.

There is too often a **tendency to confuse awareness levels with effectiveness**. In terms of public communication, the fresh vegetable and fruit campaign can be proud of achieving a very high level of awareness[1]. Nevertheless, its impact has been minimum to nil on the populations most affected by the obesity epidemic, i.e. those living in the most disadvantaged socio-economic environments. Even counter-productive results, along with frustration and incomprehension, have been noticed in these populations.

We therefore need to make messages more effective by using all available resources, including behavioural and brain sciences, which could shed new light on the true impact of autonomous preventive initiatives, so that they can be either approved or adapted prior their use in the media. For instance, using cognitive neuroscience could help INPES to assess, conduct and check obesity prevention campaigns designed and run by the institute.

In addition, efforts need to be made to make **nutrition training more reliable**, given that it is currently somewhat disparate or managed by people who care little for the detail, and that everyone seems to be able to claim themselves as a "coach" these days. As the summer gets closer, magazines are full of articles on miracle diets, and the public sometimes put more faith in these claims than any messages issued by the INPES and its expert nutritionists!

There also seems to be an urgent requirement to **make nutrition information more reliable**. On that front, Valérie Boyer favours a "PNNS[2]" label to be issued by the INPES and/or the Ministry of Health and Sports. Nutrition information, physical activity promotion and prevention initiatives need to be managed or authorised by the authorities in order to prevent "charlatanism" and conflicting messages. This is the tenor of article L. 3224-3 of the French Public Health Code, which stipulates that *"information campaigns against obesity and overweight shall be approved by the National Institute for Health Education and Prevention (INPEs)"*.

2.2. Taxation or health banners, do we have to choose?

Parliament Members addressed this issue during the last mandate period. They voted for a tax on manufactured food products and drinks with added sugar, which are the main products featuring in major communication campaigns (advertisements for fruit, vegetables or unprocessed products are indeed quite rare).

However, at the last moment and in response to heavy lobbying, it was decided that the companies targeted could be spared this tax if they put an information banner in their ads ("eat and move" banner). The French Parliament enacted this provision, thinking that industries would prefer paying a tax over including a banner.

[1] One of the major campaign in France entices people into eating five portions of fruit and vegetables a day (Manger cinq fruits et legumes par jour)
[2] National nutrition/health programme; www.mangerbouger.fr/menu-secondaire/pnns/.

Today, this tax, usually used to fund public health prevention, has a ridiculously low impact, as the agri-foods industry puts the nutrition banner in all of its advertising. The result is that **the banner no longer has any effect on consumers, and the agri-foods industry doesn't have to pay the tax that would fund prevention.** It's a "lose-lose" situation for prevention…

The lack of any real communication strategy explains the relative failure of these messages. Without any precise target audience, only members of the public who are already aware will manage to put the advice into practice. In fact, it is the members of the public most affected by obesity who, for cultural or economic reasons, are unable to put these messages into practice. A number of observers have in fact referred to the fact that they tend to **raise the concept of guilt.**

Following such a failure, Valérie Boyer proposed that the tax should be reinstated without the option to avoid it by including a nutrition banner. The proposal was rejected, and **changed into a good practice charter**[1] linking advertisers, the agri-foods industry and TV. The CSA is in charge of applying it.

According to the CSA, to date, the number of hours of programming on food and physical activity stipulated by the charter was covered by TV stations in 2009. However, programmes are not checked by the Ministry of Health and Sports or the INPES before broadcast. Discussing food or cooking on TV is not always the same as delivering education on food. Only a certain scientific caution can judge whether these programmes are appropriate of not. The charter might require improvement in this regard.

Elsewhere, a number of countries have opted for **a ban on food advertising for products that contain too much fat, sugar or salt from "children's" programming.** For its part, France has preferred to promote a process involving partnership, asking TV stations and the agri-foods industry to withdraw their advertisements from "children's" programming voluntarily. In spite of efforts by the profession, three major advertisers refuse to play the game, thus jeopardising the voluntary participation of the others. **Again, this reveals the limits of self-regulation.** It would seem paradoxical to include programmes on food education, promoting physical activity and prevention stipulated by the Charter on the one hand, but to continue to allow advertising for products with too much fat, sugar and salt during TV slots where shows for childrens are boradcasted on the other.

It is true that no direct link between advertising and obesity has been established, but nothing has been proven to the contrary, either. Health professionals and scientists all seem to agree on the impact of food advertising, especially concerning children with no powers of discrimination. This is why 23 associations and 17 learned societies have declared themselves in favour of withdrawing advertising for products with too much fat, sugar and salt from "youth" TV. Valérie Boyer herself is calling for the special treatment of advertising on children's TV to be covered by the charter. Instead of bans, she prefers methods for approval of advertising limited to certain labelled products by the Ministry of Health and Sports, where nutritional benefits have been proven. After all, she explains, everyone is totally against violence or sex in children's programming. Why not give special treatment to advertisements for products that we know should be consumed in moderation? This approach would have the advantage

[1] See Chapter 10

of protecting our children from the wrongful promotion of certain products, but without penalising TV channels financially. It is not products with too much fat, sugar and salt that constitute a danger, but promoting them to children on TV. We need to remember that **they have the primary influence on what their parents buy, whilst still not having the powers of discrimination required to make balanced food choices.** Don't children deserve to be protected by the *caution principle*?

3. Other major factors

3.1. Responding to the risk of stigmatisation

We **need to address the problem without creating a stigma**, **as obese people are the ones who suffer most from discrimination today,** according to the Sorbonne Discrimination Observatory (Observatoire des discriminations de la Sorbonne) directed by Jean-François Amadieu. Obese or overweight people are three times less likely to receive a response to an application for employment. **Their self-esteem is generally so low that they stay away from professional activities** that they would be capable of doing. A third of the active population is affected by these problems, and it is high time for action.

Campaigns promoting the acceptance of obese or overweight people are definitely needed - similar to those successfully run for people suffering from AIDS-related diseases (along the lines of "having AIDS doesn't stop you from working, loving or doing sport etc."). An amendment by Valérie Boyer to the bill entitled "Hospital, Patients, Health, Region" introduces a booklet devoted to the fight against eating behaviour problems and a title on the prevention of obesity and overweight into the Public Health Code. This title includes information campaigns for the prevention of obesity and overweight and campaigns on the acceptance of obese or overweight people and the fight against the discrimination they suffer.

With respect to charging for seats on aircraft occupied by obese or overweight people, even if, to date, no airline company has decided to make obese people pay for a second seat when travelling, numerous attempts have been regularly announced in the media. Following a survey on this topic carried out by Ryanair on its customers in April 2009, Air France-KLM issued a proposal in January 2010 to make obese people pay 75 % of the price of a second seat on top of the full price of the first seat they occupy.

Whether based on economic or security reasons, such thinking and proposals are shocking, discriminatory and totally unacceptable. In fact, Air France was penalised for a similar situation in 2007, and the practice was banned by the Canadian Supreme Court in November 2008.

As of the worrying progression in the number of obese people in France and throughout the world, aviation companies need to rethink their aircraft cabins and offer a certain number of adapted seats. They need to **adapt to the changing body shapes of citizens in developed and emerging countries, whilst avoiding any stigmatisation or discrimination against these people.**

In this context, Valérie Boyer believes that it is necessary to **take legal steps to re-establish the rights of people to travel with dignity,** whatever their body shape. She considers that, as in Canada, we need to implement the principle of "one person, one rate". In February 2010, she lodged a bill aimed at making it illegal to impose a surcharge on an extremely overweight person buying a plane ticket: *"no price supplement, even for acquiring a second seat at a reduced price, may be required because a passenger is overweight or corpulent".* She hopes that this procedure will be extended to other modes of collective transport.

3.2. A move towards education in nutrition and cookery?

Noting the reduced consumption of fruit and vegetables in France, Valérie Boyer proposed that it should be possible to buy them with restaurant vouchers. Senators approved the provision. INPES conducted a campaign to show that you don't have to stop at fresh products: tinned and frozen food can be just as nutritious.

The fall in consumption is not directly correlated to the price of fruit and vegetables. It is also connected to the fact that many people do not know how to prepare them, or do not have the time. It should be emphasized that a third of fresh products are not eaten, and end up in the bin. We are witnessing a catastrophic loss of domestic skills: many young people do not even know what a cauliflower or fennel looks like... **We will only succeed in changing eating behaviour if we increase the number of initiatives (based on prevention, education and the environment).** Such initiatives will only come from a place of encouragement, and not a repressive approach. We need to use all our resources to encourage the consumption of unprocessed foodstuffs.

A leaflet entitled "The nutritional recommendations of the Collective Catering and Nutrition Study Group" (Les recommandations nutritionnelles du Groupement d'étude des marchés Restauration Collective et Nutrition, GEMRCN) released on May 4, 2007[1] calls for a certain nutritional balance to be observed in canteen menus. Portion sizes and different food groups need to be controlled, which is not always the case, when in fact this is often the only balanced meal that children have in a day. Canteens should also encourage good eating behaviour and make sure that meals are supervised. From this point of view, it would be logical to **offer children products that they do not have at home.**

To this end, Valérie Boyer lodged a bill aimed at making it obligatory to provide leaflets on the nutritional quality of the meals served in school canteens. The proposed initiative concerns pupils at infant and secondary schools in the public and private sectors. It forms part of the fight against child obesity, because **school is an important platform for initiatives, given the essential role of school meals in food education and teaching good eating habits**. This initiative has the advantage of addressing lots of children, especially those from disadvantaged backgrounds, who are most affected by obesity.

A reminder: **six million children use the canteens in infant and secondary schools** and this has been on the increase since the end of the 1990s. Around 60% of children between 3 and 17 eat at least three meals a week there. Compared to the 21 meals

[1] www.nutritiondusport.fr/sfns/wp-content/uploads/2009/06/restauration-collective-recommandation-mai-2007.pdf.

taken in a week, this might seem little, but school meals can – and must – play an important role in the nutritional education of children.

Valérie Boyer changed her "Hospital, Patients, Health, Region" bill with an amendment. Although adopted by the French Parliament, the amendment was rejected by the Senate under pressure from city mayors due to the financial impact on local budgets and public markets that passing her proposal would have had. The bill on the modernisation of agriculture, to be debated in the spring of 2010, is bound to contain some provisions on this subject.

All in all, it would seem essential to **devise nutritional education programmes and cookery lessons for schools on TV** (provided that they are approved by the Ministry of Health and Sports as well as by the INPES) – and why not for companies in the workplace to stem the loss of domestic and cooking skills? Valérie Boyer has called for the implementation of programmes linking health and citizenship education at a national level. The promotion of a balanced diet would naturally have its rightful place in such programmes. Beyond these particular proposals, the time has come for a combined proactive and reactive approach.

CHAPTER 10

Rethinking information and education strategies for the fight against obesity in the light of behavioral and brain sciences

Sarah Sauneron[1], **Virginie Gimbert**[2] and **Olivier Oullier**[3]

Research reveals that the brain and its interactions play a major role in the onset of obesity. If we have a better understanding of the mechanisms of the brain at work, there is hope that we can ultimately achieve more effective prevention, particularly through education, communication and information campaigns. These are still a primary tool for generating public awareness of the fight against obesity, and can be improved at very little cost thanks to the newly found knowledge in behavioural and cognitive (neuro)science. Such improvement can be achieved through types of initiative that are tailored to the target audience, the primary of which is children.

1. The complex aetiology of obesity

Obesity is caused by a number of interacting factors[4]: biological, psychological, cultural and environmental.

1.1. The major importance of the brain

It is difficult to establish exactly how each factor contributes to obesity, but it is estimated that **genetic factors could be responsible for 25% to 40%**[5] **of the cases**. Cases of monogenic[6] obesity are rare, and a large number of genes have been

[1] Project Manager, Department of Social Affairs, Centre for Strategic Analysis.
[2] Project Manager, Department of Social Affairs, Centre for Strategic Analysis.
[3] Scientific adviser, Department of Social Affairs, Centre for Strategic Analysis and Associate Professor of Neuroscience, Cognitive Psychology Laboratory (UMR 6146), University of Provence (France).
[4] The body mass index (BMI) equals weight divided by height squared. A person is considered as overweight if their BMI is between 25 and 29.9, obese if it is greater than or equal to 30 and morbidly obese if it is greater than 40.
[5] Bouchard C., Pérusse L., Rice T. and Rao D. C. (2003), "Genetics of human obesity", *in* Bray G.A. and Bouchard C., *Handbook of Obesity,* 2nd edition, Marcel Dekker, New York.
[6] In general, such cases appear very early and are morbid, and involve the brain's system for regulating satiety via the metabolism of one of its hormones, leptin. This is produced in adipose tissue and is involved in reducing body fat, increasing the basic rate of metabolism and hormonal balance in general.

identified that might be involved at various levels: the metabolism of lipids, the regulation of food intake, the expenditure of energy or the associations made in the brain between pleasure and reward.

Any links that might exist between genetics and brain activity are being increasingly taken into account in the fight against obesity. For that matter, a study, the result of collaboration between 80 international scientific and medical research institutions and involving over 90,000 people, identified six new genetic risk factors giving a predisposition to weight gain, five of which are related to the brain[1]. Brain functions regulating appetite and energy balance are thought to be of primal importance. According to the author of the study, Cristen Willer from the University of Michigan, *"this suggests that certain people may simply be programmed to eat too much"*[2].

In the same way, a study published in 2008 showed that allelic variations in a gene known as FTO (*Fat Mass and O–associated*), could mean a certain genetic predisposition to obesity[3,4]. This gene, which operates in the region of the hypothalamus, particularly in connection with the regulation of appetite and glycaemia, changes eating habits, especially decisions on the type of food eaten. The "loss of control" in terms of consumption would then be a preference for food high in energy value, sugar and fat.

These results support the concept of **the major role of the brain in obesity**, given that most of these genes operate in the brain. Neuroscience data could enable us to **have a better understanding of the brain-related component of obesity** and incorporate this information in future prevention plans.

1.2. Please, please me: obesity, reward and addiction

The wide range of genes identified as risk factors is mirrored by the various theories put forward to explain obesity. Although **the hypothesis based on metabolism**, which considers that an obese person has to eat more because of a greater energy requirement, has still not been verified, a **hypothesis based on the seeking of "brain" reward** or pleasure to eat is being has recently gained acceptance in the neuroscientific field. Eric Stice and his team at the Oregon Research Institute are in fact offering a new way of explaining excessive food intake and hunger in people suffering from obesity: **the need for greater quantities of food to feel pleasure when eating.**

When one swallows food that one likes, the brain releases **dopamine,** a neuro-transmitter that is involved in the reward circuit of the brain (*Box n°12)*. The degree of pleasure linked to food consumption is therefore strongly connected to the amount of

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[1] C. H. Willer *et al*. (2009), « Six new loci associated with body mass index highlight a neuronal influence on body weight regulation », *Nature Genetics,* volume 41(1), p. 25-34.

[2] AFP (2008) « Le cerveau responsable de l'obésité ? » "Is the brain responsible for obesity?", *Le Monde,* edition December 15 issue.

[3] Cecil J. E., Tavendale R., Watt P., Hetherington M. M. and Palmer C.N.A. (2008), « An obesity-associated FTO gene variant and increased energy intake in children », *The New England Journal of Medicine*, vol. 359, 2558-2566.

[4] Predisposition does not signify direct causality. This means that there is such a thing as a favourable genetic platform and that, in fact, the person might be more inclined towards obesity because of an environment that causes obesity, for example. But it is also possible for a person with theses genetic characteristics not to become obese.

dopamine released, especially in a certain area of the brain called the striatum. Using this behavioural work and the BMI, Eric Stice and his collaborators have shown that, in obese people, the response to dopamine and the sensation of pleasure are reduced by a lower number of dopamine receptors in the striatum.

This involvement of the reward circuit in obese people is comparable at certain points with addictive mechanisms identified in smokers and gambling addicts. Furthermore, consuming too rich a diet over several years leads to the exposure of the human body to the effects of habituation and tolerance, which are already recognised in the intake of medication and drug usage, for example. For several years now, the American Association of Psychiatry has pushed for obesity to be included in the **field of psychology and mental problems**, prioritising the **addictive component**. Such an approach would seem to attract two major risks. Firstly, that of giving yet another negative label to obese people already suffering from the public perception and opinion of their pathology and numerous types of discrimination[1]. Secondly, that of sending the wrong message: if an addiction must be stopped, the fight against obesity implies a change of eating habits and physical activity not to stop eating!

Box n° 12

Should you feed your pleasure with too much fat and sugar?

As determined by the most recent INPES health and nutrition barometer[2], the representation of how the French eat has changed radically over the last few years: the pleasure gained from the taste of food has become more important. This observation, which is rather pleasing at the outset, is not without its consequences for the choice of food we eat, as evinced by the preference revealed for buying sugary and/or fatty foods. The work of American neuroscientist Amy Naleid has shown a strong correlation between repeated food intake and the concentration of sugar or maize oil in the substance consumed[3]. This tendency increases when sugar is combined with fats because the dopamine system in the brain becomes overactive. Moreover, the results lead to the conclusion that the ingestion of multi-sensory foods, i.e. those activating different sensory channels via their texture, appearance, composition, smell and temperature, tending to reinforce the operation of the reward circuit in the brain. It remains to be seen whether such increased pleasure can cause an addiction to this type of food, or whether in fact cognitive restriction and the sense of the forbidden drive people to excess consumption, which is comparable to different types of dependency[4].

1.3. Other factors implicated in the onset of obesity

However, genetic factors alone cannot explain the significant increase in the prevalence of obesity observed over the last fifteen years or so. There are several

[1] See Chapter 8.
[2] Escalon H., Bossard C. and Beck F. (dir.) (2009), *Baromètre santé nutrition 2008* (*Health and Nutrition Barometer 2008)*, Saint-Denis, INPES, coll. Baromètres santé, 424 p.
[3] Naleid A. M. *et al.* (2008), "Deconstructing the vanilla milkshake: The dominant effect of sucrose on self-administration of nutrient-flavor mixtures", *Appetite,* 50(1), p. 128-38.
[4] Parker Poppe T. (2009), "How the food makers captured our brains?", *New York Times,* June 23 issue.

major economic and social factors at work[1]: **major changes in lifestyle** are often suggested**,** especially concerning **eating habits and styles**, and **the much more sedentary life** of individuals. Such changes are the major targets of preventive information and education strategies *(Box n°13*).

Box n° 13
Promoting physical activity:
using original campaigns as first steps

To be effective, campaigns promoting physical activity must **try to reach individuals in their daily life**. To this end, the **"Canada on the move"** campaign of 2004 encouraged taking daily walks via health messages broadcast over the media, but also via the commercial distribution of pedometers in packs of cereal and a public Internet search platform. Canadians were asked to *"take 2,000 steps a day"* and *"donate their steps to research"* whilst being able to see the results of their efforts via the national count carried out on the dedicated site. The initiative was conclusive, as 3.5 times more people with the pedometers did the recommended 10,000 a day six months after the campaign, which was a real sign that there had been a true lifestyle change[2].

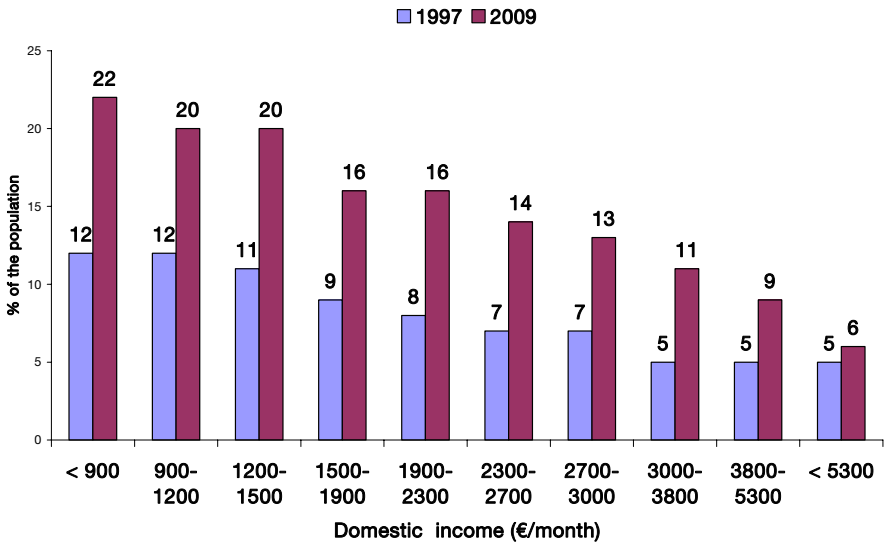
Similar to the "pédibus" initiative in France - the "***Walk Once a Week"*** programme was introduced into **English schools** in 2005: children and their parents were asked to commit to walk to school once a week. The success of the project lies in the fact that it gives an incentive, as children record progress as they go along and win prizes for their class results. In the London region, an increase of 30% was seen in trips to school made on foot. Encouraged by the success of this programme, which was initially focused on London and its immediate suburbs, the British Ministry of Health announced on the 26th of January 2010 that an additional fund of £800,000 would be made available to extend it to 900 more schools located in areas particularly concerned about child obesity and excess weight.

All of these campaigns are based on the fact that exercise is accessible to all, with **a limited number of physical, time and financial constraints,** and on social norms. The more people there are who join in the programme, the more difficult it is for individuals to opt out[3].

Obesity and overweight occur at all levels of the social scale, but there are major disparities across socio-cultural categories (with a greater prevalence in manual workers and employees compared to senior managers), levels of education (**less educated groups** are more affected) and income. Thus, it has been observed that the difference in the prevalence of obesity in adults as a function of income level increased between 1997 and 2009. The linear reduction in the percentage of obesity as a function of the increase in income level signifies the **"social gradient of obesity"** (*Figure n° 19*). Social status would seem to have a powerful influence on the attention paid to health and body, and therefore *in fine* on receptiveness to medical and nutritional information.

Figure n° 19: Development of the prevalence of obesity in adults over the age of 18 in France between 1997 and 2009 as a function of income level

[1] For a summary, see Poulain J.-P. (2009), *Sociologie de l'obésité (Sociology of obesity)*, Paris, PUF.
[2] Craig C.L., Tudor-Locke C., Bauman A. (2007), "Twelve-month effects of Canada on the Move: A population-wide campaign to promote pedometer use and walking", *Health Education Research*, vol. 22, n° 3, p. 406-413.
[3] Cf. Chapter 2.



Source: Obépi (2009)

However, aside from social status, it is above all ***social development*** that is the appropriate factor to explain people being overweight. Thus, work-related stress, unemployment and the **onset of financial insecurity and social exclusion** have a considerable effect. These factors are often accompanied by a change in eating habits, which can be explained by both the relatively high cost of healthy products and sporting activity, and also the loss of a daily routine and the need to compensate for stress and daily worries etc.

2. Improving public communication and information strategies

2.1. Previous campaigns have been somewhat half-hearted

For around a decade, information campaigns on obesity have mainly played the health card. Launched in 2001 for a period of five years, the first "National nutritional health programme" (PNNS) was primarily aimed at improving **the health of the whole population through nutrition**. This initiative included public communication and information campaigns. A campaign boasting the benefits of eating fruit and vegetables every day was devised in 2001, and another one promoting the benefits and practicality of doing 30 minutes of physical activity per day rounded off the communication initiative in 2004[1].

On another front, the law dated the 9th of August 2004 relating to public health policy imposed **the introduction of health messages in food advertising for** *"drinks with added sugar, salt or sugar substitute and processed food products"*[2]. In 2007, The National Institute for Health Prevention and Education (INPES) carried out a survey on

[1] The PNNS 2 (2006-2010) is strongly committed to providing information and communications to the public.
[2] Implemented on 27 February 2007 by legal Decree and Order under the law relating to the public health policy dated 9 August 2004 (Article 29).

the impact of these messages: welcomed by 87% of the people questioned, there was a **good reception**, ranging from 82% to 98 % depending on the slogan tested[1].

However, other studies have fine-tuned the results, since they established that, when recorded, where the viewer look thanks to eye-tracking technology, the eye of the subject was hardly ever focused on the "eat and move" banner at the bottom of advertisements promoting a food product (*Figure n° 20*). Most **health banners** would prove to be **unsuitable,** as they are repetitive and dull, compared to the effects of **habituation** and **sensory over-stimulation** generated by the exciting and dynamic ads used to attract attention and create desire. And apart from this, their size, restricted within the small area imposed on industries by law, makes them difficult to read. This relative level of ineffectiveness is made even more negative by the fact that agri-food industries can avoid paying the tax that goes to the INPES by including these very messages[2].

Figure n° 20: Eye-tracking reveals the ineffectiveness of prevention banner in French ads for agri-food products

Each circle represents the place where the subject focuses his visual attention. The number indicates the strength of focus as the eye moves and the diameter is in proportion to the focus time. In this register, the subject never looks at the health banner underneath.

Source : Médiamento©

INPES also recognises the **risk of confusion between the health message and the product being promoted**[3], a problem raised by the UFC. What choice should be made before including the banners? In fact, in 2006, this association showed that, after viewing a TV advert for cereals high in sugar with the information banner "To stay healthy, avoid eating too many fatty, sugary and salty foods", 68% of the adults surveyed thought that the manufacturer was boasting that the product was nutritionally balanced.

[1] INPES (2008), "Post-test of messages added to food ads for subjects aged 8 and over".
[2] If no health message is added, the, advertiser has to pay the INPES a contribution amounting to 1.5 % of the cost of the advert. According to available data, the tax has brought in very little revenue: 100,000 Euros in 2007 and 30,000 Euros for the first four months of 2008 – nowhere near the "900,000 to 3 million Euros" that the INPES counted on receiving in 2008. See also Chapter 8.
[3] For example, consider a fruit yoghurt as one of the five necessary daily portions of fruit and vegetables.

To make the messages more effective, we therefore need to **vary content, form and design** during the ads. Also, to prevent it being misunderstood and having to compete against the product being promoted, the health message should appear on the screen on its own and be read out by a range of different voices.

Finally, improving the message and making it more memorable does not necessarily bring about a change in consumer behaviour. Thus, only 18% of people surveyed by the INPES said that they had started to change their eating habits, and of these over three quarters did this after the onset of health problems. These results corroborate those of the Nutritional Health Barometer for 2008[1]: recognition of the fruit and vegetables "focus point" did increase from 2.5% to 28.1% between 2002 and2008, but the proportion of French people who had consumed the recommended five portions on the day before the survey had only increased from 10% to 11.8 %[2].

2.2. Broadcasting sensitive health messages

Broadcasting information messages on obesity is no easy task – for several reasons. Firstly, prevention strategies generally **have less impact** when they are not aimed at stopping a behaviour (such as smoking), but only at **changing it** (eating better, moving more). Where food is concerned, the problem lies in *"broadcasting multiple complex messages on nutrition*"[3]. Everyone accepts that tobacco is a danger to health, but **the concept of bad foods is still contested**, as, for some people, it is determined by the way people eat (quantity, frequency, food combination) and physical habits. And, while the strategy behind the fight against tobacco is aimed at making tobacco addiction socially unacceptable, the same cannot be applied to obesity, as there would be a risk of isolating a sector of the population who already suffer from considerable discrimination.

Secondly, contrary to what some public health professionals actually believe, informing those affected should not simply involve encouraging them the make more sensible health choices. The behavioural sciences show that **the decision-making processes related to consumption cannot be explained according to the dictates of standard economic theory**. Individuals have a tendency to under-estimate the long-term risks. In addition to this, the effects of an **environment that causes obesity** (attractive advertisements, fast food available everywhere[4], etc.) on decisions about what to eat are obvious, especially in people who are overweight, who show a greater sensitivity to environmental prompts than that of the rest of the population. Nutrition specialists talk of the **"external food sensitivity" (EFS)** when defining the factors that

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[1] Escalon H., Bossard C. and Beck F. (dir.) (2009), *Nutritional Health Barometer for 2008*, INPES, coll. Health Barometers, 424 p.; www.inpes.sante.fr/CFESBases/catalogue/pdf/1270.pdf.

[2] However, this observation requires fine tuning. Via descriptive and highly varied analyses (logistical regressions with adjustments for sex, age, level of education, revenue per unit of consumption, region and size of residential area), the INPES has shown a significant link between recognition of the focus point and having achieved this the day before daily intake number. Thus, 14.6% of individuals aged 19 to 75 who said that you need to eat at least five fruits and vegetables per day to remain in good health, against 10.0 % who did not know this.

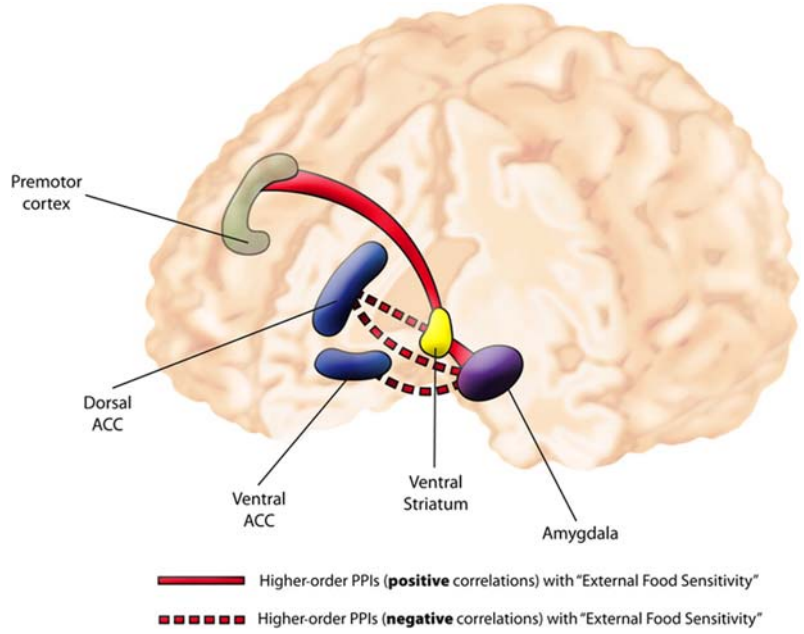
[3] Vanchieri C. (1998) "Lessons from the tobacco wars edify nutrition war tactics", *Journal of the National Cancer Institute*, 90 (6), p. 420-422.

[4] Paquet C., Daniel M., Knäuper B., Gauvin L., Kestens Y. and Dubé L. (2010), "Interactive effects of reward sensitivity and residential fast-food restaurant exposure on fast-food consumption", *American Journal of Clinical Nutrition*, volume 91(3).

show no evidence of intrinsic hunger mechanisms (triggered by metabolic requirements), but still lead to food intake.

While the sensory characteristics of a food, such as flavour,[1] smell or even texture, contribute to the pleasure **of eating, cognitive contextual factors may also play an important role** (*Box n°14*). A team of researchers at the University of Cambridge looked into the neural correlates of ESN in order to gain a better understanding of the role of communications by agri-foods groups in the obesity epidemic[2]. The authors used *"psychophysiological interaction (PPI) to address how the physiological connectivity (coupling) between pairs of regions is affected by psychological context"*. Using an MRI scanner, researchers showed that food presented in an enhanced context leads to changes in certain the brain's functional connectivity[3]: one of these can be attributed to emotional and motivational states evoked by the sight of appetising food, and the other may reflect getting ready to make the movements necessary to grab the food and eat it (*Figure n°21*).

Figure n° 21: Exchange of information between different parts of the brain as a function of external sensitivity to food.



Source : Passamonti et al. (2008) Journal of Neuroscience – Society for Neuroscience©

This study illustrates how **the enhanced presentation of a food** in an **advert** changes the activity of areas in the brain that contribute to **preparing for motor action** and the **sensation of pleasure** when eating.

[1] Representations of flavour in the brain are mainly located in the insular cortex, frontal operculum and the orbitofrontal cortex.
[2] Passamonti L. *et al.* (2009), "Personality predicts the brain's response to viewing appetizing foods: The neural basis of a risk factor for overeating", *Journal of Neuroscience,* 29, p. 43-51.
[3] The connectivity observed is classed as functional, and does not always correspond to anatomical connections between these areas of the: between the amygdala and the ventral striatum and between the ventral striatum and the premotor cortex respectively.

Box n° 14
The pleasure of eating - words have weight

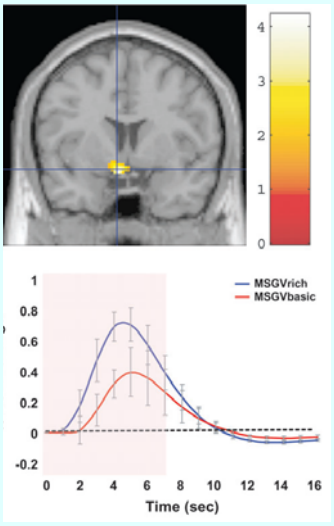


Figure n° 22 : Change in brain activity when ingesting food as a function of its description
(Oxford Press©)

When developing an awareness campaign, as for any initiative involving communication, the choice of words is of primary importance. A recent experiment might suggest some new avenues for assessing how to communicate and promote a balanced diet. Researchers at the University of Oxford[1] have shown that, when food was ingested, activity in areas of the brain contributing to the pleasure of eating was greater if the intake of food was accompanied by the mention of positive words ("rich and delicious flavour" instead of "boiled vegetable water"). Thus, presenting the food as having a "delicious flavour" stimulates significantly greater activity in the ventral striatum than if it is simply described as "vegetable bouillon" (*Figure n° 22*). We learn two things from these results. This can be applied so that **foods highest in calories are given a "neutral "presentation in advertising**. They also suggest that **talking about fruit and vegetables in an appetising way would certainly be more effective in persuading consumers to eat them** five portions of fruit and vegetables a day.

There is no way that we could classify this conclusion as "evidence", but it is still hardly ever applied in promoting a balanced diet. This approach still focuses too often on the nutritional qualities of food, rather than on it being pleasurable to eat.

The third limitation is that these methods of intervention have contrasting effects on populations, as they are **more effective when directed at populations that already aware of the problem**[2], an observation which is not limited to the fight against obesity. The people most affected are the last to be reached by these campaigns (families who are not very aware of nutrition, younger children or overweight children[3]), which serves to **increase health inequalities** (*Box n° 15*).

The risk of adverse effects can clearly be identified as an explanation of this difficulty in persuading individuals who are reluctant right from the start – especially if a message **raises the concept of guilt, is dogmatic, stigmatising or causes anxiety**. If it is advisable to avoid a reaction of defence and denial, the reverse, a **message that is too consensual and without any notion of personal responsibility, is equally to be avoided,** as it will not have a motivational effect. It is therefore advisable to choose any words used with care.

[1] Grabenhorst F., Rolls E. T. and Bilderbeck A. (2008), "How cognition modulates affective responses to taste and flavor: Top-down influences on the orbitofrontal and pregenual cingulate cortices", *Cerebral Cortex*, 18, 1549-1559.
[2] The categories identified in this way are women, well educated people with high socio-professional status, eating few products outside a balanced diet and with a lower proportion of overweight children.
[3] Other data, a study by Ayadi and Ezan (2008) of children aged 8 to 12 shows that health messages might well be remembered, but have not been able to change behaviour, as they are not very attractive or much fun.

In addition to this, a study by Todd Hare and Colin Camerer of the California Institute of Technology shows that prefrontal cortex activations differ in accordance with whether individuals are able to resist the temptation of tasty-looking dishes and choose healthier ones[1] or not. For those who are, taste and health criteria activate a cerebral network governing self-control, which then impacts on a network involved in decision-making. For those who aren't – "irrational gluttons", **the taste criteria get the upper hand**. It is therefore not enough to simply put forward health arguments in a systematic approach in order to have an effect on individuals most affected. Conversely, **enhancing the presentation of diet foods, making them more palatable[2] and devising food and cookery education** that would help people to fully appreciate the flavour would seem to be advisable.

Box n° 15
Obesity and socio-economic inequality

Disadvantaged populations show a greater prevalence of obesity than the rest of the population. It would be appropriate to consider the impact of prevention campaigns on social health inequality: do they constitute an effective way of reducing this, or do they only make the existing disparities wider? A study by Corine Delamaire at the INPES looked into how communication campaigns were received by disadvantaged populations[3].

It would seem that nutritional focus points (such as "5 portions of fruit and vegetables per day") are all viewed in the same way, but **health messages are viewed and accepted to varying degrees depending on socio-economic category**. So, almost twice the number of manual workers consider that messages are supplying new information but likewise, **2.5 more consider that they raise the concept of guilt** and **5 times more consider that they create anxiety**, probably in connection with a feeling of not being able to put them into practice. So, various studies reveal two aspects of food consumption in homes with modest income: **an under-consumption of fresh products and an over-consumption of fatty, salty and sugary foods.** It is generally acknowledged that the price of healthy food is a barrier to consumption, but other factors should be taken into consideration: the extended cooking time, the loss of daily routine with inactive people, eating habits influenced by strong cultural traditions and psychological factors (the problems of daily life push people towards fatty foods, which help quell anxiety or replace affection). In order to develop effective obesity prevention campaigns aimed at disadvantaged persons, it **would seem essential for us to have a greater knowledge of their social backgrounds.**

2.3. Nutrition labelling: a necessity, but not panacea

Nutritional information and education can also be delivered by labelling products, helping consumers to choose according to general or specific recommendations. Even though basing obesity prevention campaigns solely on the energy factor is doomed to failure, such is the importance of the **social, economic and affective aspects** of food, these initiatives are useful, and even more so if they are improved.

[1] Hare T., Camerer C. and Rangel A. (2009), "Self-control in decision-making involves modulation of the vmPFC valuation system"*, Science*, vol. 324, n° 5927, p. 646-648.
[2] "Said of a nice-tasting food".
[3] Delamaire C. (2007), « Facteurs socioéconomiques et perception des campagnes de communication du PNNS » ("Socio-economic Factors and perception of the communication campaigns of the PNNS"), Paris Food Day, session 4.

Widespread throughout many countries, the nutrition labelling system currently **all looks the same in terms of form and content.** The "Proposed European ruling on consumer information for foodstuffs[1]" of the European Parliament and Council is aimed at making nutritional information compulsory and standardising symbols[2].

The European Food Information Council (EUFIC) ran a study in supermarkets in six European countries to compare consumer behaviour in relation to nutrition information[3]. After taking an average of 30 seconds to consider before making a purchase, **the French took the least time to find out this information**, with a figure of only 8.8 %, as against 16.8% for Europe. These figures are lower still when you only look at products purchased for pleasure, which are already known to be not part of a healthy diet.

In addition, according to data from the 2008 health and nutrition barometer, of the 44.1 % of individuals aged 15-75 who say that they read nutrition information on packaging either systematically, now and again or rarely, 45.7 % found the information difficult to read.

Such observations lead one to consider what the ingredients of an effective recipe for nutrition information might be (*Box n° 16*). The same study by the EUFIC reveals that French consumers prefer to see labels giving **recommended daily intake** (RDI) rather than nutrition tables. Also, **a** "ruler"- type **coloured graphic representation**, as for the RDI, is both more attractive and easier to understand [4].

[1] Proposal adopted on the 30th of January 2008; http://agriculture.gouv.fr/sections/thematiques/alimentation/comprendre-informer/informer/informer4149/downloadFile/FichierAttache_3_f0/proposition_reglement_information_consommateur_janvier_2008.pdf?nocache=1264774550.71 .

[2] This is set to replace the two European directives on the subject: directive 2000/13/CE, which defines a certain number of essential rules concerning the labelling of provisions and directive 90/496/CEE of the Council, which establishes that "*nutritional labelling is only compulsory if nutritional or health claims are made on the product, and can otherwise be provided by manufacturers on a voluntary basis*".

[3] Grunert K. G. and Kills J. M. (2008), "Pan-European consumer research on in-store behaviour, understanding and use of nutrition information on food labels, and nutrition knowledge",

[4] Drichoutis A. C., Lazaridis P. and Nayga R. M. (2006), "Consumers' use of nutritionals labels: A review of research studies and issues", *Academy of Marketing Science Review*, n° 9.

Box n° 16
"*Super-inform me*"?

The *Washington Post* site offers its readers a "fast-food Calorie counter"[1].

Moving on from the products themselves, fast-food restaurants could also be made to show the **Calorie content of their menus**, as some brands already do. In fact, for the first time, one study[2] indicates that such an initiative can **change parental behaviour in choosing meals for their children.** Following an experimental protocol, two groups were identified from parents of children aged 3 to 6 years: one having access to a menu giving nutritional information, and the other not. Parents ordered for their children and themselves. It would seem that, on average, the "informed" parents ordered food for their children containing 102 calories less. On the other hand, far from setting a good example in a typical "do as say don't do as I do" fashion, the adults were a lot less sensible when it came to themselves, and the parents who had the nutritional information and changed the order for their children didn't do the same for theirs!

Elsewhere, the application, advocated many times[3], **of a "PNNS label[4]" certified by an independent "recommended" food organisation, could be effective**. Consumers are already used to seeing labels about the production quality of items to precise specifications, as is the case for organic production, for example. This proposal is of even more interest because of the cerebral deregulation that might lead some people to rate these foods too highly in terms of their usefulness, making them to eat too much of them, would be potentially compensated for by labels relating to cognitive strategies.

This logo should appear on the front of the product – the only surface looked at by over 60% of consumers – and be easy for young people to read. Aside from the reluctance of the agri-foods industry, **adding negative symbols, for example a red traffic light[5],** is not very popular with consumers, who **see it as raising the concept of guilt** and too much like "banned products". In contrast to this, since 1989 Sweden has had a **logo in the form of a green lock to identify the healthiest products[6]** (*Figure n° 23*). This system has been rolled out as a common reference across Scandinavian countries, and has been a really successful initiative because the people there have the greatest awareness of labelling systems in Europe.

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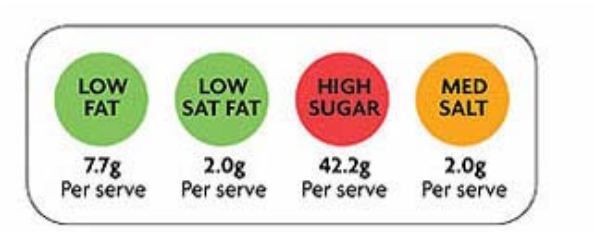
[1] Counter: www.washingtonpost.com/wp-srv/flash/health/caloriecounter/caloriecounter.html.
[2] Tandon P. S., Wright J., Zhou C., Rogersa C. B. and Christakis D. A. (2010), "Nutrition menu labelling may lead to lower-calorie restaurant meal choices for children", *Paediatrics*, appearing soon.
[3] Especially in the parliamentary report by the mission on the prevention of obesity presented by Valérie Boyer en 2008; www.assemblee-nationale.fr/13/rap-info/i1131.asp.
[4] "National nutritional health programme".
[5] The Food Standards Agency (FSA) set up a « traffic light » nutrition labelling system in 2007. For each of the key nutrients– lipids, saturated fats, carbohydrates and salt – an indication is given if it contains a low (green), average (amber) significant (red) amount.
[6] The lock indicates the most balanced food items (containing the least lipids, saturated fatty acids and trans fats, glucides and sodium, and containing the most fibre) for a given category (dairy products, meat, fish, ready meals, fruit, vegetables, cereals, etc.).

Figure n° 23: **Examples of current labelling systems for food products in the United Kingdom (A) Sweden, Norway and Denmark (B)**



(A) *Source: Food Standards Agency*

(B) *Source: Livsmedelsverket*

3. Early intervention to support specific prevention campaigns for children

3.1. The necessity for early prevention strategies

Prevention policies for young children are certainly expensive to implement, but they are justifiable because they are really effective in the long term. A study by the OCDE established that strategies targeted at child obesity have effects that are measurable around forty years after implementation[1]. A number of major arguments show the importance of **acting from a younger age in the fight against obesity.**

First of all, it is hard to move on from being obese or overweight, which is why prevention is preferable in order to avoid onset. This strategy is also based on biology-based arguments. In fact, there is a strong correlation between the BMI at the age of 6 and the same in adulthood, which is specifically explained by the considerable capacity for the formation of adipose cells in early childhood.

Additionally, there is a **progressive deregulation of the system of satiety**: children moderate themselves spontaneously in their first years, but become increasingly sensitive to environmental signals transmitted by products. Thus, it is thought that towards the age of 5, larger portions can mean a general increase in food consumption[2]. This kind of information cannot but encourage us not only to **limit the size of portions offered** by the agri-foods industry, but also to **require packaging of non-healthy food to have a more sober appearance**[3].

Elsewhere, early intervention is required, as it is during childhood that the **process of learning about taste in a social context** takes place. The mere fact of offering a product to children regularly increases their preference for it, and it is during the first

[1] Cf. OCDE (2009), "Improving lifestyles, tackling obesity: the health and economic impact of prevention strategies", *OECD Health Working Papers*, n° 48.
[2] Fomon S. J., Filer L. J. Jr, Thomas L. N., Anderson T. A. and Nelson S. E. (1975), "Influence of formula concentration on caloric intake and growth of normal infants ", *Acta Paediatrica Scandinavica*, 64, p. 172-181.
[3] Chandon P. and Ordabayeva N. (2008), "Supersizing in 1D, downsize in 3D: Effects of spatial dimensionality on size perception and preferences", *Journal of Marketing Research*, XLV, p. 739-753, .

six years that appetence and taste can still be modulated[1]. It is therefore advisable to make the range of food consumed by young children as wide as possible during this period.

In parallel to this, early intervention with children can help in accessing certain populations of parents who are not traditionally aware of information campaigns, especially if they come from disadvantaged backgrounds. In fact, we can observe a **process of transfer from children to their parents** that could bring changes to the eating habits of the whole family.

3.2. The sensitivity of children to images: risk factors…

More time spent in front of the TV means **more time staying sedentary** and encourages **young people to snack**. Also, **increased exposure to advertisements** can bring about an even greater change in their eating habits[2]. Numerous studies reveal that children are particularly sensitive to the impact of images, mainly due to the considerable plasticity of their brains, sometimes referred to as a "**brain like a sponge**". This increased receptivity is a potential danger in that it can be exploited by agri-foods industries, who regard children as a preferred target market.

In fact, ads influence the choice of young people in terms of brand, and change their perception of taste and their preferences. This phenomenon is more marked in **overweight children, as they are more sensitive to food advertising** than non-food advertising, and seeing an advert increases consumption more than in those with a normal BMI[3], hence the **risk of a cumulative effect**.

A recent experiment carried out in children aged 5 demonstrates the influence of fast food brands: when eating totally identical meals but with different packaging, children said they preferred the food that had supposedly come from a leading brand, known for its widespread advertising campaigns[4]. Moreover, this effect was not limited to "junk food", since it was also observed with carrots.

Using the obvious attraction that children have to these brands (and products) to encourage them to eat a more balanced diet would seem to be appropriate here. However, faced with the extent of the problem, some people recommend more ambitious measures, such as **limiting the exposure of children to advertising, but also to promotional items** through restrictive legal provisions (*Box n° 17*).

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[1] Fox M. K., Pac S., Devaney B. and Jankowski L. (2004), "Feeding infants and toddlers study: What foods are infants and toddlers eating? ", *Journal of the American Dietetic Association,* 104 (1 Suppl. 1) : S22-S30.

[2] Martin C. K., Coulon S. M., Markward N., Greenway F. L. and Anton S. D. (2009), "Association between energy intake and viewing television, distractibility, and memory for advertisements", *American Journal of Clinical Nutrition,* 89 (1), p. 37-44.

[3] Halford J. C. G., Gillespie J., Brown V. *et al.* (2004), "Effect of television advertisements for foods on food consumption in children", *Appetite*, 42, p. 221-225.

[4] Robinson T. N. *et al* (2007), "Effects of fast food branding on young children's taste preferences", *Archives of Paediatrics & Adolescent Medicines,* 161(8), p. 792-797.

Box n° 17

Is the banning advertising for food during TV programs for kids the solution?

The merit of a possible ban on food advertising before, during and after youth programming is the subject of controversy[1,2]. The rejection by the National Assembly of the amendment moving in this direction after a long and difficult debate in 2008 is an important sign.

The stakeholders opposed to such an initiative emphasize the lack of any impact observed in the countries that have put this measure in place, such as the United Kingdom in 2007, for example. Besides, there is the risk of the adverse effect of the development of hidden advertising via the strategy of "hidden placement" and the moving of this kind of advertising to other time slots. Faced with the impossibility of protecting children against all risks, the challenge is rather to teach them how to deal with them. Plus, the loss in financial gain would be considerable for TV stations, especially those such as Gulli, which declared in 2008 that its food advertising represented 30% of revenue.

However, a number of experts say that they are in favour of this type of ban[3], the effects of which will only be felt in the long term, and only if accompanied by other measures aimed at changing an environment that encourages obesity (especially through taxation policy[4]). Given the considerable amount of time that children spend in front of the TV, "educating against the risks" is not enough on its own, and parents should not be asked to take full responsibility for it. Finally, with regard to the economic arguments, some people suggest that we allow advertising for products that are recommended for consumption and develop partnerships with agri-foods industries in this respect.

In the recent monograph entitled "Enfants, télévision et poids" [Children, television and weight], the Louis Bonduelle Foundation[5] pays a substantial amount of attention to scientific results that underline the role of advertising in the incidence of obesity. Numerous scientific studies on thousands of individuals across different continents are reviewed. In particular, this monograph indicates that calculations made by the US national office of economic research [6] indicate that banning this type of

[1] Naucourt R. (2009), "Obésité infantile: la publicité en accusation" ("Childhood obesity: publicity to blame"), Le Monde, February 18_ issue,

[2] On this subject, see also two articles recently published that present opposing opinions: Kelly C. (2010), "Lutte contre l'obésité infantile: Les paradoxes de la télévision, partenaire d'une régulation à la française" ("Fight against childhood obesity: The paradoxes of television, partner to a French regulation"), *Le Monde*, February 17 issue, and Bourdillo F, Hercberg S. (2010), "Lutte contre l'obésité: soyons cohérents!" ("The fight against obesity: let us be consistent!"), *Le Monde*, February 25 issue,.

[3] On March 9th, 2010, around 20 learned societies from the medical and sporting sectors officially requested that, based on the available scientific data, the debate on the regulation of TV advertisements for certain foods at peak children's viewing times should be reopened. Amongst the signatories were the French Public Health Association (SFSP), the French Pediatrics Association (SFP), the French Association for Studies and Research on Obesity (Afero), the French Nutrition Association (SFN), the French Cardiology Federation (FFC), the National Association for the Prevention of Alcoholism and Addictions (ANPAA) and the french Federation of Health Education Committees (FNES).

[4] On this subject, read the work of Pierre Dubois of the INRA, according to which an increase of 10% in the price of products in the "junk food" category would reduce child obesity by a quarter and overweight in children by over 28%.

[5] De Reynal B. (2009), "Enfants, télévision et poids" ("Children, television and weight"), Louis Bonduelle Foundation, 11 p.

[6] The National Bureau of Economic Research ; www.nber.org/papers/w11879.

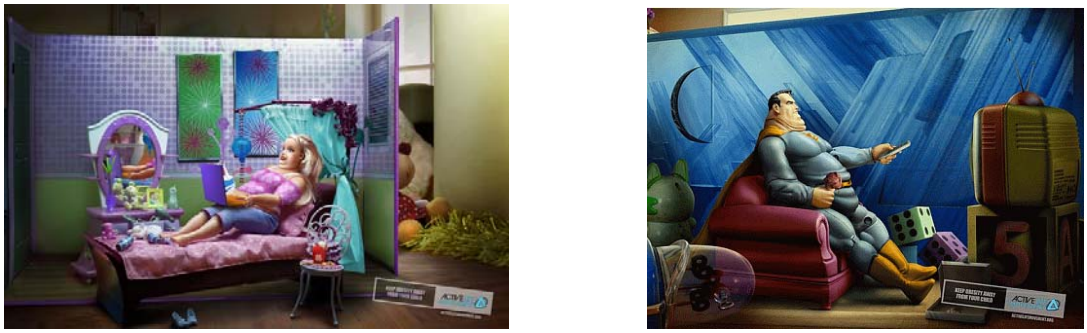
advertising could reduce the number of obese and overweight children by over 10 % in children aged 3-11 and 12% in children aged 12-18[1].

3.3. …and solutions

The considerable impact of images on children is a good reason to hope that an effective communication campaign will have a greater effect on this population. From this perspective, we need to look to **provide solutions for the unfitness for purpose of current messages aimed at young people**, as they take less notice of written than visual information, and hardly interest in the issue of health.

In the USA, the Active Life Movement association has developed an obesity prevention campaign using graphics showing children's super heroes deformed by the consumption of fizzy drinks and other sugary products linked to obvious inactivity (*Figure n° 24*). The campaign received widespread praise for its form (innovative graphic design), but the content was criticised, because it was considered to be degrading to overweight people. Another issue raised was that it would be harder to understand for younger children, as they would not see the link between dietary imbalance and changes to the body.

Figure n° 24. The "Keep obesity away from your child" campaign



Source: Active Life Movement[2]

This concept of **using the persuasive elements traditionally used in children's advertising**, including the use of familiar characters, attractive colours and humour, should even be applied outside campaigns that are strictly focused on health – in **educational media**, for example (*Box n°18*).

A recurrent cartoon character working as a cook and interacting with another character promoting physical activity and sports could have a positive effect, just as has been achieved in other areas such as environment, DIY and English lessons, **as a fun, non-prescriptive teaching method**[3]**.** Neuroscience experimentation might also be in a position to improve the impact of cartoons – also bringing **tools and**

[1] Chou S.-Y., Rashad I. and Grossman M. (2008), "Fast•food restaurant advertising on television and its influence on childhood obesity", *The Journal of Law and Economics,* volume 51(4), p. 599–618,

[2] http://activelifemovement.org/.

[3] This is one of the proposals made by the Strategic Analysis Centre on 28 October 2009 when heard by the Commission for the prevention and management of obesity set up by the President of France;
www.elysee.fr/documents/index.php?mode=view&lang=fr&cat_id=8&press_id=3205.

knowledge necessary for evaluating a range of elements: the image showing attachment to the hero, the number of important messages to be included in each episode, the right points at which to do it, etc.

Box n° 18
The French food charter

On 18 February 2009, a Charter designed to "promote healthy food and physical activity in programmes and advertisements broadcast on television" was signed by a great number of stakeholders in the audio-visual sector in France (TV stations, producers' and authors' unions, representatives and advertisers) and the public authorities. They signed up to this commitment for a period of five years, against a background where a continued increase in childhood obesity forced everyone to take their share of responsibility and contribute to the fight against such a scourge.

Under this Charter, advertisers are committed to improving the quality of food advertising under the watchful eye of the ARPP (French advertising standards authority) and to finance short programmes for young audiences. For their part, TV stations have to offer preferential rates to media prevention campaigns, help put the spotlight on the mangerbouger.fr site and broadcast programmes that promote good diet and exercise habits. This type of system therefore depends on the sector's voluntary involvement and self-regulation, a system that has already proved beneficial, but which also has limitations, in the field of corporate social responsibility, for example.

The *Conseil supérieur de l'audiovisuel* (CSA) is tasked with monitoring compliance with the Charter and evaluating results. A year after its launch, the CSA has produced an initial assessment of this system and applauded the effectiveness of the commitment of the various signatories. Aside from its symbolic value, the Charter has made concrete progress. Over 600 hours of fun educational programming have been broadcast via TV stations, far exceeding the initial target set of between 340 and 470 hours per year. In addition to this, 37 short food and sports awareness programmes have been broadcast using well-known children's characters. Moreover, in accordance with the Charter, the ARPP published the "Code on dietary behaviour" in September 2009, setting down professional ethical regulations for the content of food advertisements aimed at young people.

Finally, **campaigns outside the domestic environment also need support, especially in schools**. Requiring school meals to be balanced and ensuring that this does not increase the price, organising regular cooking sessions, or highlighting the principles of nutrition as part of lessons that are more generally related to health education, are also avenues that offer some promise. All of these initiatives need to be organised in an entertaining way to hold the attention of younger ones and ensure that they are remembered more effectively[1].

* * *

Information and awareness campaigns are still an **essential tool** in obesity prevention. More and more people are saying that they are well informed about food, mainly via the media, and less and less via health professionals. However, they might

[1] The exhibition "Bon appétit: l'alimentation dans tous les sens" ("Bon appetit: food in all senses") at the Cité des Sciences from the 2nd of February 2010 to the 31st of January 2011 invites people to discover *"food in a celebratory, playful and educational way"*; www.cite-sciences.fr/francais/ala_cite/expositions/bon-appetit/.

be informed, but consumers are still not changing their eating habits. The latest advances in behavioural and brain sciences can help to improve the effectiveness of prevention against obesity and overweight by reshaping health messages to make them clearer and more motivating. Whether it be health banners at the bottom of advertisements, nutrition information on packaging, the promotion of physical activity or educational materials for children - all kinds of communication strategies can benefit from what the behavioural neuroscience have to offer. Nevertheless, a preventive approach to obesity based solely on invoking individual responsibility would have limited impact. It would be advisable to achieve **a better balance between individual social approaches and educational initiatives and changes to the immediate environment**

CHAPTER 11

How can consumer neuroscience improve interventions to fight obesity?

Hilke Plassmann[1,2]

Neuroscientific studies using functional brain imaging (e.g. fMRI) can enable us to get a better understanding of the neural correlates of how decisions involving food intake are made. One open question in the neuroscience of decision-making has been whether the brain has implemented a system that tracks the subjective value of (food) items for choice, how these systems are at play when consumers "miscompute" their subjective value resulting in disadvantageous decision-making in the long run like in the case of obesity or other decision-making disorders, and whether brain activity in this system and through it food choice can be consciously regulated. Answers to these questions have important implications for understanding the underlying neuropsychological mechanisms of obesity and for designing public policy intervention to fight obesity.

1. Neural basis of food preferences at the time of food choice

1.1. The concept of value and value-based decision-making

Value or Utility is a central concept in economics. It represents an estimate of how (subjectively) pleasant or avoidable a decision outcome might be and is central for guiding choices of consumers. In the neuroeconomics literature a distinction between different types of values is made to refine the understanding of the neural dynamics underlying decision-making.

Take the example of a product that you would like to consume like a can of coke. The purchase and consumption of the can of coke represents a **potential hedonic pleasure**. The desire to purchase is driven by a prediction of the potential well-being during and after consumption: this is what I refer to as **predicted value**. Based on this value signal, at the time of choice between at least two different options (e.g. Coke© vs. Pepsi© can) we have to **compare predictive values** and assign **decision weights** reflecting the relative attractiveness of the options for choice (referred to as decision

[1] Professor of Marketing at INSEAD, affiliated to INSERM's Cognitive Neuroscience Laboratory (U960) where she is the PI of the Decision Neuroscience Group, l'École Normale Supérieure and l'École des Neurosciences de Paris.

[2] The present chapter is an adapted version of the presentation given during the "Neuroscience and public health prevention" workshop held by the Centre for Strategic Analysis on June 16, 2009.

or goal values) to then act and chose the option with the largest value (referred to as action value).

Finally, after having purchased the good or service, we are enabled to consume it. During **consumption** we then derive (or not) a certain pleasure what is referred to as **experienced value** or outcome value. Sometimes the experienced value deviates from the predicted value because for example the consumed food item was expired and tasted aversive. This would lead to learning and updating of the value next time we have to make a choice about the respective food item and is part of the remembered value in our memory system.

1.2. Neural correlates of decision values

Jointly with researchers from the California Institute of Technology, USA, I have been investigating the neural signatures of decision value and how knowledge of their neural basis might help to elicit changes in behavioral food preferences when consumers make disadvantageous food choices.

In an article published in 2007 in the *Journal of Neuroscience*[1], my co-authors and I investigated the question whether there is a brain system that tracks decision values of hungry subjects using fMRI. Based on the results of several previous studies using monkey electrophysiology or human fMRI, we hypothesized a-priori that activity in the medial orbitofrontal cortex (mOFC) would be involved in decision value (DV) computations.

To test this hypothesis, we scanned 19 hungry subjects' brains using fMRI while they placed bids for the right to eat 50 different junk foods (chips and candy bars) in a Becker-DeGroot-Marshak auction[2]. Subjects were instructed not to eat for 4 hours prior to the experiment, which increased the incentive value that they placed on the foods. They were also instructed that they would have to remain in the lab for 30 minutes at the conclusion of the experiment, and that the only thing that they will be able to eat is whatever food they purchased from us during the task. In addition to a $35 participation fee, each subject received three $1 bills in "spending money" to purchase food from us. Whatever money they did not spend was theirs to keep.

Subjects placed bids for the right to eat a snack at the end of the experiment in 100 different bidding trials. In each trial they were allowed to bid $0, $1, $2 or $3 for each food item. At the end of the experiment one of those trials was randomly selected, by drawing a ball from an urn, and only the outcome of that trial was implemented. As a result, subjects did not have to worry about spreading their $3 dollar budget over the different items and they could treat each trial as if it were the only decision that counted.

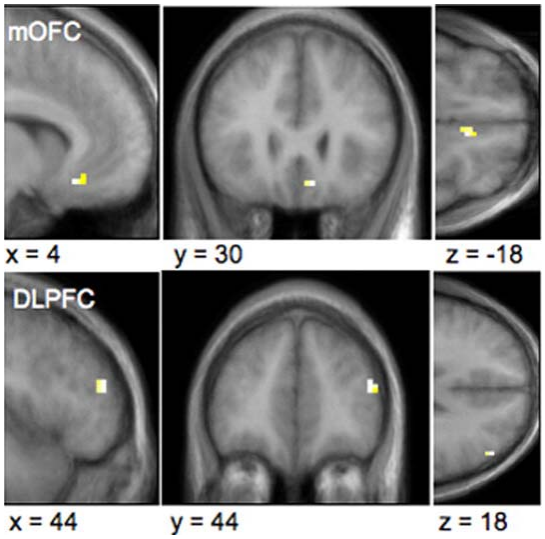
We employed two different kinds of trials: free bid trials and forced bid trials. Each of the 50 items was shown twice, once in a bid trial and once in a forced trial. The existence of two types of bidding trials is a novel and essential component of the experimental design. A difficulty in searching for the neural basis of DV computations

[1] Plassmann H., O'Doherty J. and Rangel A. (2007), "Orbitofrontal cortex encodes willingness to pay in everyday economic transaction", *Journal of Neuroscience*, vol. 27(37), p. 9984-9988.
[2] Becker G., DeGroot M. and Marschak J. (1964) "Measuring utility by a single-response sequential method", *Behavioural Science*, vol. 9, p. 226-232.

is that, when the brain is exposed to a picture of a food item, it might calculate other variables that are correlated with DV such as anticipated taste. The presence of free and forced trials provides a solution to the problem. The only difference between both types of trials is that the subject needs to perform a DV computation in the free trials, since she needs to decide how much to bid, but not in the forced trials, since she is told what her bid should be. Every other computation, such as the anticipated taste of the food, should be carried out equally in both types of trials. As a result, we can conclude that a brain area encodes the DV computation whenever its activity increases with the WTP in the free trials, but not in the forced trials.

In the data analysis we looked for areas that (1) showed increasing activation with DV in the free trials and (2) were significantly more activated in the free trials than in the forced trials. As predicted, we found that right mOFC satisfied these conditions. Unexpectedly, we also found that right dorsolateral prefrontal cortex (DLPFC) satisfied them. *Figure 25* describes the results of this contrast.

Figure n° 25: Activity in the medial orbitofrontal cortex (mOFC) and the dorsolateral prefrontal cortex (DLPFC) during the calculation of utility



Source: Adapted from de Plassmann and collaborators (2007) Journal of Neuroscience – Society for Neuroscience ©

We also extracted trial averaged time-course data from peak voxels in the mOFC for each subject, which were then averaged across subjects. The time courses show that activity in this area during free trials showed an increase in activation that was correlated with the subjects' bids. The time courses also show that activity during forced trials did not discriminate the subjects' DV for the items (as measured by their bids for that item during free trials) or the magnitude of the forced bids. We thus concluded that activity in the right medial OFC and dorsolateral prefrontal cortex encode for DV during choice between unhealthy but appetitive food items.

However, it is important to note that DV computations are done when choosing among appetitive and aversive items. Since dissociations between appetitive and aversive components of value signals have been shown in other domains such as anticipatory and outcome values, it is an important question whether appetitive and aversive DVs are computed in similar brain regions, or in separate ones. We

investigated this question in a follow-up study while subjects placed real bids in an economic auction for the right to avoid eating disliked foods.[1] We found that activity in a common area of the medial orbitofrontal cortex and the dorsolateral prefrontal cortex correlated positively with appetitive DVs and negatively with aversive DVs. These findings suggest that the medial orbitofrontal cortex might comprise a common valuation region that encodes for both appetitive and aversive DVs.

2. Changes in the neural basis of decision values lead to behavioral changes in food preferences

2.1. How inhibiting brain activity in the Dorsolateral Prefrontal Cortex changes food preferences?

In our work described above and several related studies from other groups decision-making related value signals have been found in the medial part of the orbitofrontal cortex (mOFC) and the dorsolateral prefrontal cortex (DLPFC). However, given our priors about the involvement of the mOFC as main "valuation hub" for food preferences, the role played by the DLPFC in decision-making remains unclear. In a follow-up study my co-authors and I investigated whether the DLPFC plays a causal role for DV computations, or if it implements computations that are correlated with valuations, but that do not participate in the valuation process itself.[2] We addressed this question by using repetitive transcranial magnetic stimulation (rTMS) while subjects were involved in an economic valuation task involving the consumption of real foods. We found that compared to a control condition, applying rTMS to the DLPFC caused a decrease in the values assigned to the stimuli. The results are consistent with the possibility that the DLPFC plays a causal role in the computation of DV at the time of choice. In a control study we could ensure that these effects are distinct for value-based food judgments, not numerical judgments about foods in general.

2.2. Cognitive regulation of food preferences

The assignment of subjective values during decision-making constitutes one of the fundamental computations supporting human behavior. However, the presence of decision-making disorders such as obesity, addiction, and gambling disorders, suggest that this process may sometimes be more sensitive to immediate hedonic concerns than to long-term goals and outcomes. When this happens, strategies such as cognitive reappraisal and emotion regulation may be required to modulate the computations of the value system. The neural correlates and consequences of this process are not well understood. In a follow-up study my co-authors and I, investigated the process of cognitive regulation during appetitive decision-making using fMRI.[3] We found that cognitive regulation strategies can be used to teach us

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[1] Plassmann H., O'Doherty J. and Rangel A. "Appetitive and aversive goal values are encoded in the medial orbitofrontal cortex at the time of decision-making", *accepted for publication at Journal of Neuroscience*.

[2] Camus, M. et al. (2009), "Repetitive Transcranial Magnetic Stimulation over the Right Dorsolateral Prefrontal Cortex Decreases Valuations during Food Choices", European Journal of Neuroscience, 30 (10), 1980-88.

[3] Hutcherson, C. et al. (2009), "Deliberate regulation of decision-making involves modulation of ventromedial PFC value computations by ventrolateral PFC ", poster presented at the Society for Neuroeconomics Conference 2009.

regulating our food preferences on both, a behavioral and neural level. In particular, we found that, consistent with other work, regions of the ventrolateral prefrontal cortex (vlPFC) may implement cognitive regulation during the assignment of value in food choice. However, in contrast to studies examining experienced emotion, which observe the strongest effects in subcortical regions such as the amygdala and striatum, we observed effects of regulation in the medial orbitofrontal cortex (mOFC), a region shown to be critical in valuation as described above. These effects appear to be mediated by direct inhibitory connections between the vlPFC and vmPFC, as well as by a modulation of connectivity between vmPFC and striatum by the vlPFC.

Our research has important implications for understanding both basic food preferences as well as the mechanisms by which we consciously modify these preferences. It also has implications for the understanding of disorders of food decision-making, such as obesity. Evidence suggests that these disorders may stem from hypersensitivity to reward compared to cost information in the construction of decisions. Our results suggest that people can use cognitive strategies to intentionally modify the computations involved in determining the preference for a food, and can also diminish their motivation to obtain a food via activation of regions involved in executive control and behavioral inhibition. These findings may have important implications for how public policy interventions are designed to fight obesity, and also how health information on food packaging could be used more efficiently.

CONCLUSION

Improving public health prevention with behavioural and brain sciences: Toward new interdisciplinary collaborations

Health protection is a State duty enshrined in the French Constitution[1]. It is therefore appropriate to do everything possible to implement preventive measures and improve the citizens' health and well-being. Today, several voices are calling for a rethink, at least in part, on public health prevention strategies. At a time when obesity and tobacco addiction figures remain dangerously high -to name two of the most dangerous conditions-, any new method that you complement and potentially improve current public health prevention strategies should be welcome, as long as the ethics are respected.

Our report proposes to explore new grounds to try to improve strategies in public health prevention. We have gathered the work of national and international experts in behavioural and brain sciences some of whom are currently leading lights in their respective fields. A considerable number of measures are advanced. Some require sophisticated equipment in order to be effective (e.g. evaluation of the impact of prevention banners in TV commercials) and others are very simple and low cost (removing trays in canteens). Their one common feature is they can lead to changes in people's daily behaviour that could improve their health and well being. These operational strategies and possible approaches result from laboratory and field experiments but require coordination and cooperation between prevention specialists as well as scientists.

However, most of the results reported here come from work carried out abroad. Whether it is a case of eating habits or risky behaviour, there are obvious cultural differences between countries. Thus, the aim of this work is not to call for a systematic transfer of strategies developed by other countries onto ours, but rather to be aware of them and use them to nurture the debate on their potential effectiveness and ethical implications. We think that every country should consider the use of behavioral and brain sciences ... on its own terms and in a fashion that takes into account local cultural and social features to hope for efficient results in public health prevention.

[1] The Preamble to the Constitution of 1946 declares in Article 11 that "it shall guarantee to all, notably to children, mothers and elderly workers, protection of their health, material security, rest and leisure". The law dated the 9th of August 2004 relating to public health policy extended its original missions with regard to participation in the management of urgent or exceptional situations with consequences for collective health and health education training.

Far from calling for the abandonment of methods used currently, this work promotes the possible benefits of using fields that have mostly been ignored by the public authorities, including cognitive neuroscience, social psychology and behavioural economics. Behavioral and brain sciences could therefore become an essential complement to the work carried out so far. It has been recognised by some of the most powerful international institutions: France cannot afford to delay.

The application of brain sciences outside research laboratories presents a challenge of scale. In addition to the ethical issues, there is the question of what they can actually contribute to public health prevention. Additionally, the argument is often put forward that the data from these disciplines merely confirms what most consider as "the obvious". Common sense is enough… in theory. But let us ask ourselves this question: *if it already known that certain measures suggested here are both efficient and optimal, why aren't they used yet by governments and administrations?* Perhaps because, often in spite of itself, economics has held sway, over an area, public health prevention, that certainly concerns it, but which above all touches human life in all its complexity And requires many other fields to intervene.

Even the most enthusiastic among us will point out that, for now at least, the primary contribution of behavioral and brain sciences in terms of public policy consists in drawing attention to hypotheses that would have remained ignored if they had not benefited from the attractive and seductive power of brain imaging and the illusory "(neuro)-scientifically proven" as it is often sarcastically called.

But we dare thinking that the goal should remain to improve people's health and well being. Hence why should not we implement strategies that seem innovative but efficient, especially when they are rooted in rigourous scientific and medical studies? Once we get beyond appearances and a certain outmoded ideological inertia, one can bet that behavioural sciences will be of considerable epistemological value.

However, it should never be forgotten that studying the brain in isolation from physical and social environments[1], and particularly if we marginalise other disciplines such as psychology, economics, sociology, law and ethics, will not deliver probative results[2]. A brain on its own is rather useless! Whether we talk about a great thinker or a neuroscientific study, interactions remain the key thing since, however relevant or interesting it might be, laboratory data cannot be used as a basis for public policy before being tested by other areas of expertise. Thus, whilst being life sciences, from now on, neuroscience are a key actor of human and social sciences. Better still, they bring the Human Being, his body, his brain, his moods and even his propensity to be influenced by others back to the centre of public policy concerns.

Finally, the possibilities offered by behavioural brain sciences should not make us forget the ethical challenge inherent in any prevention strategy. It is certainly necessary to assess the risks of drifting towards more intrusive and restrictive preventive measures, which would be incompatible with our democratic principles. Public health prevention cannot meddle too much in the choices and decisions of individuals disguised as an attempt to improve their health or well-being. For this

[1] Kelso J. A. S. and Engstrøm D. A. (2006), *The Complementary Nature*, Cambridge, MIT Press.
[2] Oullier O. and Basso F. (2010), "Embodied economics: How bodily information shapes the social coordination dynamics of decision making", *Philosophical Transactions of the Royal Society: B: Biological Sciences*, 365, p. 291-301.

reason, methods such as “nudges” are only acceptable if the people at whom they are targeted are informed of both their implementation and their option not to follow them.

With such precautions as a given, behavioural and brain sciences, without exactly being a miracle solution that will solve all the problems around, this has and will never be our claim, could work as complementary methods with the tools traditionally employed[1]. This approach opens up serious avenues for improving public health prevention, an area which requires an overhaul. Not just because of the limitations of current methods, but above all because of new risks emerging constantly and their interdependence. New risks call for new measures[2].

[1] By way of example, the measures taken to fight obesity need to reach the most vulnerable audiences, primarily children. They are particularly affected by the advertising, and we need to be fighting with weapons of equal power, even if there is a huge disparity between public health prevention and private sector communications budgets.

[2] See Michel-Kerjan E. and Slovic P. (2010), *The Irrational economist: Making decisions in a dangerous world*, Public Affairs, New York for contributions based on the necessity to update and rethink risk management (including chronic diseases) in light of the new risks that have emerged. In the words of the first author, it is time move to *“risk management version 2.0“* ; www.theirrationaleconomist.com.

APPENDICES

Authors' biographies

Frédéric BASSO is trained in human and social sciences. He is an "Ecole normale" law graduate and a professor of economics and management with the "agrégation" diploma (the highest teaching diploma in France). His programme of study is based on economics, law and management sciences in relation to European politics. On a doctoral fellowship, he continues research for his thesis on the conflicts between health and marketing rationales in consumer behaviour, combining social and neuroscience, at the Center for Research in Economics and Management (UMR CNRS 6211) of the university of Rennes-1. He divides his teaching time between the theory of organizations and political economics to the "agrégation" students at École normale supérieure de Cachan and private contract law and product experience to future company executives at the Rennes 1 University Business School (IGR-IAE). His multi-disciplinary research is based on the epistemology of embodiment and has recently been published and reviewed in different fields of the social sciences.
e-mail: frederic.basso@univ-rennes1.fr

Valérie BOYER has been a Bouches-du-Rhône MP since 2007. She is the deputy mayor of Marseille, in charge of the town's policy, urban renewal and the urban contract for social cohesion, and is a Marseille Provence Métropole community advisor. She holds diplomas from the Sciences politiques school and École nationale des directeurs de la sécurité sociale, and her professional career is devoted to the sphere of health (Institut médico-éducatif pour enfants et adultes handicaps (medical-educational institute for disabled children and adults), Caisse primaire d'assurance maladie des Bouches-du-Rhône (Bouches-du-Rhône primary health care insurance fund) and Agence régionale pour l'hospitalisation PACA (Provence Alps Côte d'Azur regional hospitalization agency)). With her competencies in the health and social fields, she was appointed national secretary of the UMP in charge of health matters and became a member of the social affairs commission of the French Parliament. Her initial research concerned the prevention of eating disorders (under-nutrition et obesity). She steered her bill for the prevention of inducement to extreme thinness and anorexia passed through the French Parliament where it was passed unanimously. In 2008, she was appointed chairperson of an information group on the prevention of obesity. Its report entitled *Faire de la lutte contre l'épidémie d'obésité et de surpoids une grande cause nationale* (Making a major national cause of the campaign against the epidemic of obesity and excess weight) made over 80 proposals for acting in all areas in order to eliminate obesity and excess weight. On the basis of this report, Valérie Boyer tabled over 60 amendments to the "Hospital, Patients, Health and Territory" bill: possibility of buying fruit and vegetables with luncheon vouchers, better nutritional quality in school canteens, requirement to show the number of calories in all food advertisements, free prevention advertising, as well as the creation of a chapter in the public health code entitled "Lutte contre les troubles du comportement alimentaire et prévention de l'obésité" (campaign against eating disorders and the prevention of obesity), etc. In 2009, Valérie Boyer was chosen by the the President of France to join the commission on obesity prevention and treatment. The same year, her bill aimed at having airbrushed photos in

advertisements labelled as such, was well received in France and abroad, in particular in the *New York Times,* which printed a feature story on her.
More information at: www.valerieboyer.fr

Gemma CALVERT has a BSc in Psychology from the London School of Economics and a DPhil in Clinical Medicine from the University of Oxford. Between 1998-2003, she was Head of the Multisensory Neuroimaging Group based in the Department of Physiology, University of Oxford and in 2004, she took up a Readership at the University of Bath, extending her research into the fields of neuromarketing and neuroeconomics. Over the past 12 years, Professor Calvert has played a substantial part in the development of the neuroimaging field, publishing over 40 scientific articles in internationally renowned journals, including Science and Nature Neuroscience and has appeared on several major radio and TV programmes including CBS 60 Minutes. In 1997 she established the world's first Neuromarketing Consultancy which involved the commercial application of FMRI. Over the past 10 years, Neurosense Limited has undertaken FMRI projects for numerous industries including advertising and marketing companies, fragrance and flavour houses, as well as the media communication industry. Much of this work has used FMRI to investigate complex consumer decision-making and investigation of how the brain responds to products, their packaging and relevant communication. Professor Calvert also holds a Chair in Applied Neuroimaging at the University of Warwick.
e-mail: gemma.calvert@neurosense.co.uk

Robert B. CIALDINI is Regents' Emeritus Professor of Psychology and Marketing at Arizona State University. He has taught at Stanford University and Harvard's Kennedy School of Government. He has been elected president of the Society of Personality and Social Psychology. He is the recipient of the Distinguished Scientific Achievement Award of the Society for Consumer Psychology, the Donald T. Campbell Award for Distinguished Contributions to Social Psychology, the (inaugural) Peitho Award for Distinguished Contributions to the Science of Social Influence, and the Distinguished Scientist Award of the Society of Experimental Social Psychology. Professor Cialdini's book "Influence: Science and Practice", which was the result of a three-year program of study into the reasons that people comply with requests in everyday settings, has sold over two million copies while appearing in numerous editions and twenty-six languages. His recently coauthored new book titled, YES! 50 Scientifically Proven Ways to be Persuasive, has appeared on the New York Times, Wall Street Journal, and USA Today best seller lists.
e-mail: Robert.Cialdini@ASU.EDU

Cary L. COOPER is Distinguished Professor of Organizational Psychology and Health, and Pro Vice Chancellor at Lancaster University. He is the author/editor of over 120 books (on occupational stress, women at work and industrial and organizational psychology), has written over 400 scholarly articles for academic journals, and is a frequent contributor to national newspapers, TV and radio. He is currently Founding Editor of the Journal of Organizational Behavior and Editor-in-Chief of the medical journal Stress & Health. He is a Fellow of the British Psychological Society, The Royal Society of Arts, The Royal Society of Medicine, The Royal Society of Public Health, The British Academy of Management and an Academician of the Academy of Social Sciences. Professor Cooper is past President of the British Academy of Management, is a Companion of the Chartered Management Institute and one of the first UK based Fellows of the (American) Academy of Management (having also won the 1998 Distinguished Service Award for

his contribution to management science from the Academy of Management). In 2001, Cary was awarded a CBE in the Queen's Birthday Honours List for his contribution to occupational safety and health. He holds Honorary Doctorates from Aston University (DSc), Heriot-Watt University (DLitt), Middlesex University (Doc. Univ) and Wolverhampton University (DBA); an Honorary Fellowship of the Faculty of Occupational Medicine in 2005, was awarded an Honorary Fellowship of the Royal College of Physicians (Hon FRCP) in 2006, in 2007 a Life Time Achievement Award from the Division of Occupational Psychology of the British Psychological Society and in 2008 an Honorary Fellowship of the Royal College of Physicians of Ireland (College of Occupational Medicine) and in 2009 as Companion of the International Court of Arbitration in Europe. Professor Cooper has recently been elected Chair of the UK's Academy of Social Sciences (an umbrella body of 37 learned societies in the social sciences) from July 2009; as well as Chair of the Chronic Disease and Wellbeing Global Agenda Council of the World Economic Forum in Geneva.
e-mail: c.cooper1@lancaster.ac.uk

Karine GALLOPEL-MORVAN is one of the rare expert in social marketing in France. She is an associate professor at the Institut de Gestion de Rennes (Rennes 1 University) and is also a member of the Centre for Research in Economics and Management, University of Rennes 1 (UMR CNRS 6211). Her research focuses on the prevention of smoking behavior: anti-tobacco prevention messages, health warnings on cigarette packets, cigarette packets and analysis of standardized marketing strategies of tobacco companies. Dr. Gallopel Morvan edited a book on "marketing and communication associations" (Dunod, 2008). She works with national and international institutions such as the National Cancer Institute (scientific contract research), the French Office for Drugs and Drug Addiction (IDT committee member: Tobacco Indicators Data), the National cons on Tobacco (board member) and the European Union (member of the work group addressing the renewing of sanitary warnings). It has been designated by the French Ministry of Health to represent France as part of the elaboration of Article 11 of the Framework Convention on Tobacco Control of the World Health Organisation.
e-mail: karine.gallopel@univ-rennes1.fr

Sara-Lou GERBER is a project manager in the Department of Social Affairs at the Centre for Strategic Analysis. She is a graduate of École normale supérieure (Ulm) and has an "agrégation" (the highest teaching diploma in France) in economic and social sciences (2007). She did her research thesis on the introduction of anti-papillomavirus vaccines into the French vaccination policy (Sciences Po Paris). She specialized in public policy analysis and her main areas of expertise are macroeconomic and social health policy issues. She is in charge of a cycle of seminars on health spending and is organizing a number of workshops on various related topics (financing, and reorganization of the health field) in the first half of 2010
e-mail: sara-lou.gerber@strategie.gouv.fr

Virginie GIMBERT is a project manager in the Department of Social Affairs at the Centre for Strategic Analysis. She graduated from École normale supérieure de Cachan and has an "agrégation" (the highest teaching diploma in France) in economic and social sciences and a doctorate in sociology. She specialized in public policy analysis and did her doctoral thesis on the changes in public action related to the emergence of "new" health risks. Her main research topics are public health policies and dependency. She has also worked on the middle classes and the integration of people sidelined from the work market.

e-mail: virginie.gimbert@strategie.gouv.fr

Maryvonne HAYEK-LANTHOIS is a hospital practitioner, an anaesthetist-intensive care specialist, a member of Société française de toxicologie clinique (French clinical toxicology society) and is responsible for the emergency telephone hotline of the Centre antipoison de Marseille (Marseille poison control centre).
e-mail: maryvonne.hayek@ap-hm.fr

Sendhil MULLAINATHAN is a Professor of Economics at Harvard University and Director of ideas42, a center devoted to taking insights about people from behavioral economics and using it to create novel policies, interventions, and products. He is also a Research Associate at the National Bureau of Economic Research, a Founding Member of the Poverty Action Lab, a Board Member of the Bureau of Research in the Economic Analysis of Development and a Member of the Russell Sage Foundation Behavioral Economics Roundtable. He was hired with tenure by Harvard in 2004 after spending six years at MIT, first as a junior faculty member and then as a full Professor. He is a recipient of a MacArthur Foundation 'genius grant.' He received his B.A. in Computer Science, Mathematics, and Economics from Cornell University in 1993 and his Ph.D. in Economics from Harvard in 1998. Professor Mullainathan conducts research on development economics, behavioral economics, and corporate finance. His work includes an article published in the American Economic Review, in which he and co-author Marianne Bertrand test for the existence of race-based hiring in the Boston and Chicago labor markets by sending out identical résumés to employers, half with traditionally African American names and the other half with traditionally Caucasian names. They observe a 50 percent difference in call-back rates between the two samples. Professor Mullainathan has published extensively in top economics journals including the American Economic Review, the Quarterly Journal of Economics, and the Journal of Political Economy. He also recently co-authored an article with Hunt Allcott in Science magazine. In addition to being a MacArthur Fellow, Mullainathan is the recipient of numerous grants and fellowships, including those from the National Science Foundation, the Olin Foundation, the Sloan Foundation, and the Russell Sage Foundation.
e-mail: mullain@fas.harvard.edu

Sylvain ORDUREAU is the founder of UsefulProgress. His company develops new software and hardware strategies for scanning, analysing, handling and storing display high-definition 3D Relief. Sylvain's path both academically and professionally helped to develop skills in four key areas, scientific research, computing, communication and finance. A major problem in these different disciplines for the production of models that test scientific hypotheses whether living or inert matter. With his professional experience as a technical director partner in a communication group, he has acquired control of the management and financing of projects primarily in the service of outside companies and since February 2003 in his own company UsefulProgress. The research laboratory of the company is based in the University Paris Descartes. In September 2007, in collaboration with him, the Unit of Anatomy at the University, created a Unit for Research in Development, Imaging and Anatomy (URDIA) who works in the teaching of anatomy with new media. The company benefits from the proximity of INSERM and CNRS research laboratories and also from researchers from the Institut Pasteur. The applications developed by UsefulProgress affect sectors as diverse as medical, pharmaceutical, industrial, mining (diamonds), archeology, higher education. Collaboration with hospital radiology centers (CCML, CH Evry / baskets) allows UsefulProgress to evolve its software and hardware

solutions through access to clinical expertise, the CT scan / MRI of last generation and documented clinical cases. The partnership with American company NVIDIA assures UsefulProgress a significant technological advance in terms of computing power and performance for their hardware. Working with teams from Grenoble Synchrotron (ESRF) adds various new applications in biomedical research. Since January 2010, UsefulProgress Canada Inc.. was created in Montreal. In June 2010, China will be launched UsefulProgress and confirm the willingness of Sylvain Ordureau to conquer new international markets
e-mail: sylvain@usefulprogress.com website: www.usefulprogress.com

Olivier OULLIER is associate professor of neuroscience at the University of Provence (Marseille, France) where he teaches the neurophysiology of sensory systems neuroendocrinology, neuroeconomics, neuroethics and dynamical systems. He conducts research on social neuroscience at the Cognitive Psychology Laboratory (UMR 6146) and the Center for Complex Systems and Brain Sciences (Florida Atlantic University). Together with his collaborators, he conducts theoretical and empirical work exploring decision making, multilevel social coordination dynamics, embodied cognition and neuroeconomics. Dr. Oullier is also affiliated with the Groupement de Recherche en Economie Quantitative d'Aix-Marseille (GREQAM, UMR 6579). A member of the World Economic Forum's Global Agenda Council on Decision-Making and Incentive, he is a scientific adviser to the Center for Strategic Analysis of the Prime Minister of France, where he heads the "Neuroscience and Public Policy" programme –the world's first govermental initiative to specifically evaluate and implement the applications of the newly found knowledge on behavioural and brain sciences in various aspects of our daily lives including health prevention, risk management, education and justice. Founder of the first graduate course on neuroeconomics and neuroethics in France, Dr. Oullier serves as an expert on these topics for various public and private institutions including the French Parliament and the European Commission. He has recently been appointed a member of the scientific board of the newly founded High Council on Strategic Education and Research.
e-mail: olivier@oullier.fr

Hilke PLASSMANN is assistant Professor of marketing at INSEAD, where she has been since September 2008. Since 2009 she is an affiliated faculty at the Cognitive Neuroscience Laboratory INSERM U960 of the École Normale Supérieure, and the École des Neurosciences de Paris-Île-de-France. Before that, she was a postdoctoral researcher in the Division of Humanities and Social Sciences of the California Institute of Technology and the Department of Economics of Stanford University. She received a Ph.D. from the University of Muenster's School of Business and Economics in 2005 and a M.Sc. jointly from Muenster University and Montpellier Graduate School of Management in 2001. Dr. Plassmann's primary research areas are decision-making in the intersection of neuroscience, psychology and economics. In recent and current research projects she investigates the influence of cognitive concepts such as health labels on the consumption experience, satiation for different rewards, and the neural basis of different decision-making related value signals, and ways to alter/self-control/regulate these signals with a particular focus on food decisions.
e-mail: hilke.plassmann@insead.edu

Dorothée RIEU is the founding CEO of Mediamento. She was awarded a doctorate in neuroscience (majoring in neuropsychology) in December 2004 (University of Lyon-I). Before that, she got her bachelor's degree in cognitive sciences (University of Bordeaux-II), and her master's degree in neuropsychology (University of Lyon-I). During her years of research at the Centre Paul Broca (Paris INSERM U324: Neuropsychology and Neurobiology of cerebral ageing) and la Salpêtrière hospital (Paris INSERM U610: Functional neuroanatomy of behaviour and its disorders), Dr. Rieu's specialist area of study was the different systems and processes of memory. Her research dealt in particular with the organization of the semantic memory and its disorders in Alzheimer's disease, as well as the relation between the different systems of memory, attention, mental imaging and, finally, the drawing up of cognitive assessment tests (methodology for the development, adaptation and validation of cognitive tests). In 2007, she worked in an advertising effectiveness consultancy where she gained field experience. At the end of 2007, the Mediamento project was started. It was selected by HEC Challenge+ programme and, in March 2009, the company Mediamento was created. This institute for cognitive studies of the media and advertising provides solutions for the different stakeholders in communication: advertisers, medias, and public bodies. Being well aware of the importance of ethics in advertising and marketing, Dorothée Rieu drew up an ethical and deontological charter for Mediamento, corresponding to its activities.
e-mail: d.rieu@mediamento.com website: www.mediamento.com/

Philippe ROBERT-DEMONTROND is a member of the Center for Research in Economics and Management (UMR CNRS 6211) of the university of Rennes-1. He is a professor of management science with the "agrégation" and teaches at the institute of management in Rennes. His initial research consisted of developing various biomimetic systems (genetic algorithms and neural networks) with the goals of solving complex problems in operational research and modelling phenomena "forgotten" by the dominant consumer behaviour theories (inconsistency and ambivalence of representations, systemic effects in the composition of attitudes, sensitivity to initial conditions, etc.). His current research is, in methodological terms, geared towards cognitive linguistics and socio-discursive analysis, with applications focusing on the processing of problems related to corporate social responsability.
e-mail: philippe.robert@univ-rennes1.fr

Sarah SAUNERON is a project manager in the Department of Social Affairs at the Centre for Strategic Analysis. She earned a diploma from the institute of Sciences Politiques (Paris) and a master's degree in neurobiology graduate from the Pierre-et-Marie Curie University. Her main areas of expertise concern the relations between health, science and society. With this background, she contributed to the report *La santé mentale, l'affaire de tous* (Mental health, everyone's concern) which distinguishes the multiple dimensions of mental health and well-being and highlights the different operational levers acting on the quality of life in French society. She was also involved in the revisions of the bioethics laws, more specifically whether it should be extended to neuroscience and was heard at on the French Parliament on this subject. She heads the "Neuroscience and public policy" programme, and continues this ethical reflection envisaging the different fields of application of neuroscience research, with public health prevention and justice being the foremost.
e-mail: sarah.sauneron@strategie.gouv.fr

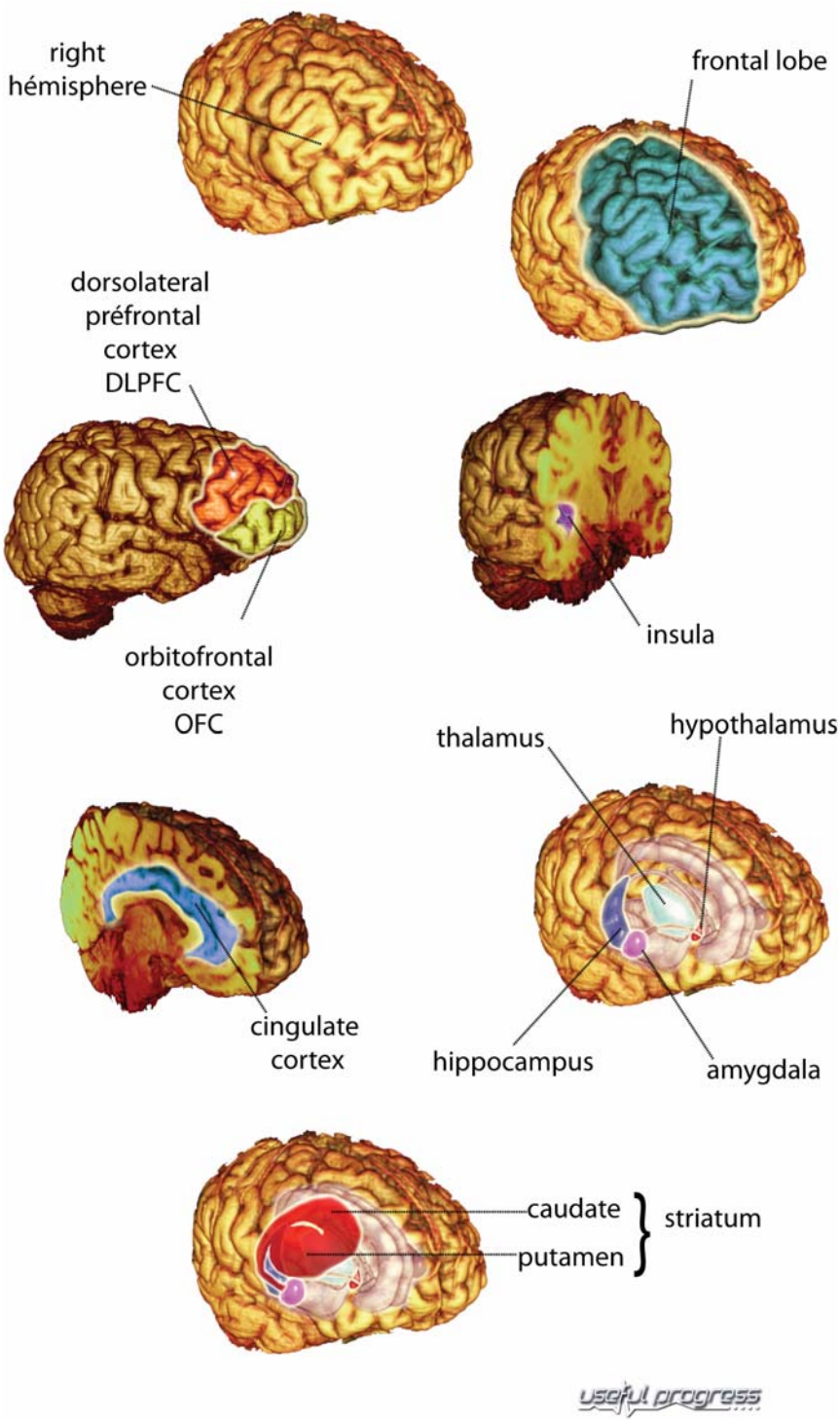
Richard H. THALER is the Ralph and Dorothy Keller Distinguished Service Professor of Economics and Behavioral Science at the University of Chicago's Graduate School

of Business where he director of the Centre for Decision Research. He is also a Research Associate at the National Bureau of Economic Research where he co-directs the behavioral economics project. Professor Thaler's research lies in the gap between psychology and economics. He is considered a pioneer in the fields of behavioral economics and finance, and has specialized in the study of saving and investing decision making. He is the author of numerous articles and books including the global bestseller *Nudge: Improving Decisions about Health, Wealth and Happiness* (with Cass Sunstein) and is a regular contributor to the Economic View column that appears in the *New York Times* Sunday Business Section. He is also a principal of the firm Fuller and Thaler Asset Management in San Mateo California that uses behavioral finance to invest in equities for institutional clients.
e-mail: richard.thaler@chicagobooth.edu

Jean-Louis WILQUIN is a research specialist on smoking at the National Insitute for HEalth Prevention and Education (INPES). INPES is a public institution responsible for implementing prevention policies under the public health guidelines laid down by the government. Communication plays an important role here, with the aim of informing the public on priority risk factors, like smoking, nutrition, drink, AIDS, etc., and helping people change their behaviour to improve their health.
e-mail: Jean-Louis.WILQUIN@inpes.sante.fr

Neuroanatomical illustrations

These figures are not experimental data. They are 3D anatomical reconstructions, for illustrative purposes, of several brain areas mentioned throughout the book. Courtesy of Sylvain Ordureau (Useful Progress)



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Acknowledgements

First of all, the coordinators of this report would like to thank Nathalie Kosciusko-Morizet for giving them the opportunity of working on this important subject of prevention in public health from the angle of an innovative approach.

In addition, they would like to thank all of the contributors who have enriched this document with their genuine and disinterested involvement.

Finally, they thank all of the people listed below for their much valued support and help:

Jeanne Bestieu
Marine Boisson
Vincent Chriqui
Caroline de Jessey
Sara-Lou Gerber
Glenn Gould
Pascal Huguet
J.A. Scott Kelso
Eva Jané-Llopis
Nikolai Khlystov
François Laurent
Monique Lingagne
Erwann Michel-Kerjan
Audrey Oullier
Julien Ravier
Jean-Michel Roullé
René Sève
Marie-José Toulgoat
Danièle Vidal
Victor Willi
Julien Winock
Liah Wong