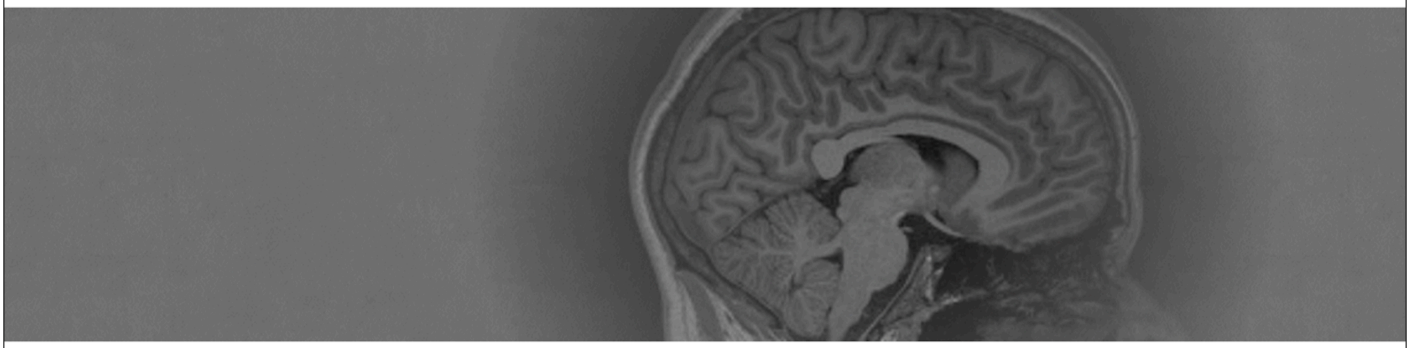
labneuroeducation.org youtube.com/stevemasson facebook.com/profstevemasson twitter.com/stevemasson

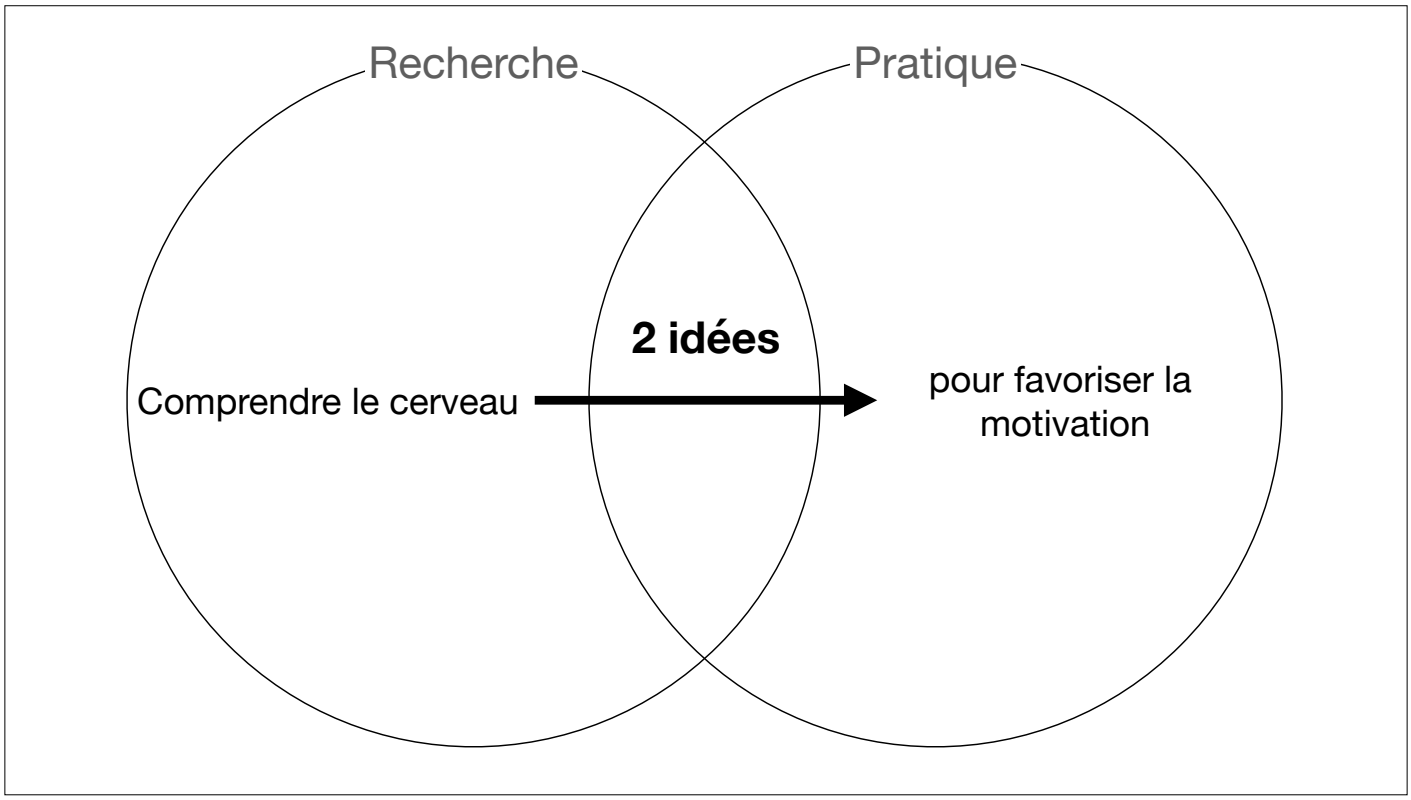


Les neurosciences au service de la motivation et de la réussite éducative

Partenaires pour la réussite éducative dans les Laurentides - 18 octobre 2023
Steve Masson, professeur à l'Université du Québec à Montréal

Motivation

volonté d'agir pour atteindre un **but**,
malgré les **efforts** qui sont requis



Analyse

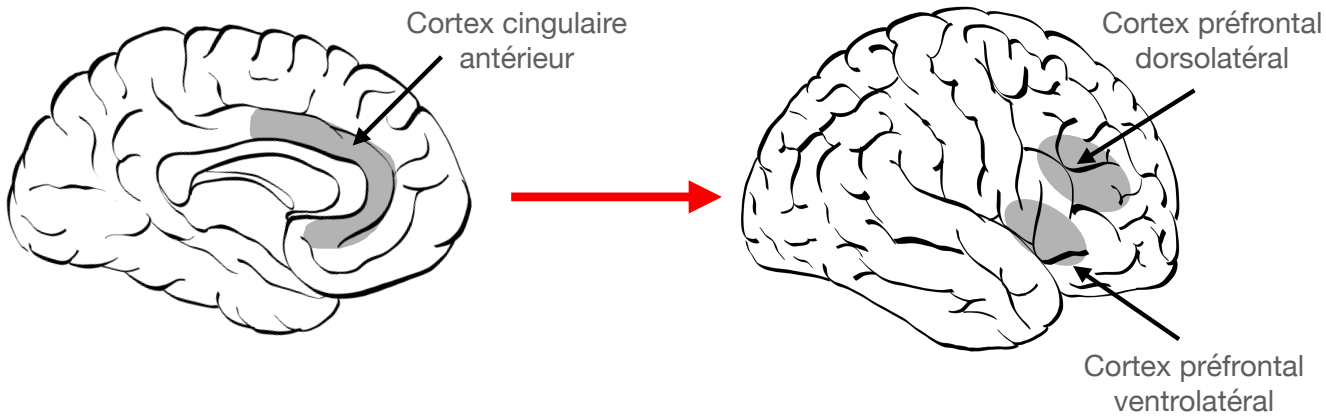
coût

vs

bénéfice

Idée 1

Coût (effort)

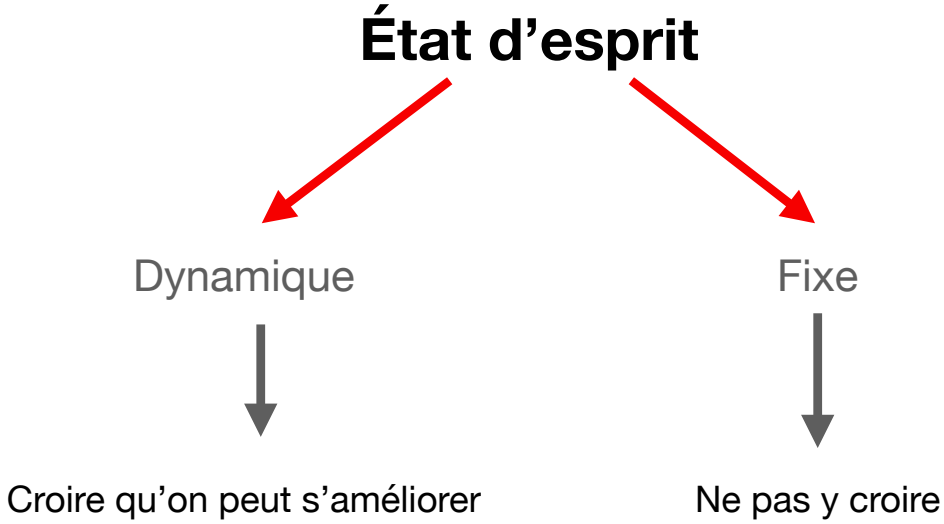


Étape 1
Analyse **coût-bénéfice**

Étape 2
Effort

Déterminant dans l'analyse coût-bénéfice

Croire qu'on peut s'améliorer



Étude de Moser et al.

Research Report

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Psychological Science
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DOI: 10.1177/0956797611419520
http://pss.sagepub.com
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Mind Your Errors: Evidence for a Neural Mechanism Linking Growth Mind-Set to Adaptive Posterror Adjustments

Jason S. Moser[1], Hans S. Schroder[1], Carrie Heeter[2], Tim P. Moran[1], and Yu-Hao Lee[2]
[1]Department of Psychology and [2]Department of Telecommunications, Information Studies, and Media, Michigan State University

Abstract

How well people bounce back from mistakes depends on their beliefs about learning and intelligence. For individuals with a growth mind-set, who believe intelligence develops through effort, mistakes are seen as opportunities to learn and improve. For individuals with a fixed mind-set, who believe intelligence is a stable characteristic, mistakes indicate lack of ability. We examined performance-monitoring event-related potentials (ERPs) to probe the neural mechanisms underlying these different reactions to mistakes. Findings revealed that a growth mind-set was associated with enhancement of the error positivity component (Pe), which reflects awareness of and allocation of attention to mistakes. More growth-minded individuals also showed superior accuracy after mistakes compared with individuals endorsing a more fixed mind-set. It is critical to note that Pe amplitude mediated the relationship between mind-set and posterror accuracy. These results suggest that neural mechanisms indexing on-line awareness of and attention to mistakes are intimately involved in growth-minded individuals' ability to rebound from mistakes.

Keywords

individual differences, electrophysiology, cognitive processes

Received 2/22/11; Revision accepted 7/11/11

Whether you think you can or think you can't—you are right. (popularly attributed to Henry Ford)

Decades of research by Dweck and her colleagues indicate that academic and occupational success depend not only on cognitive ability, but also on beliefs about learning and intelligence (e.g., Dweck, 2006). Dweck's model of implicit theories of intelligence (TOIs) distinguishes people who believe intelligence is unchangeable (i.e., those who have a *fixed mind-set*) from people who believe intelligence is malleable and can be developed through learning (i.e., those who have a *growth mind-set*). It is critical to note that these mind-sets are associated with different reactions to failure. Fixed-minded individuals view failure as evidence of their own immutable lack of ability and disengage from tasks when they err; growth-minded individuals view failure as potentially instructive feedback and are more likely to learn from their mistakes (Dweck, 1999; Ullman, 1997).

Despite years of work examining the self-report and behavioral correlates of these different mind-sets, little is known about the neural mechanisms that underlie them—only one study has examined the neural underpinnings of mind-set. In that study, Mangels, Butterfield, Lamb, Good, and Dweck (2006) measured event-related potentials (ERPs)—electrical brain signals elicited by external or internal events—in college students endorsing a fixed or growth mind-set while they performed a difficult general knowledge test. They found that compared with fixed-minded individuals, growth-minded individuals allocated more attentional resources to corrective information following error feedback and were more likely to correct their mistakes on a surprise retest.

Although Mangels et al. (2006) found differences between individuals with fixed versus growth mind-sets in neural and behavioral responses to corrective information, they demonstrated these effects on a task in which performance accuracy was ambiguous. Participants became aware of their mistakes only when they were signaled by external feedback. This task was also quite difficult (success rates were kept at ~40%), which may have exaggerated differences between the groups

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Effet de l'**état d'esprit** sur l'**activité** du cerveau

Étude de Moser et al.

Activation du cerveau

0,52

0,62

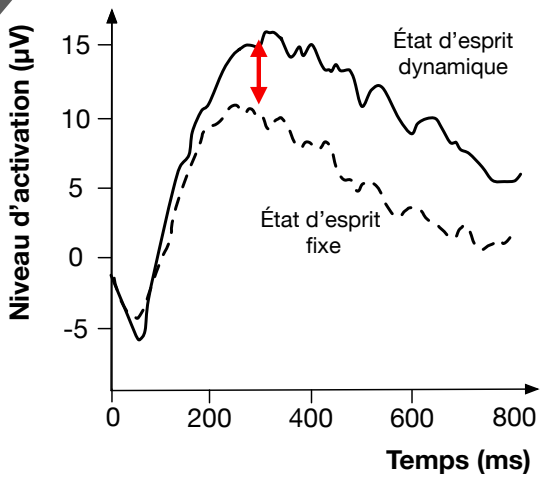
État d'esprit

0,43

Performance après erreur

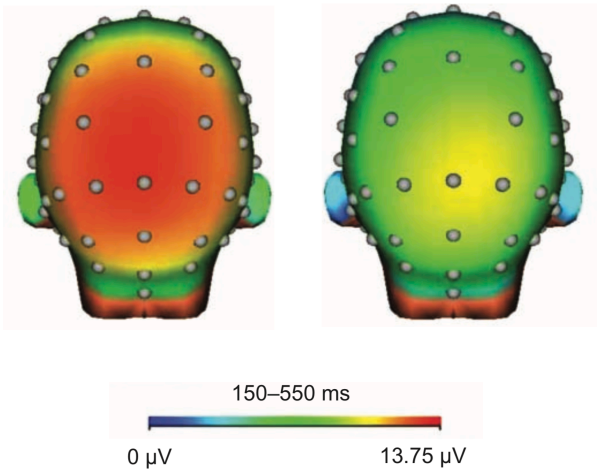
Étude de Moser et al.

Après erreur



État d'esprit **dynamique**

État d'esprit **fixe**



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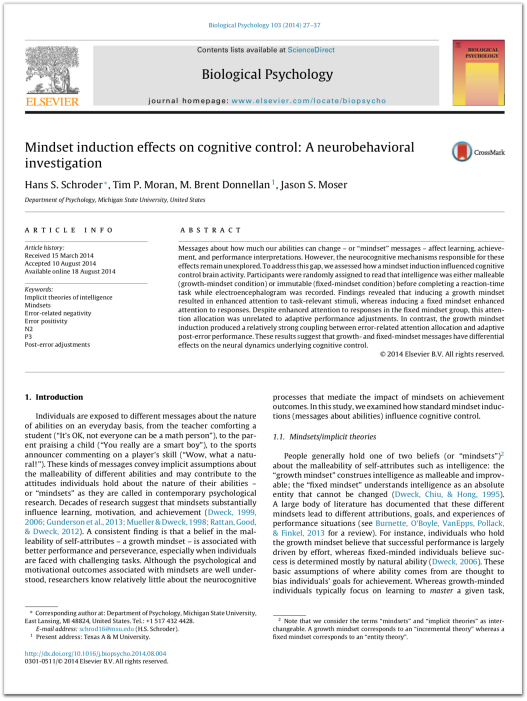
Étude de Schroder et al.



Biological Psychology 103 (2014) 27–37

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Mindset induction effects on cognitive control: A neurobehavioral investigation

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Error positivity
N2
P3
Post-error adjustments

ABSTRACT

Messages about how much our abilities can change – or "mindset" messages – affect learning, achievement, and performance interpretations. However, the neurocognitive mechanisms responsible for these effects remain unexplored. To address this gap, we assessed how a mindset induction influenced cognitive control brain activity. Participants were randomly assigned to read that intelligence was either malleable (growth-mindset condition) or immutable (fixed-mindset condition) before completing a reaction-time task while electroencephalogram was recorded. Findings revealed that inducing a growth mindset resulted in enhanced attention to task-relevant stimuli, whereas inducing a fixed mindset enhanced attention to responses. Despite enhanced attention to responses in the fixed mindset group, this attention allocation was unrelated to adaptive performance adjustments. In contrast, the growth mindset induction produced a relatively strong coupling between error-related attention allocation and adaptive post-error performance. These results suggest that growth- and fixed-mindset messages have differential effects on the neural dynamics underlying cognitive control.

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1. Introduction

Individuals are exposed to different messages about the nature of abilities on an everyday basis, from the teacher comforting a student ("It's OK, not everyone can be a math person"), to the parent praising a child ("You really are a smart boy"), to the sports announcer commenting on a player's skill ("Wow, what a natural!"). These kinds of messages convey implicit assumptions about the malleability of different abilities and may contribute to the attitudes individuals hold about the nature of their abilities – or "mindsets" as they are called in contemporary psychological research. Decades of research suggest that mindsets substantially influence learning, motivation, and achievement (Dweck, 1999, 2006; Gunderson et al., 2013; Mueller & Dweck, 1998; Rattan, Good, & Dweck, 2012). A consistent finding is that a belief in the malleability of self-attributes – a growth mindset – is associated with better performance and perseverance, especially when individuals are faced with challenging tasks. Although the psychological and motivational outcomes associated with mindsets are well understood, researchers know relatively little about the neurocognitive processes that mediate the impact of mindsets on achievement outcomes. In this study, we examined how standard mindset inductions (messages about abilities) influence cognitive control.

1.1. Mindsets/implicit theories

People generally hold one of two beliefs (or "mindsets")[2] about the malleability of self-attributes such as intelligence: the "growth mindset" construes intelligence as malleable and improvable; the "fixed mindset" understands intelligence as an absolute entity that cannot be changed (Dweck, Chiu, & Hong, 1995). A large body of literature has documented that these different mindsets lead to different attributions, goals, and experiences of performance situations (see Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013 for a review). For instance, individuals who hold the growth mindset believe that successful performance is largely driven by effort, whereas fixed-minded individuals believe success is determined mostly by natural ability (Dweck, 2006). These basic assumptions of where ability comes from are thought to bias individuals' goals for achievement. Whereas growth-minded individuals typically focus on learning to *master* a given task,

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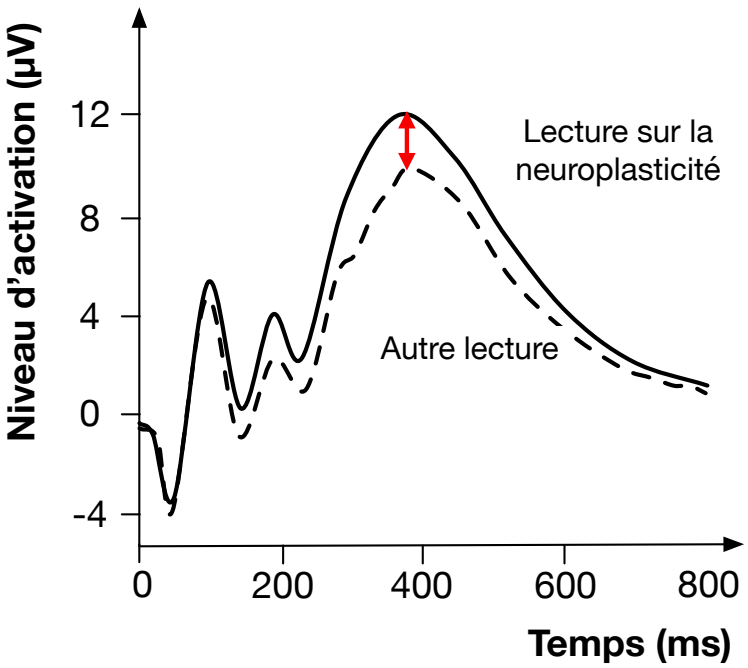
[2] Note that we consider the terms "mindsets" and "implicit theories" as interchangeable. A growth mindset corresponds to an "incremental theory" whereas a fixed mindset corresponds to an "entity theory".

Effet de la lecture d'un **texte** (dynamique vs fixe) sur l'activité du cerveau

12

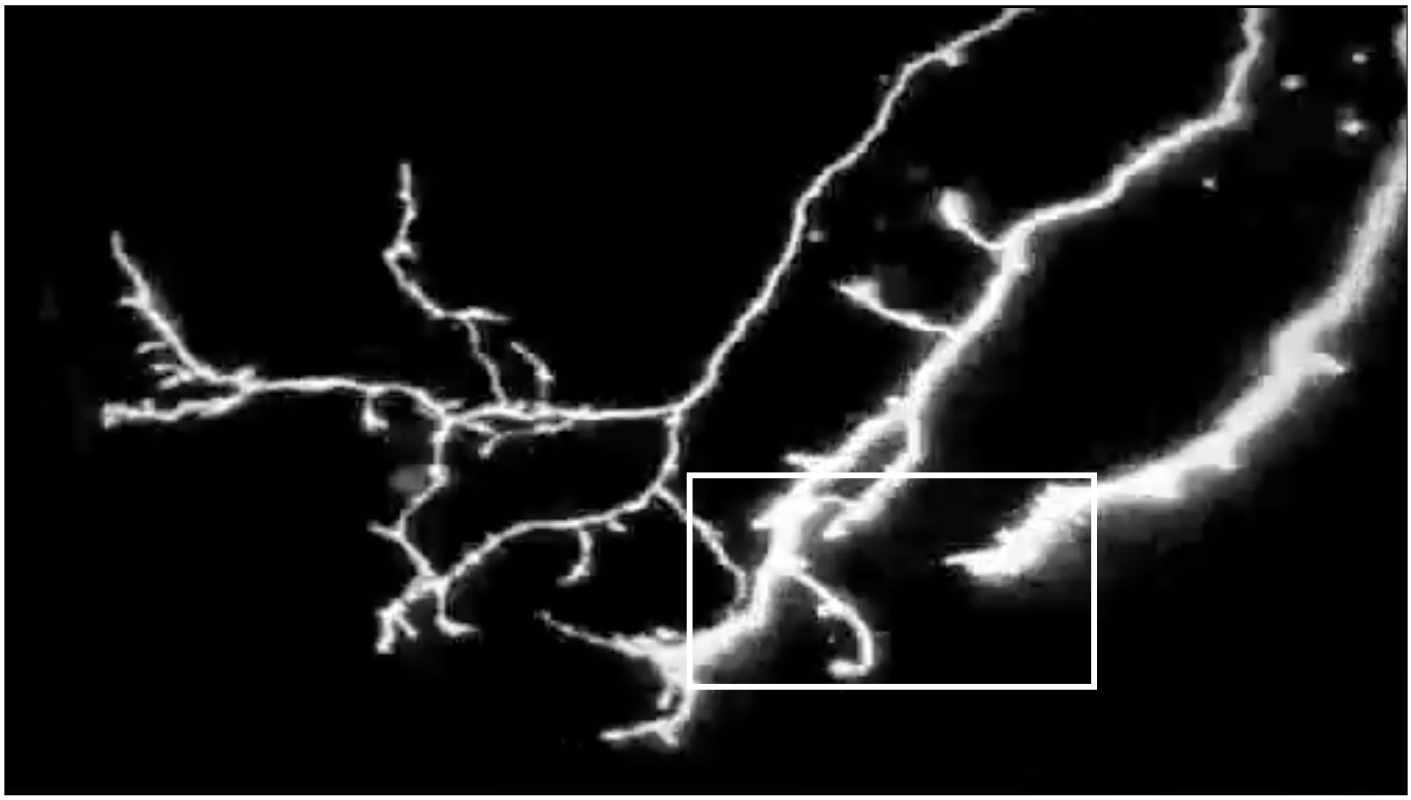
Étude de **Schroder et al.**



Idée 1
Cultiver un état d'esprit dynamique

Comment ?

Stratégie 1
Connaître la notion de neuroplasticité



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http://www.labneuroeducation.org/cerveau

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Idée 1
Cultiver un état d'esprit dynamique

Comment ?

Stratégie 1
Connaître la notion de neuroplasticité

Stratégie 2
Fournir des rétroactions compatibles avec un état d'esprit dynamique

Quoi dire ?

Succès = **processus** (impliquant effort **et** stratégies)

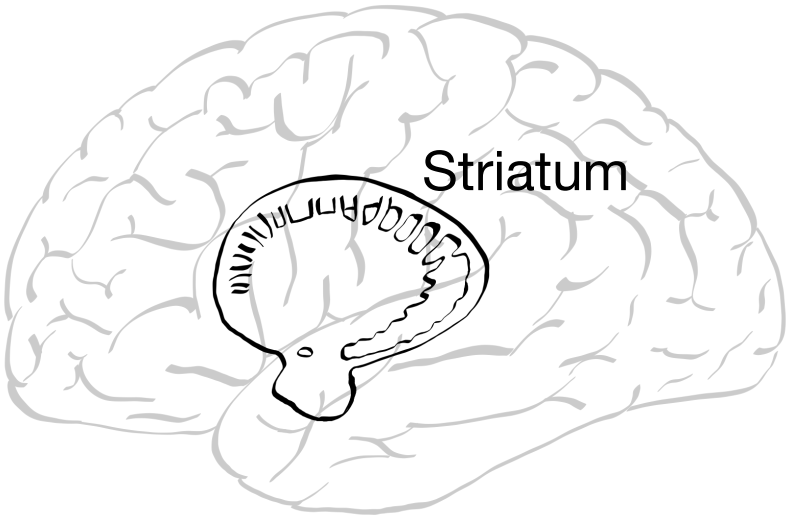
« L'objectif, ce n'est pas de tout réussir d'un coup. L'objectif est de développer ta compréhension étape par étape. Que peux-tu essayer d'autre ? »

« Bravo pour ton excellent résultat. Tu as travaillé fort, tu as amélioré tes stratégies d'étude et, depuis, tu ne cessez de t'améliorer ! »

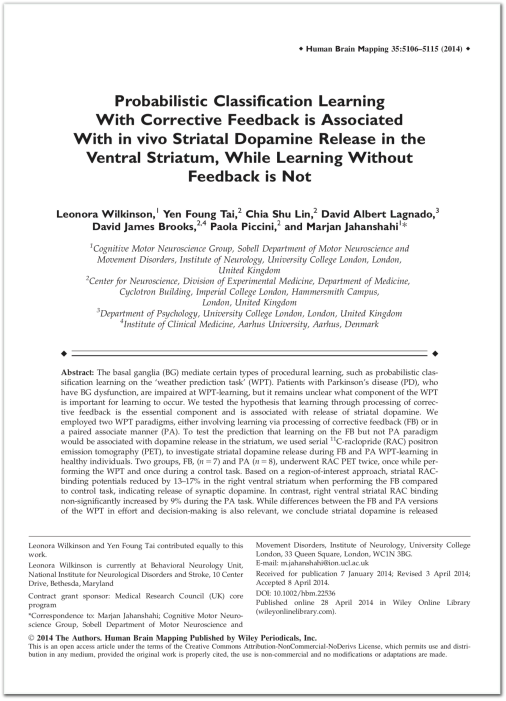
Inspiré de Dweck (2015)

Idée 2

Bénéfice



Étude de Wilkinson et al.



• Human Brain Mapping 35:5106–5115 (2014) •

Probabilistic Classification Learning With Corrective Feedback is Associated With in vivo Striatal Dopamine Release in the Ventral Striatum, While Learning Without Feedback is Not

Leonora Wilkinson,[1] Yen Foung Tai,[2] Chia Shu Lin,[2] David Albert Lagnado,[3] David James Brooks,[2,4] Paola Piccini,[2] and Marjan Jahanshahi[1]*

[1]*Cognitive Motor Neuroscience Group, Sobell Department of Motor Neuroscience and Movement Disorders, Institute of Neurology, University College London, London, United Kingdom*
[2]*Center for Neuroscience, Division of Experimental Medicine, Department of Medicine, Cyclotron Building, Imperial College London, Hammersmith Campus, London, United Kingdom*
[3]*Department of Psychology, University College London, London, United Kingdom*
[4]*Institute of Clinical Medicine, Aarhus University, Aarhus, Denmark*

Abstract: The basal ganglia (BG) mediate certain types of procedural learning, such as probabilistic classification learning on the 'weather prediction task' (WPT). Patients with Parkinson's disease (PD), who have BG dysfunction, are impaired at WPT-learning, but it remains unclear what component of the WPT is important for learning to occur. We tested the hypothesis that learning through processing of corrective feedback is the essential component and is associated with release of striatal dopamine. We employed two WPT paradigms, either involving learning via processing of corrective feedback (FB) or in a paired associate manner (PA). To test the prediction that learning on the FB but not PA paradigm would be associated with dopamine release in the striatum, we used serial ^{11}C-raclopride (RAC) positron emission tomography (PET), to investigate striatal dopamine release during FB and PA WPT-learning in healthy individuals. Two groups, FB, ($n = 7$) and PA ($n = 8$), underwent RAC PET twice, once while performing the WPT and once during a control task. Based on a region-of-interest approach, striatal RAC-binding potentials reduced by 13–17% in the right ventral striatum when performing the FB compared to control task, indicating release of synaptic dopamine. In contrast, right ventral striatal RAC binding non-significantly increased by 9% during the PA task. While differences between the FB and PA versions of the WPT in effort and decision-making is also relevant, we conclude striatal dopamine is released

Leonora Wilkinson and Yen Foung Tai contributed equally to this work.

Leonora Wilkinson is currently at Behavioral Neurology Unit, National Institute for Neurological Disorders and Stroke, 10 Center Drive, Bethesda, Maryland

Contract grant sponsor: Medical Research Council (UK) core program

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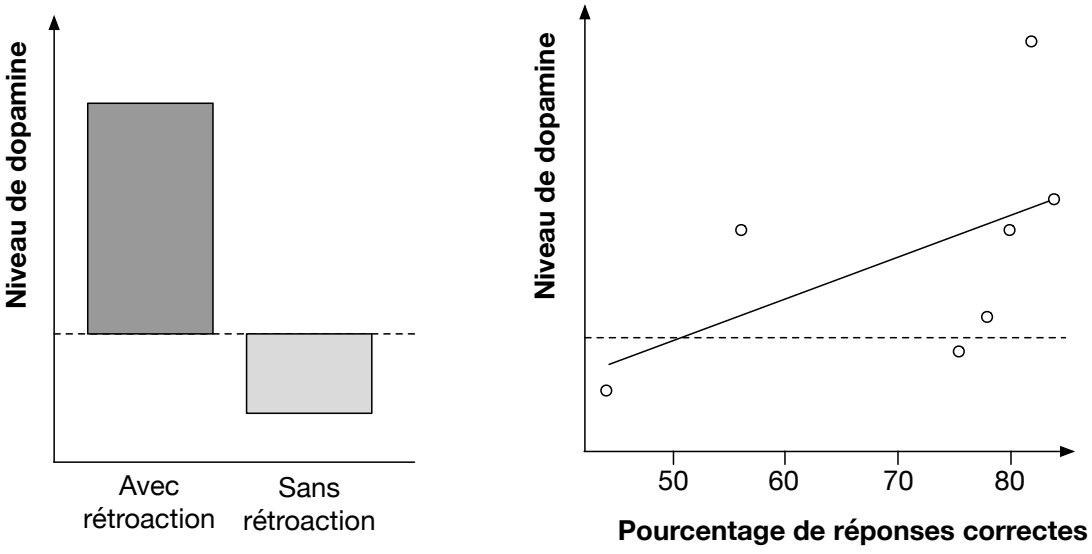
Published online 28 April 2014 in Wiley Online Library (wileyonlinelibrary.com).

Effet de la **rétroaction** sur le cerveau et le relâchement de **dopamine**

Étude de Wilkinson et al.

Dans le striatum



Réussite ⇒ rétroaction positive ↑ ⇒ striatum ↑ ⇒ dopamine ↑

⇒ sentiment de plaisir/satisfaction ↑ ⇒ **motivation**

Étude de Garon-C. et al.

CHILD DEVELOPMENT

Child Development, January/February 2016, Volume 87, Number 1, Pages 165–175

Intrinsic Motivation and Achievement in Mathematics in Elementary School: A Longitudinal Investigation of Their Association

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Michel Boivin
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Frank Vitaro
Department of Psychoeducation, Université de Montréal

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Institute of Genetic, Neurobiological, and Social Foundations of Child Development, Tomsk State University and Department of Pediatrics and Psychology, Université de Montréal and University College Dublin

This study examined the associations between intrinsic motivation and achievement in mathematics in a sample of 1,478 Canadian school-age children followed from Grades 1 to 4 (ages 7–10). Children self-reported their intrinsic motivation toward mathematics, whereas achievement was measured through direct assessment of mathematics abilities. Cross-lagged models showed that achievement predicted intrinsic motivation from Grades 1 to 2, and from Grades 2 to 4. However, intrinsic motivation did not predict achievement at any time. This developmental pattern of association was gender invariant. Contrary to the hypothesis that motivation and achievement are reciprocally associated over time, our results point to a directional association from prior achievement to subsequent intrinsic motivation. Results are discussed in light of their theoretical and practical implications.

This research was supported by grants from the Québec Ministry of Health, the Fonds Québécois de la Recherche sur la Société et la Culture (FQRSC), the Social Science and Humanities Research Council (SSHRC), the Canadian Institutes for Health Research (CIHR), and Grant 11.G34.31.003 from the Russian Federation. Michel Boivin is supported by the Canada Research Chair Program. We are grateful to the parents of the children participants to the Québec Longitudinal Study of Child Development (QLSCD). We thank the Québec Institute of Statistics, Mireille Jetté, and the GRIP staff members for data collection and management, and Bei Feng and Hélène Paradis for assistance with statistical analyses.

Correspondence concerning this article should be addressed to Michel Boivin, CRC in Child Development, École de psychologie, Université Laval, Québec, Canada G1K 7P4. Electronic mail may be sent to michel.boivin@psy.ulaval.ca.

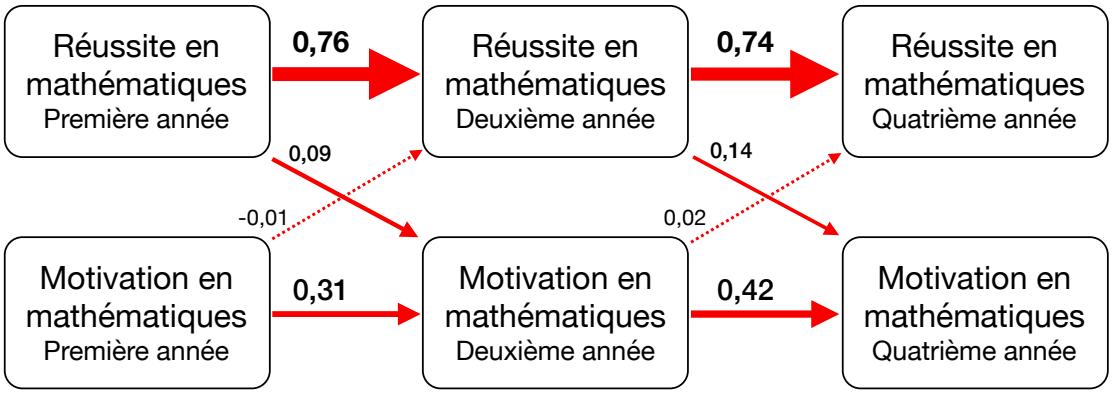
[Correction added after online publication on November 9, 2015: an author's name was corrected from "Jean Séguin" to "Jean R. Séguin."]

The question as to whether intrinsic motivation predicts academic achievement has attracted much attention among education researchers and school professionals (Reeve, 2002). Under self-determination theory (SDT), intrinsic motivation refers to being engaged in an activity because of one's inherent interest and pleasure for this activity rather than due to external contingencies (Ryan & Deci, 2000). It is conceptualized as a natural catalyst for learning and achievement (Gottfried, 1985, 1990; Ryan & Deci, 2009).

 0009-3920/2016/8701-0014
DOI: 10.1111/cdev.12488

Motivation cause réussite ou **réussite** cause motivation ?

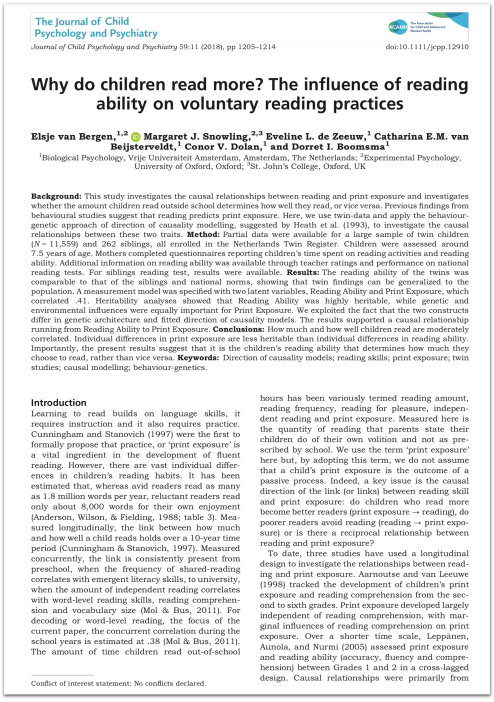
Étude de Garon-C. et al.



La **réussite** cause la **motivation !**

25

Étude de Bergen et al.



The Journal of Child Psychology and Psychiatry

Journal of Child Psychology and Psychiatry 59:11 (2018), pp 1205–1214 doi:10.1111/jcpp.12910

Why do children read more? The influence of reading ability on voluntary reading practices

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Background: This study investigates the causal relationships between reading and print exposure and investigates whether the amount children read outside school determines how well they read, or vice versa. Previous findings from behavioural studies suggest that reading predicts print exposure. Here, we use twin-data and apply the behaviour-genetic approach of direction of causality modelling, suggested by Heath et al. (1993), to investigate the causal relationships between these two traits. **Method:** Partial data were available for a large sample of twin children ($N \sim 11{,}559$) and 262 siblings, all enrolled in the Netherlands Twin Register. Children were assessed around 7.5 years of age. Mothers completed questionnaires reporting children's time spent on reading activities and reading ability. Additional information on reading ability was available through teacher ratings and performance on national reading tests. For siblings reading test, results were available. **Results:** The reading ability of the twins was comparable to that of the siblings and national norms, showing that twin findings can be generalized to the population. A measurement model was specified with two latent variables, Reading Ability and Print Exposure, which correlated .41. Heritability analyses showed that Reading Ability was highly heritable, while genetic and environmental influences were equally important for Print Exposure. We exploited the fact that the two constructs differ in genetic architecture and fitted direction of causality models. The results supported a causal relationship running from Reading Ability to Print Exposure. **Conclusions:** How much and how well children read are moderately correlated. Individual differences in print exposure are less heritable than individual differences in reading ability. Importantly, the present results suggest that it is the children's reading ability that determines how much they choose to read, rather than vice versa. **Keywords:** Direction of causality models; reading skills; print exposure; twin studies; causal modelling; behaviour-genetics.

Introduction

Learning to read builds on language skills, it requires instruction and it also requires practice. Cunningham and Stanovich (1997) were the first to formally propose that practice, or 'print exposure' is a vital ingredient in the development of fluent reading. However, there are vast individual differences in children's reading habits. It has been estimated that, whereas avid readers read as many as 1.8 million words per year, reluctant readers read only about 8,000 words for their own enjoyment (Anderson, Wilson, & Fielding, 1988; table 3). Measured longitudinally, the link between how much and how well a child reads holds over a 10-year time period (Cunningham & Stanovich, 1997). Measured concurrently, the link is consistently present from preschool, when the frequency of shared-reading correlates with emergent literacy skills, to university, when the amount of independent reading correlates with word-level reading skills, reading comprehension and vocabulary size (Mol & Bus, 2011). For decoding or word-level reading, the focus of the current paper, the concurrent correlation during the school years is estimated at .38 (Mol & Bus, 2011). The amount of time children read out-of-school hours has been variously termed reading amount, reading frequency, reading for pleasure, independent reading and print exposure. Measured here is the quantity of reading that parents state their children do of their own volition and not as prescribed by school. We use the term 'print exposure' here but, by adopting this term, we do not assume that a child's print exposure is the outcome of a passive process. Indeed, a key issue is the causal direction of the link (or links) between reading skill and print exposure: do children who read more become better readers (print exposure → reading), do poorer readers avoid reading (reading → print exposure) or is there a reciprocal relationship between reading and print exposure?

To date, three studies have used a longitudinal design to investigate the relationships between reading and print exposure. Aarnoutse and van Leeuwe (1998) tracked the development of children's print exposure and reading comprehension from the second to sixth grades. Print exposure developed largely independent of reading comprehension, with marginal influences of reading comprehension on print exposure. Over a shorter time scale, Leppänen, Aunola, and Nurmi (2005) assessed print exposure and reading ability (accuracy, fluency and comprehension) between Grades 1 and 2 in a cross-lagged design. Causal relationships were primarily from

Conflict of interest statement: No conflicts declared.

Lire davantage cause réussite ou **réussite** cause lire davantage ?

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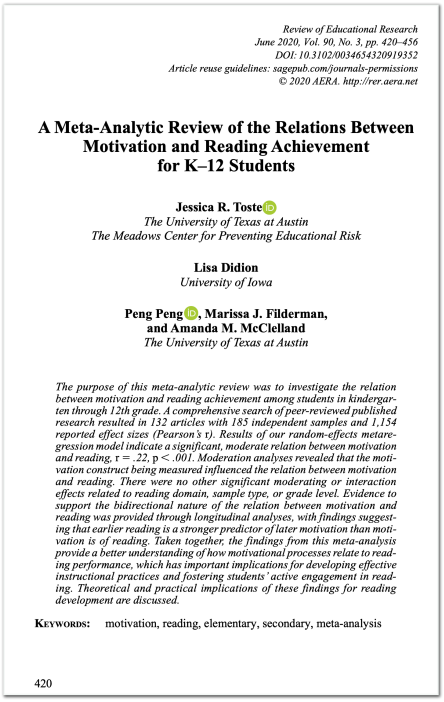
Étude de

Toste et al.



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A Meta-Analytic Review of the Relations Between Motivation and Reading Achievement for K–12 Students

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The University of Texas at Austin
The Meadows Center for Preventing Educational Risk

Lisa Didion
University of Iowa

Peng Peng, Marissa J. Filderman, and Amanda M. McClelland
The University of Texas at Austin

The purpose of this meta-analytic review was to investigate the relation between motivation and reading achievement among students in kindergarten through 12th grade. A comprehensive search of peer-reviewed published research resulted in 132 articles with 185 independent samples and 1,154 reported effect sizes (Pearson's r). Results of our random-effects metaregression model indicate a significant, moderate relation between motivation and reading, r = .22, p < .001. Moderation analyses revealed that the motivation construct being measured influenced the relation between motivation and reading. There were no other significant moderating or interaction effects related to reading domain, sample type, or grade level. Evidence to support the bidirectional nature of the relation between motivation and reading was provided through longitudinal analyses, with findings suggesting that earlier reading is a stronger predictor of later motivation than motivation is of reading. Taken together, the findings from this meta-analysis provide a better understanding of how motivational processes relate to reading performance, which has important implications for developing effective instructional practices and fostering students' active engagement in reading. Theoretical and practical implications of these findings for reading development are discussed.

Keywords: motivation, reading, elementary, secondary, meta-analysis

Relation entre **motivation** et **réussite** en lecture

Idée 2
Favoriser la réussite et l'augmentation de dopamine

Comment ?

Stratégie 1
Fournir de la rétroaction positive

Rétroaction positive

Fréquente et idéalement immédiate

29

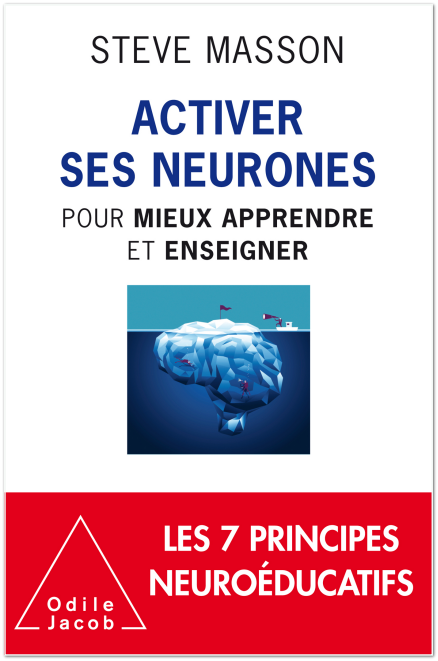
Idée 2
Favoriser la réussite et l'augmentation de dopamine

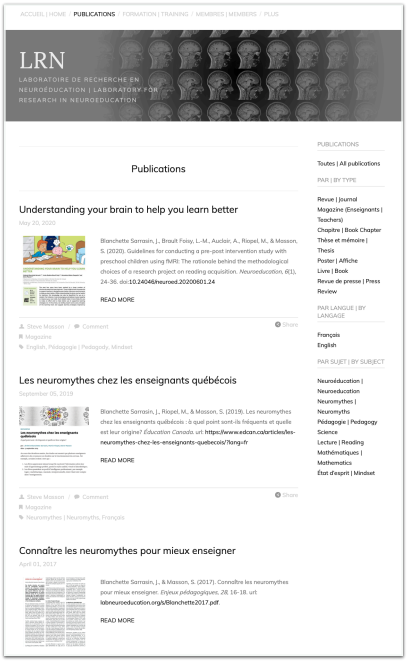
Comment ?

Stratégie 1
Fournir de la rétroaction positive

Stratégie 2
Utiliser des principes issus de la recherche

30





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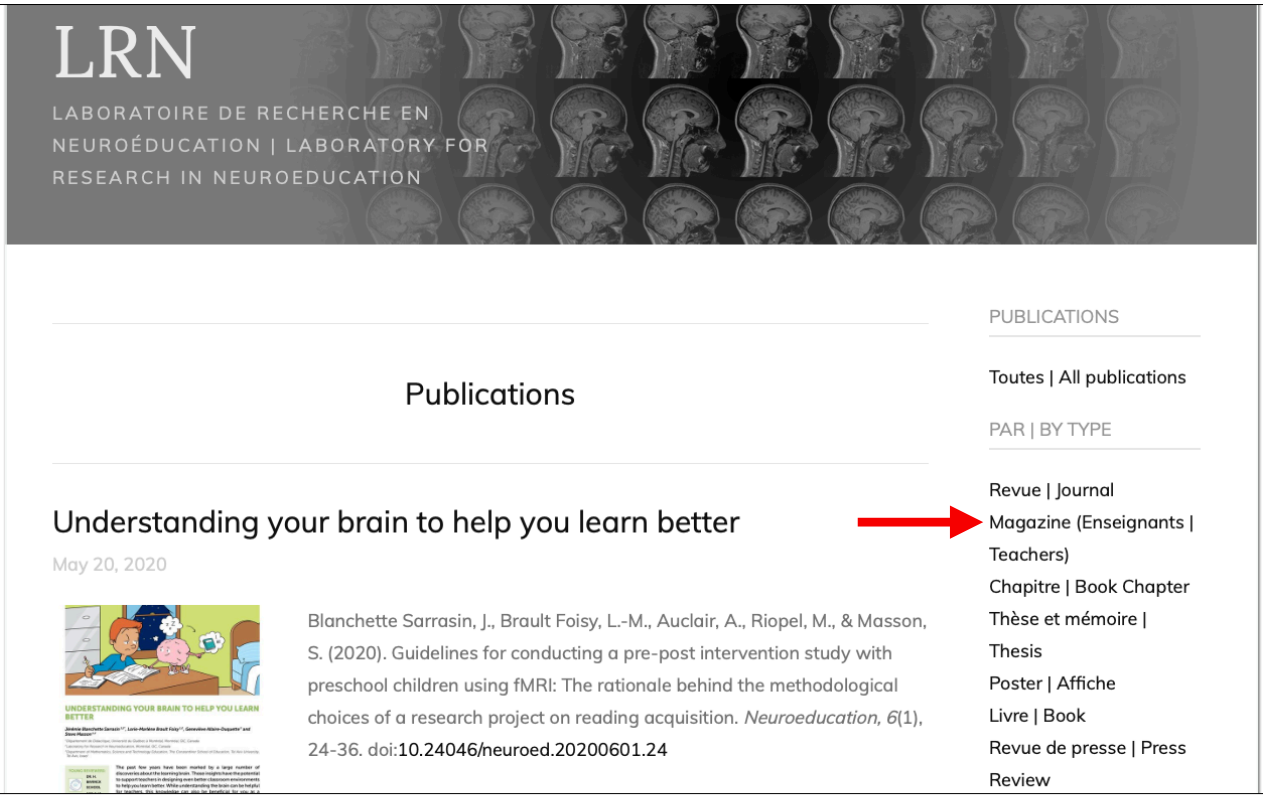

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Idée 2
Favoriser la réussite et l'augmentation de dopamine

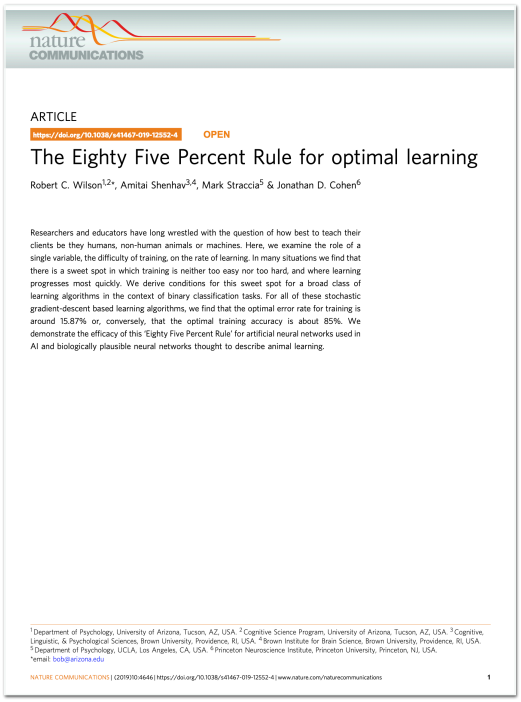
Comment ?

Stratégie 1
Fournir de la rétroaction positive

Stratégie 2
Utiliser des principes issus de la recherche

Stratégie 3
Tâches ni trop faciles ni trop difficiles

Étude de **Wilson et al.**



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ARTICLE

https://doi.org/10.1038/s41467-019-12552-4 OPEN

The Eighty Five Percent Rule for optimal learning

Robert C. Wilson[1,2*], Amitai Shenhav[3,4], Mark Straccia[5] & Jonathan D. Cohen[6]

Researchers and educators have long wrestled with the question of how best to teach their clients be they humans, non-human animals or machines. Here, we examine the role of a single variable, the difficulty of training, on the rate of learning. In many situations we find that there is a sweet spot in which training is neither too easy nor too hard, and where learning progresses most quickly. We derive conditions for this sweet spot for a broad class of learning algorithms in the context of binary classification tasks. For all of these stochastic gradient-descent based learning algorithms, we find that the optimal error rate for training is around 15.87% or, conversely, that the optimal training accuracy is about 85%. We demonstrate the efficacy of this 'Eighty Five Percent Rule' for artificial neural networks used in AI and biologically plausible neural networks thought to describe animal learning.

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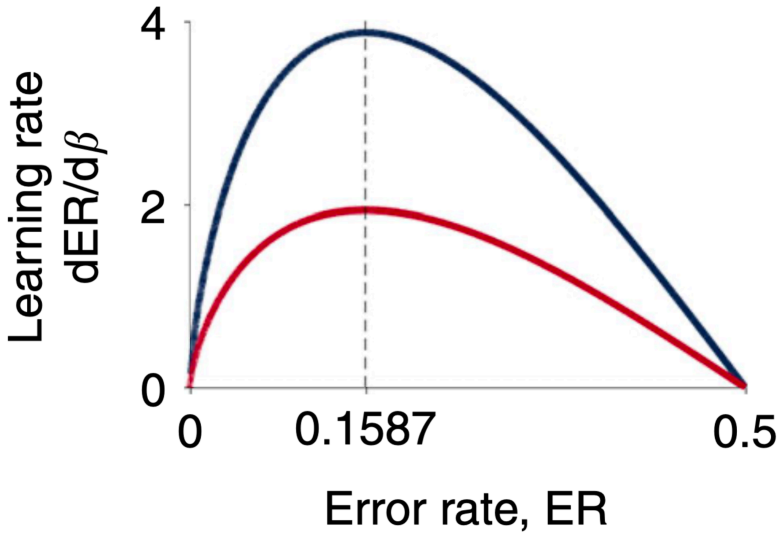
Effet du **taux de réussite** sur l'apprentissage

Étude de

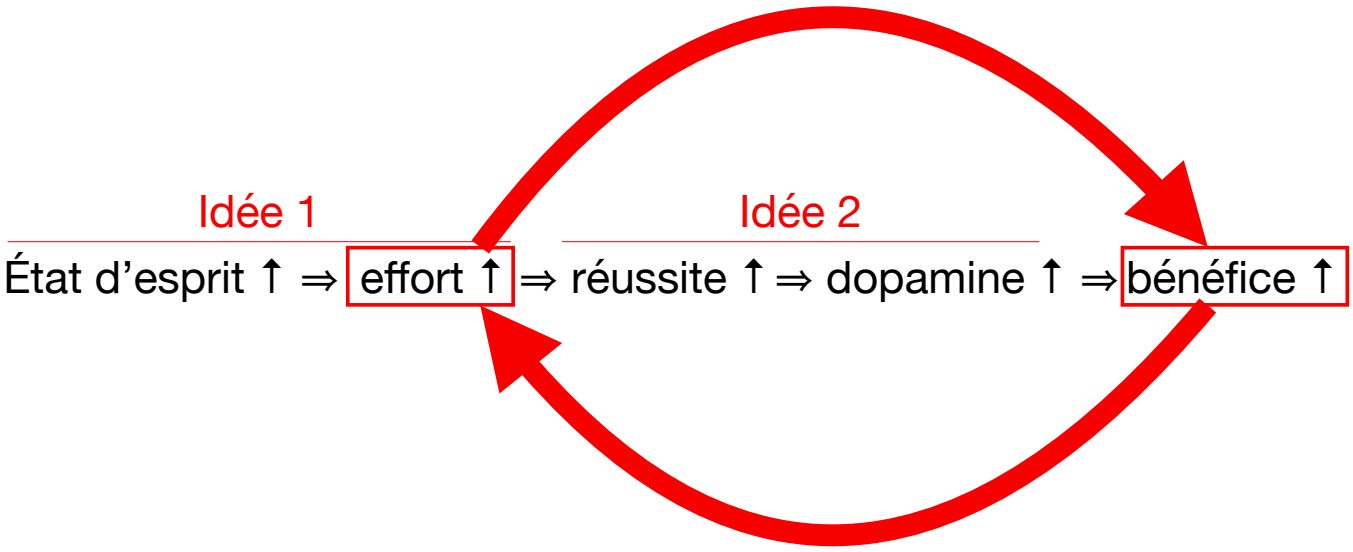
Wilson et al.



Taux d'erreur optimal : 15,9%

Taux de réussite optimal : 84,1%

Synthèse



Idée 1
Cultiver un état d'esprit dynamique

Connaître la notion de neuroplasticité

Fournir des rétroactions compatibles avec un état d'esprit dynamique

Idée 2
Favoriser la réussite et l'augmentation de dopamine

Fournir de la rétroaction positive

Utiliser des principes issus de la recherche

Proposer des tâches ni trop faciles ni trop difficiles