

## A QUESTION OF ATTENTION OR THE REASONS FOR AN EASY CONNECTION BUT A DIFFICULT DISCONNECTION

### Authors and date

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The primary objective of sponsored websites: online news media, social networks, commercial sites, online games, etc. is to make their managers earn money.

The user is indeed, above all, a consumer, source of profit. Even when the application is free because he then becomes... the product ("When it's free, you're the product!").

It is thus necessary to keep the user on the application for as long as possible, in order to collect his navigation data for advertising purposes. Because the longer the user stays on the application, the more browsing data will be collected. This will enhance the value of the site for advertisers, and therefore enrich its owners. Thanks to the analysis of this data in real time (algorithms), it is easy to show each person what they like: this will reinforce their desire to prolong the current visit and to spend money (suggestions for purchases, linked sites, etc.).

**Attracting our attention, and keeping it captive as long and as often as possible** is therefore a basic principle for developers. Making us "addicted" is even a declared objective of the designers of applications such as Facebook, a pioneer model of the genre (Cf [Interview Sean Parker, The Guardian, 2017](#)).

However, as developed in the previous chapters, the apparent dematerialization of digital tools is an illusion. Their use has a colossal ecological impact, but also deleterious effects on human health (which we will not be able to develop, in particular via the sedentary lifestyle that this use promotes [ANSES Report 2016](#) and [2020, INCA 3 2017](#)).

We will first outline some notions on how attentional processes work, then detail the main cognitive biases used by apps to capture our attention. We will then discuss the effects of the use of screens on attentional capacities. Finally, we will discuss the issue of addiction to video games before concluding on the consequences of all these mechanisms, not only on health, but also on the environment.

### PHYSIOLOGY OF ATTENTION

Our attention is the first step towards our relationship with the world and with others. It is fundamental to every learning process and is involved in every action we take.



Without detailing the complex neural networks that underlie attentional mechanisms, a few notions seem important to specify.

### ATTENTIONAL FILTER OR ATTENUATOR

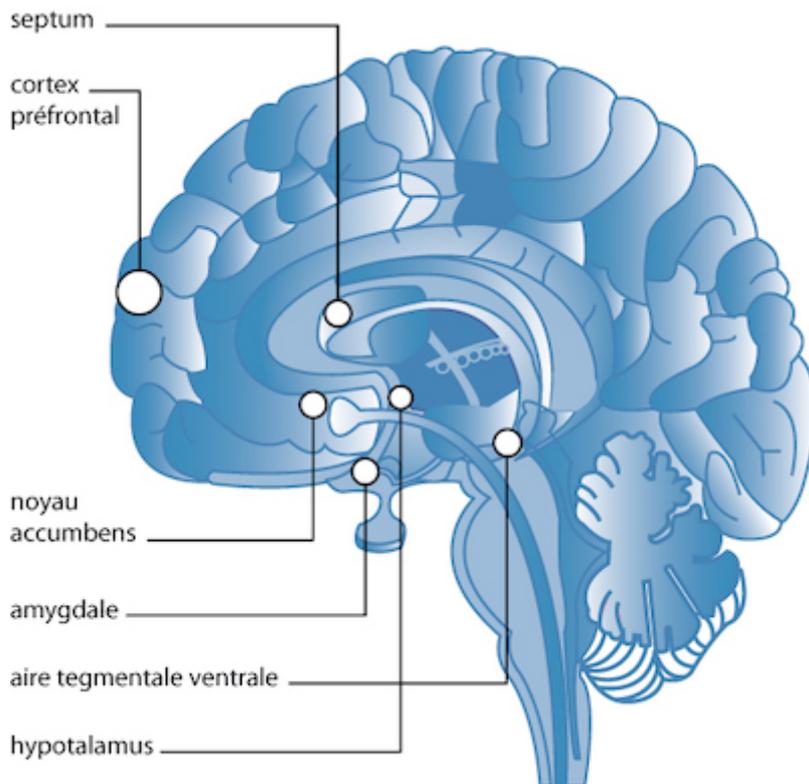
It is a matter of permanently filtering the flow of information that reaches us through all our senses with precision and relevance. This is essential in order to concentrate on an action, by discarding stimuli that are not relevant to the realization of the action, **distractors**, but not neglecting signals of **potential danger**, alerts. For this, reflex responses are counterbalanced by inhibition processes (attenuation), some of which can be mobilized voluntarily. Only what "pre-attentional" mechanisms have allowed to pass through, considering them relevant, thus reach consciousness.

However, the wealth of stimuli mediated by digital tools exceeds the filtering or attenuation capacities (pop-ups, notifications, etc.): it is not possible, for example, among the dozens of notifications indicating the arrival of e-mails or sms, to know before having read them, which ones are important.

Moreover, **light stimuli, movements, sounds**, attract and capture our attention in a **quasi-automatic** way (fast movements are particularly irresistible for the small child). It is thus difficult, if not impossible, not to divert the gaze towards a pop-up, which will be read automatically.

**Novelty** is a very efficient sensor of attention, and applications, social networks, movies, video games, are designed as a succession of new stimuli. This is particularly true for the activation of the **reward system** (see below).

### THE REWARD SYSTEM



*The reward system © A. Métayer /Réseau Canopé*

Our attention is guided by our **search for satisfaction, pleasure, reward**. It will naturally be directed towards stimuli likely to activate the reward system. Thanks to the executive functions, we exercise control over our attention, in particular to favour an action leading to the achievement of an abstract but essential objective that is satisfying in the long term (e.g. passing an exam requiring difficult and regular work over several months), over an action bringing immediate and concrete satisfaction (going out with a friend, watching a film). The main brain structures involved are the frontal regions, in particular the orbitofrontal cortex (OFC), the amygdala-hippocampus complex (A-H) and the nucleus accumbens.

The **maturation of executive functions** in humans is a long process, which continues until about **the age of 25**.

Repeated pleasant stimuli tend to favor short-term reward choices over long-term rewards. This is probably a key mechanism in the development of compulsive behavior and addictions.

### COGNITIVE BIASES AND ATTENTION CAPTURE.

Here are some of the cognitive biases that different applications rely on to keep the user online (Adam Adler, Irresistible, 2017; Montag et al, 2019).

- **Flow** is a positive state of mind, achieved when an individual has a defined goal that is accessible to his or her abilities, but difficult enough to be challenged, and toward which he or she moves with a sense of control over the task. This state is associated with a distortion of temporal perception. It is particularly interesting to place the user in this

state if we want him to stay on a site or an application. To do this, multiple means are used. For example: endless scrolling on *YouTube*, with "reward" videos that correspond to expectations and interests, and video chaining on *Netflix*.

- **The "Endowment effect"**, which is related to the fact that making or buying an object/item increases the value we give it, and the **"mere exposure effect"**, whereby repeated exposure to an object increases the affection we have for it. Ex: video games such as *Hayday*, which gives the player the chance to build his universe. Some elements are free and quickly assembled. To progress, it is then necessary to buy, and the player, who has spent time building "his world", during several sessions, has become attached to it and will tend to want to continue.
- The **"Fear of Missing Out"**, "fear of missing out", is particularly at play in online social networks. Ex: on *WhatsApp*, the default settings are called "double ticks", i.e. the user is warned when he receives a message, but also when the message he has sent is read. His attention is thus permanently maintained towards the application.
- **Social pressure**. Ex: in games like *World of Warcraft* with the "guild meetings". Players are responsible for themselves but also for their team, the guild. The success is based on the cohesion, the presence of everyone. Social pressure is both endogenous, as the individual wants to win, and exogenous, as the group's chances of success are maximized by the presence of everyone. But we also observe it for social networks, messaging, this is manifested by multiple checks.
- **The Zeigarnik/Ovsiankina Effect**, is related to the fact that a tension is created by the interruption during a task requiring a high degree of investment, tension theoretically relaxing when the task is completed. Ex: *Candy crush*, the level of difficulty increasing, and the passage to higher levels requiring...purchases.

All this contributes to maintain our attention captive, by relying on our reward system.

- **Receiving "likes"** activates the reward system.

## EXPOSURE TO SCREENS AND ATTENTIONAL CAPACITIES, IMPULSE CONTROL

In the long term, a significant amount of screen time (the threshold remains to be defined) could weaken voluntary or directed attention capacities.

**An association between screen use and attention deficit disorder with or without hyperactivity (ADHD) or poorer performance on attentional tasks has been established.**

The direction of the association remains debatable, but there is strong evidence in favor of a deleterious effect of screens ([Christakis et al, 2004](#)). This does not exclude the possibility that the link is a two-way one, i.e. that subjects with ADHD tend to expose themselves more to screens, finding in them a source of well-being linked to the intense cerebral stimulation that they provide (it is recalled that ADHD results from a lack of inhibition, rather than from an excess of stimulation, and that the stimulation of the inhibitory system, for example by amphetamines, thus improves the symptoms)

In the short term, the **deleterious effects of the simple presence of the mobile, of endogenous (user-initiated) and exogenous (notifications, ringing)** interruptions have been demonstrated: errors are more numerous, the time needed to complete a task is longer. The long-term effects remain to be clarified ([Wilmer et al, 2017](#)).

An impulse control study ([Hadar et al 2017](#)) showed that mobile use decreases abilities to defer a reward for a higher payoff. Other correlation studies are congruent, suggesting that this effect is mediated by a **decrease in impulse control** rather than an increase in novel sensation/reward seeking behavior.

## ADDICTION AND ICT: ONLINE VIDEO GAMES, INTERNET, ONLINE SOCIAL NETWORKS, SMARTPHONE

There are most probably individual **susceptibilities and "fragilities"** on which certain cognitive skills may depend, in particular **self-regulation abilities** which would explain why certain individuals are more likely to abuse digital media, especially smartphones at the present time.

Only the "**addiction to internet video games**" is referenced in the **Diagnostic and Statistical Manual of Mental Disorders V**, published in 2015. Estimating its prevalence remains difficult, but it is probably low, about 1% of video game users.



However, in clinical practice and research, much work focuses on "**problematic smartphone use**". Researchers and practitioners are calling for the concept of nomophobia (**No Mobile Phobia**, [Bragazzi et al, 2014](#)), which would be defined by regular and time-consuming use, anxiety when the cell phone is not available, repeated checking of messages or even the perception of a "phantom" alert, a cell phone that is always available, a preference for online



social interactions (rather than face-to-face), financial problems resulting from cell phone use.

Numerous studies are also looking at the issue of addiction to online social networks and, more generally, at the problems of addiction linked to NICTs.

## CONCLUSION

We have not been able to address all the health problems related to these digital tools. Some include increase in sedentary lifestyle, especially among teenagers, which is a cardiovascular risk factor; alterations in sleep, and multiple harmful effects (cardiovascular, psychological, accidents, etc.), interference in parent-child relationships, especially for children under three; exposure of children and teenagers to inappropriate content (violence, sexuality, drugs) are just consequences in relation to environmental pollution; etc.

The diffusion of these technologies is at the heart of major public health issues in the medium and long term. It also deeply modifies the functioning of our society, by its impact on interpersonal relations in particular. It seems necessary and urgent to us to reflect on the place we give them and will give them.

Finally, let's remember that the mechanisms of attention capture used by suppliers have no other function than to keep us as long as possible in front of screens, on applications that consume our time, but also energy and resources (via the equipment used) while the serious environmental crisis should incite us to adopt a more moderate behaviour, that is to say exactly the opposite.

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