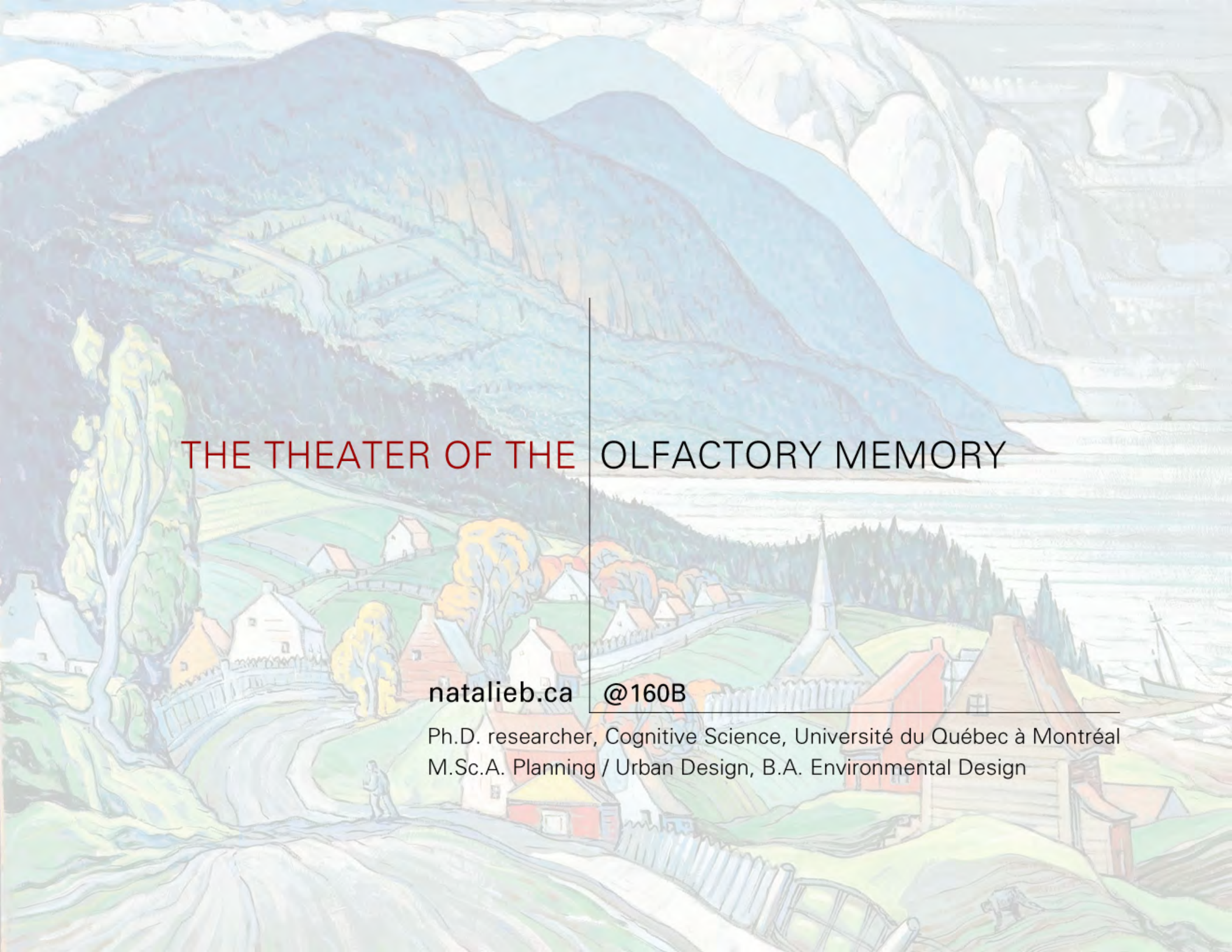


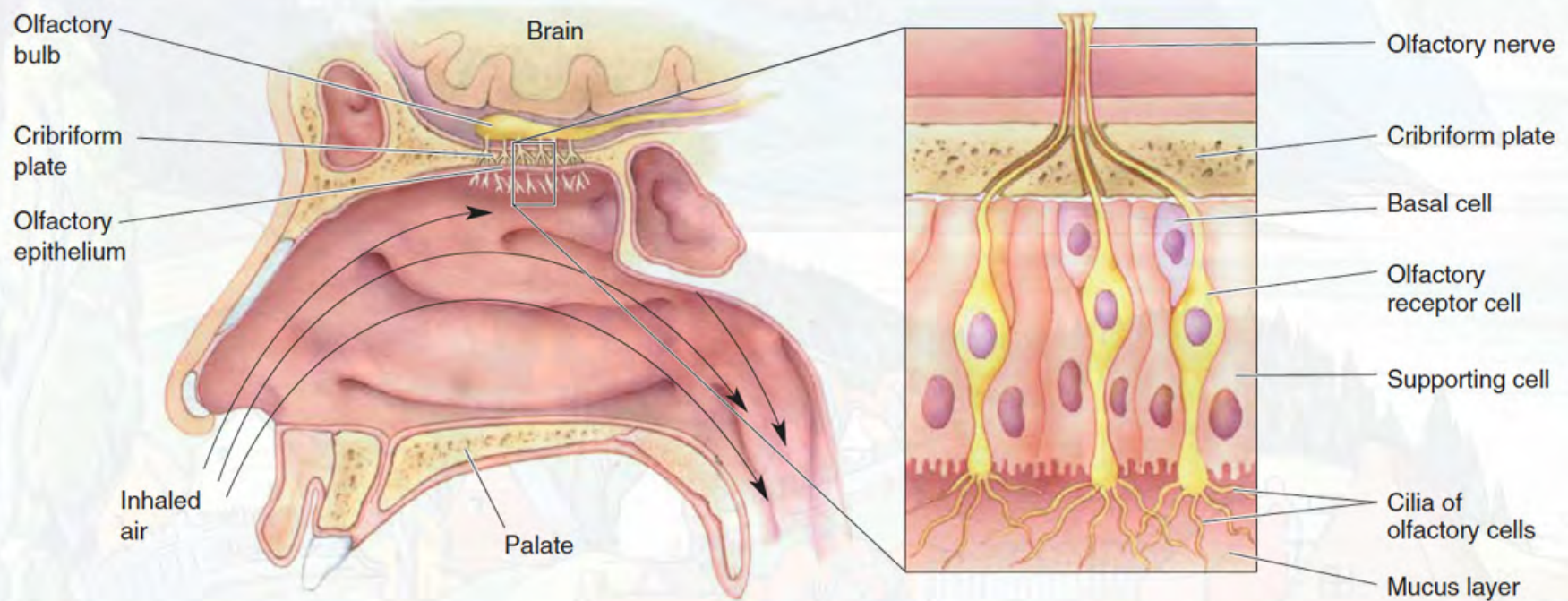


THE THEATER OF THE OLFACTORY MEMORY

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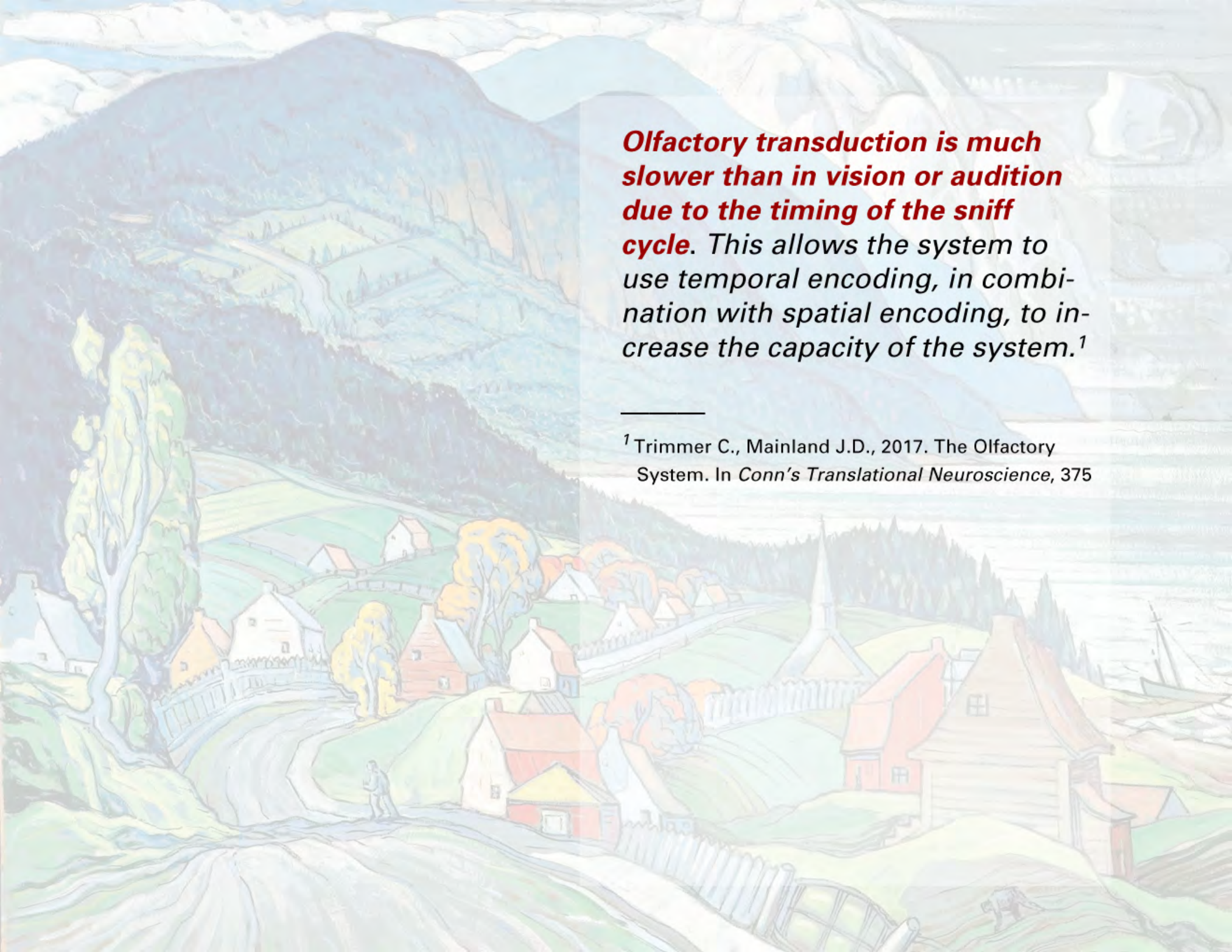
Ph.D. researcher, Cognitive Science, Université du Québec à Montréal
M.Sc.A. Planning / Urban Design, B.A. Environmental Design

Five to ten percent of the air we breathe is directed by the nasal conchae toward a patch of cells (the olfactory epithelium) on the roof and adjacent sides of the nasal cavity (Keyhani et al., 1995; Zhao et al., 2004). This area, which contains more than 100 million receptor cells (Keller & Vosshall, 2016), is where the stimulus conversion—transduction—kicks off.



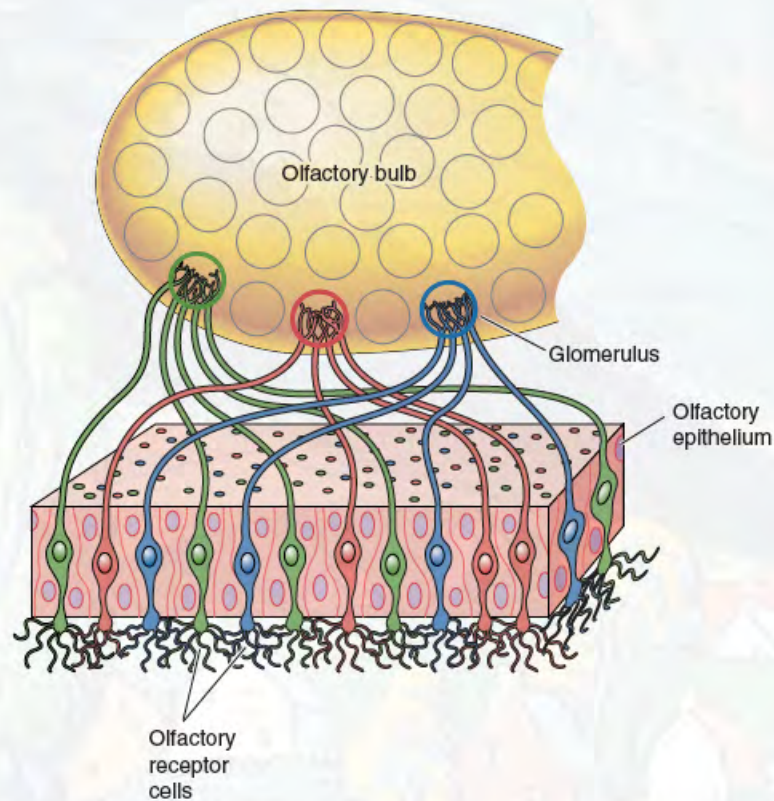
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BEAR M.F., CONNORS B.W., PARADISO M.A., 2016.
Neuroscience. Exploring the Brain, 4th edition, p.278



Olfactory transduction is much slower than in vision or audition due to the timing of the sniff cycle. This allows the system to use temporal encoding, in combination with spatial encoding, to increase the capacity of the system.¹

¹ Trimmer C., Mainland J.D., 2017. The Olfactory System. In *Conn's Translational Neuroscience*, 375



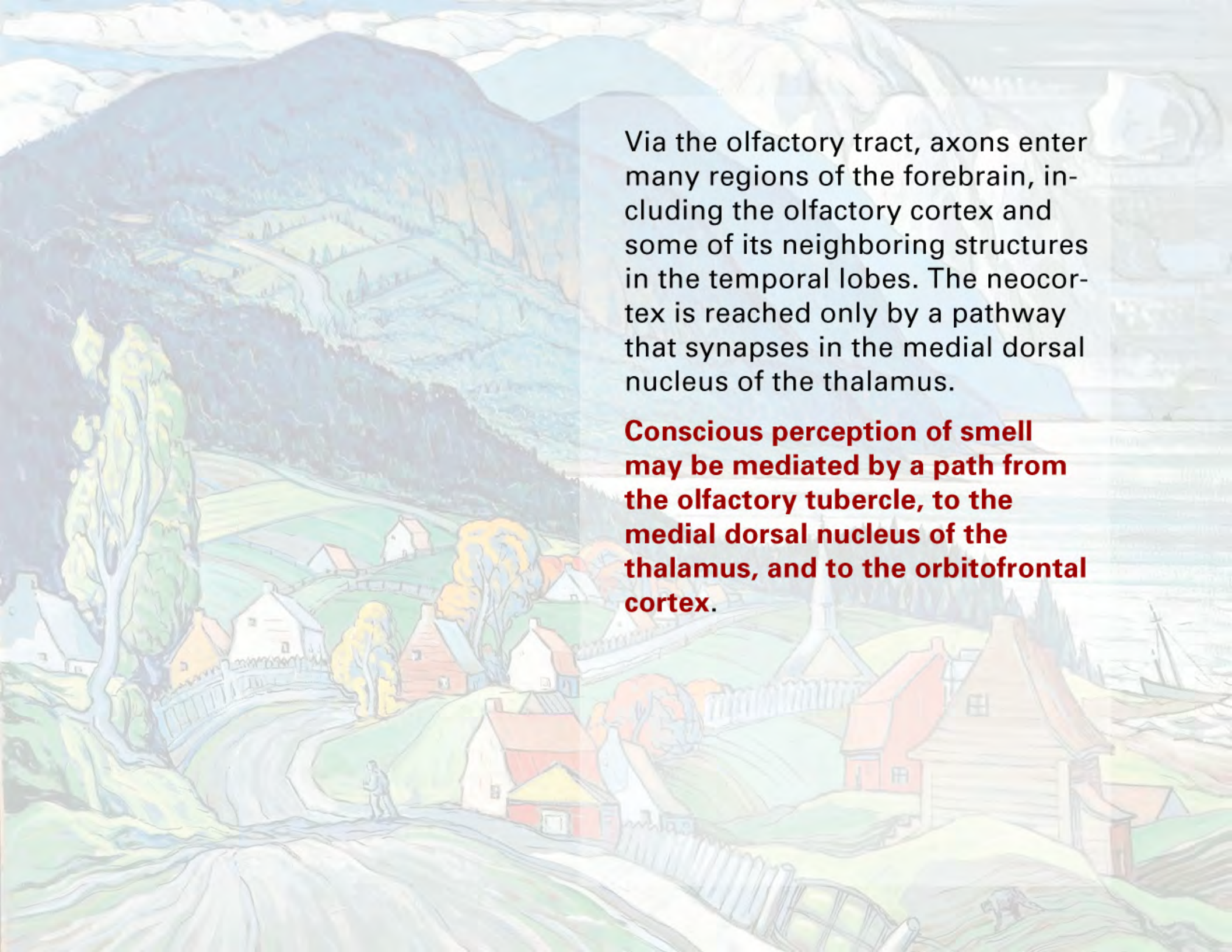
In humans, the olfactory receptor genes are scattered about on the genome, and nearly every chromosome has at least a few of them.

Each receptor gene has a unique structure, allowing the receptor proteins encoded by these genes to bind different odorants.

Each neuron that expresses a particular receptor type, projects to a specific glomerulus within the main olfactory bulb, establishing an organizational map at the level of the second order neurons.

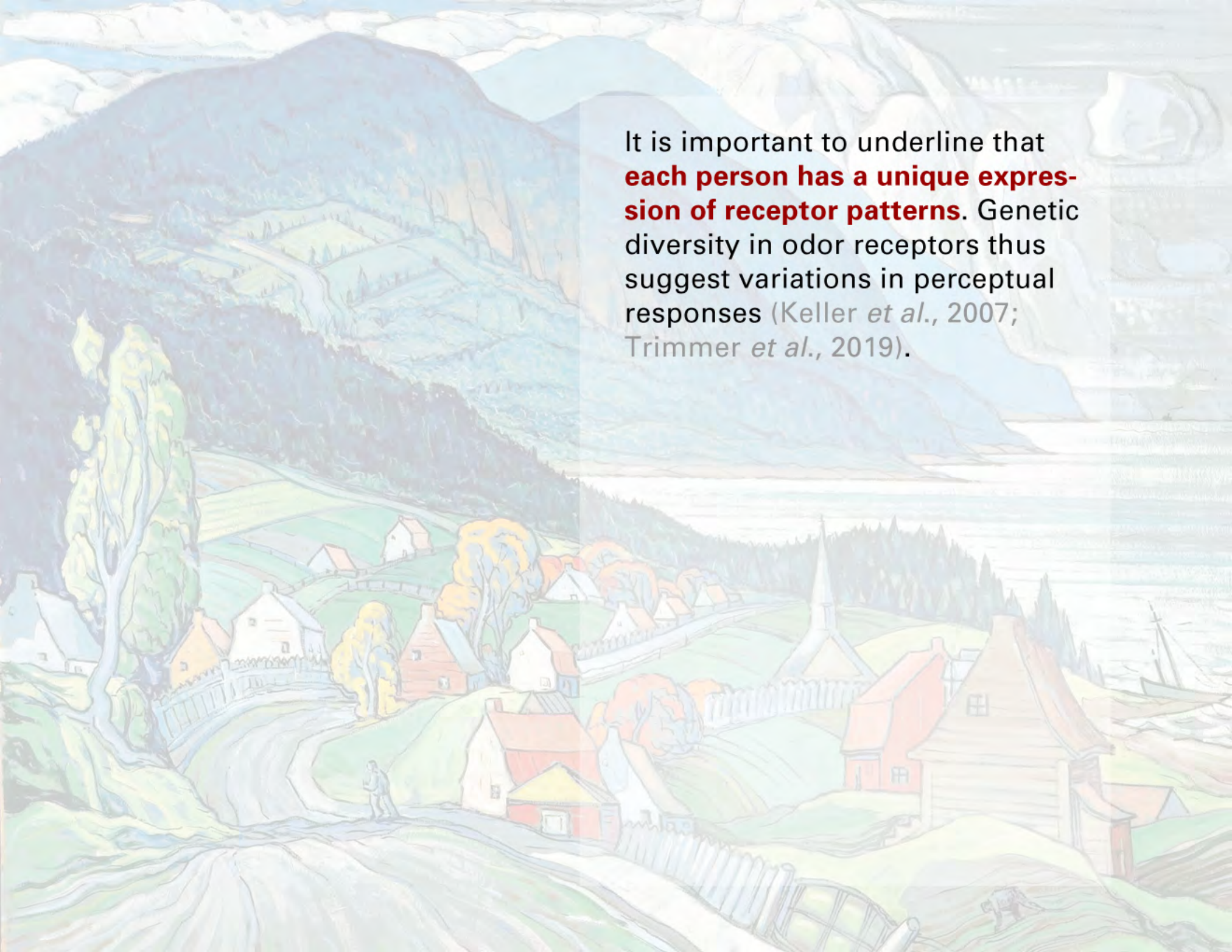
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BEAR M.F., CONNORS B.W., PARADISO M.A., 2016.
Neuroscience. Exploring the Brain, 4th edition, p.286

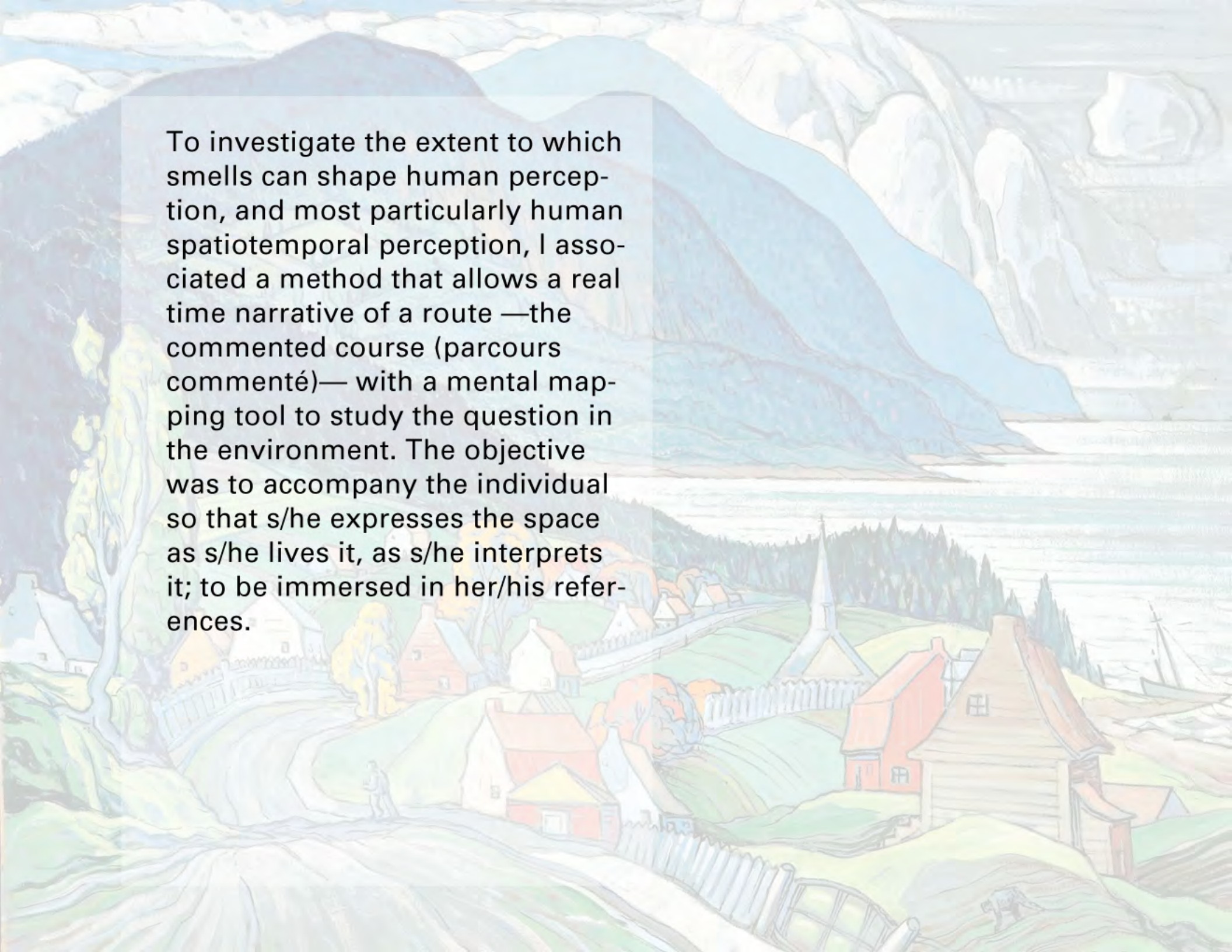


Via the olfactory tract, axons enter many regions of the forebrain, including the olfactory cortex and some of its neighboring structures in the temporal lobes. The neocortex is reached only by a pathway that synapses in the medial dorsal nucleus of the thalamus.

Conscious perception of smell may be mediated by a path from the olfactory tubercle, to the medial dorsal nucleus of the thalamus, and to the orbitofrontal cortex.



It is important to underline that **each person has a unique expression of receptor patterns**. Genetic diversity in odor receptors thus suggest variations in perceptual responses (Keller *et al.*, 2007; Trimmer *et al.*, 2019).

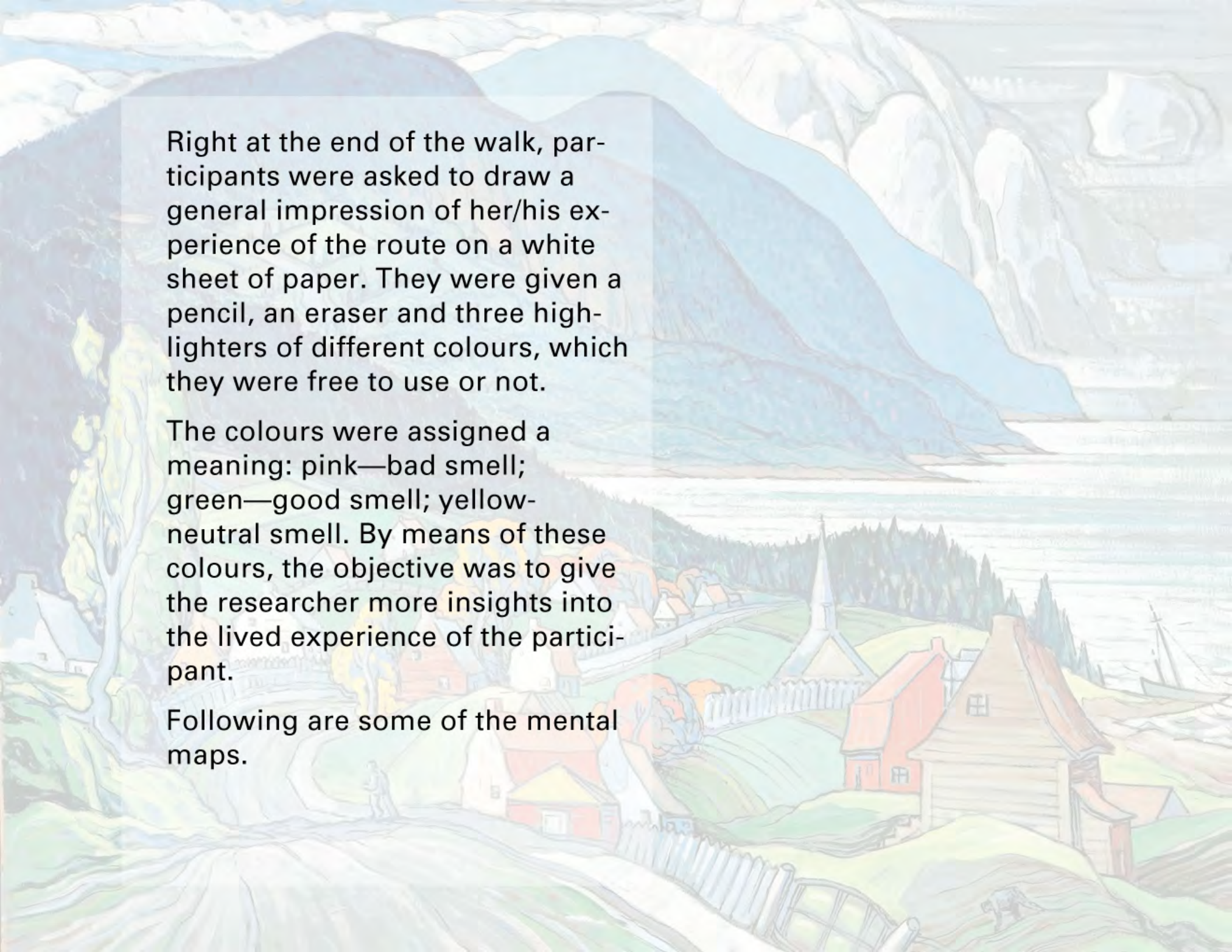


To investigate the extent to which smells can shape human perception, and most particularly human spatiotemporal perception, I associated a method that allows a real time narrative of a route —the commented course (parcours commenté)— with a mental mapping tool to study the question in the environment. The objective was to accompany the individual so that s/he expresses the space as s/he lives it, as s/he interprets it; to be immersed in her/his references.

In my company, each volunteer carried out, on foot, the same pre-determined walk of a duration of more or less 35 minutes. The route allowed participants to meet with a variety of smells as well as various types of urban spaces.

During the walk, the participant had to verbally express spontaneously what came into their mind when they were encountering smells or anything that made them think about smells. These comments were recorded on a voice recording device.

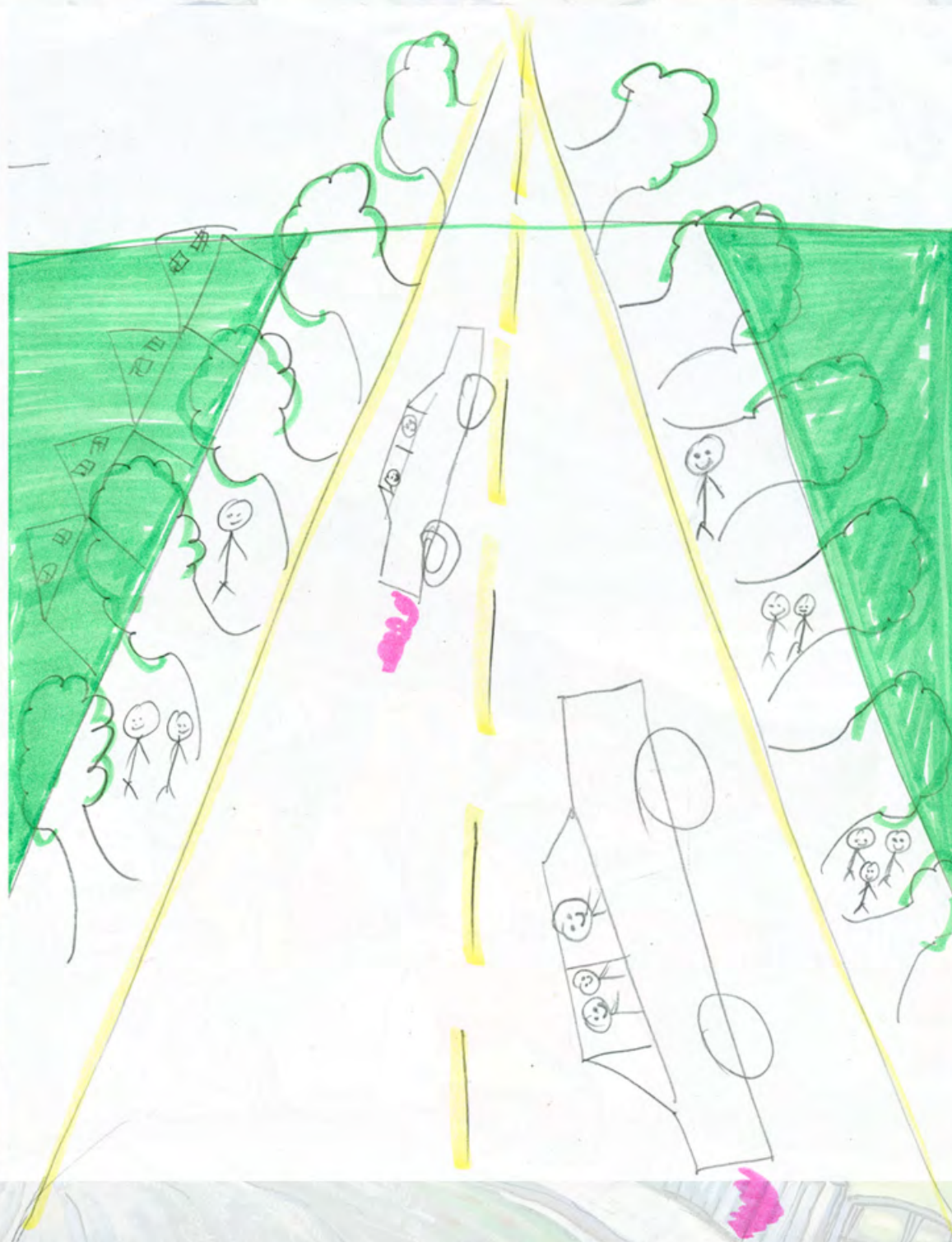




Right at the end of the walk, participants were asked to draw a general impression of her/his experience of the route on a white sheet of paper. They were given a pencil, an eraser and three highlighters of different colours, which they were free to use or not.

The colours were assigned a meaning: pink—bad smell; green—good smell; yellow—neutral smell. By means of these colours, the objective was to give the researcher more insights into the lived experience of the participant.

Following are some of the mental maps.



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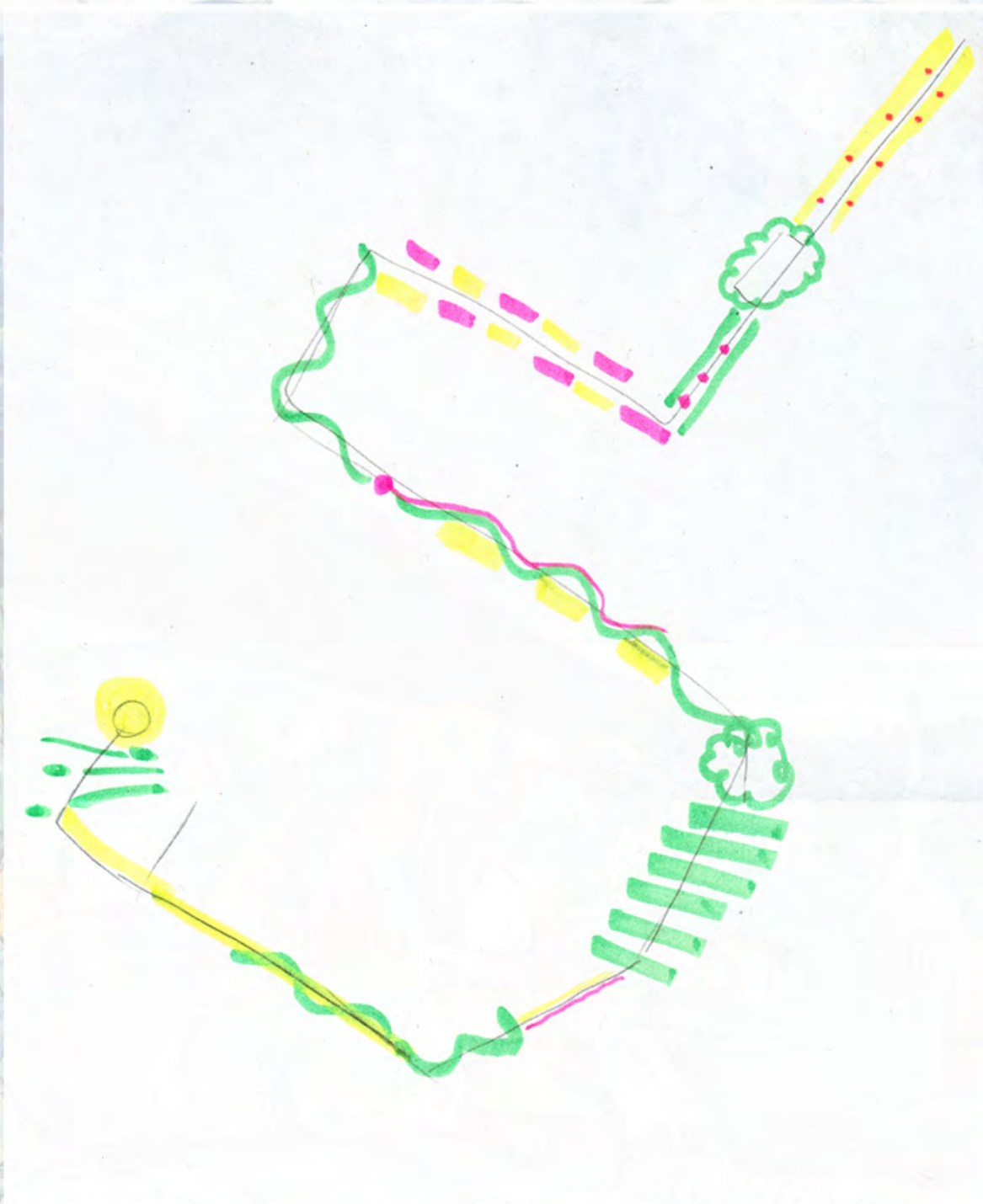
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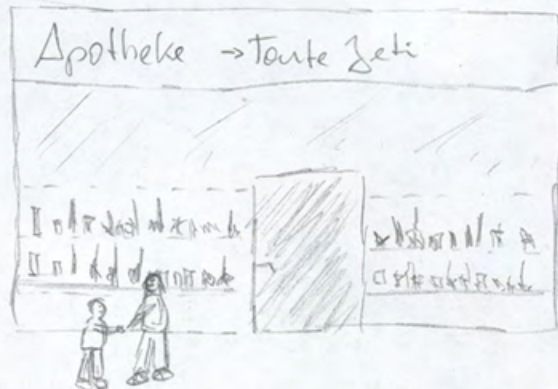
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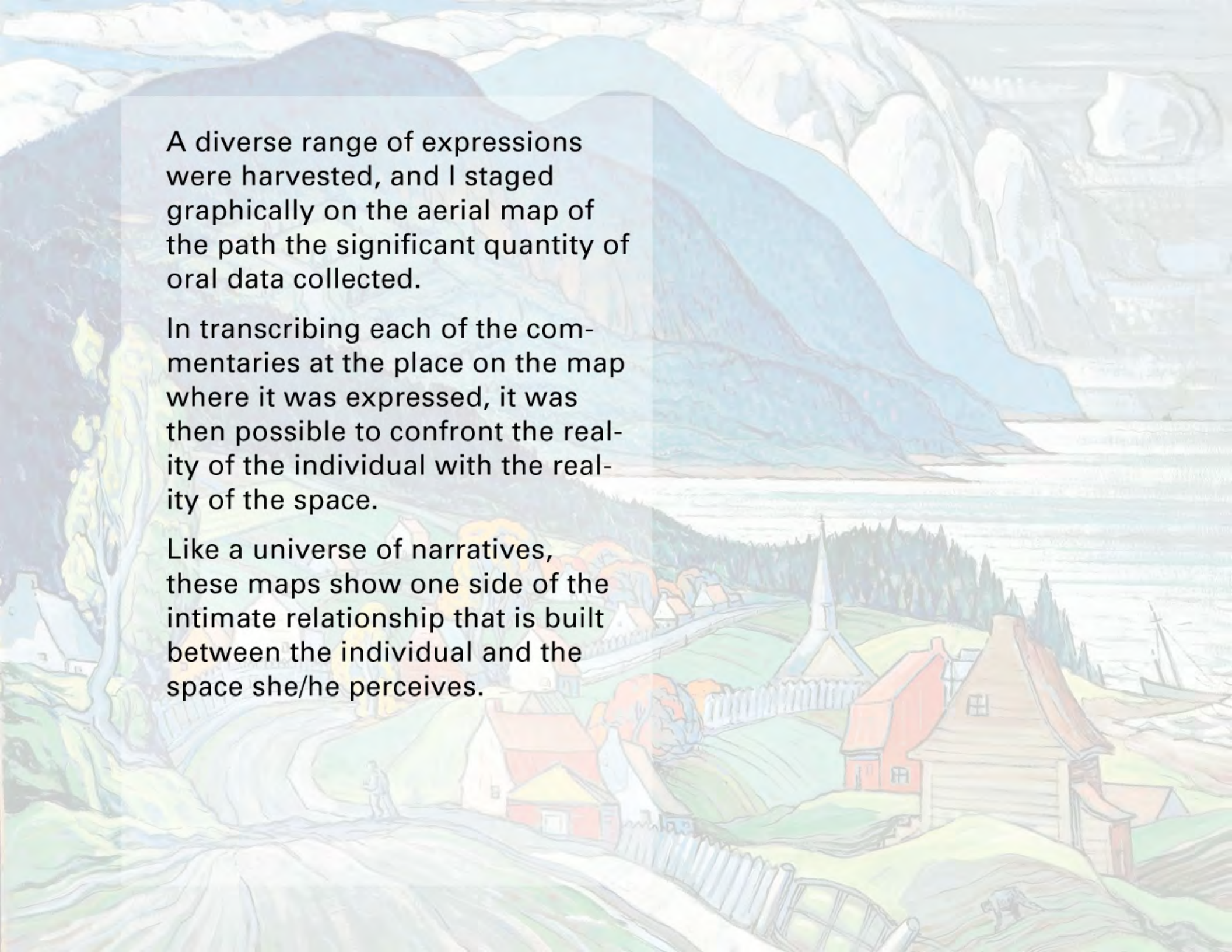
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A diverse range of expressions were harvested, and I staged graphically on the aerial map of the path the significant quantity of oral data collected.

In transcribing each of the commentaries at the place on the map where it was expressed, it was then possible to confront the reality of the individual with the reality of the space.

Like a universe of narratives, these maps show one side of the intimate relationship that is built between the individual and the space she/he perceives.

Fragments du paysage olfactif montréalais (secteur Mile End)

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participant #10-OP
age: **34** sex: **M**
ethnic group:
Latino (born in México)

departure time: **18:23**
date: **07/08/2011**
season: **summer**
weather: **light rain**
• **23°C**
• **wind N-19km/h**
• **78% humidity level**

spoke in English —>

participant #07-ET
âge: **53** sexe: **F**
groupe ethnique:
Québécoise (née au QC)

heure de départ: **20:04**
date: **07/06/2011**
saison: **printemps**
météo: **ensoleillé**
• **27°C**

ah! de l'huile! ça me rappelle la grosse fournaise à l'huile chez mes parents. C'est tout un système de chauffage à eau chaude... j'allais au sous-sol des fois et ça sentait ça.

ça c'est l'odeur d'une journée hyper chaude en été, quand les vidanges sont à l'extérieur.

aah! j'ai faim! Une odeur de pizza me traverse les narines.

right now I don't smell anything.

pas évident de ne pas se laisser influencer par les sons ou par ce que je vois...

that small smell reminded me of Mexico City. Like being downtown. I don't know why. Probably because of the pollution of the cars.

rien de particulier sauf un fond d'humidité.

again, that car pollution smell. It reminds me of a city.

encore! c'est dommage! une bonne odeur de poulet et encore la cigarette qui est derrière. Ça me défait toute le plaisir de cette senteur-là.

toujours les mêmes odeurs d'une soirée chaude, lourde... humide... ça me fait penser à des

une odeur de feu de bois... au chalet du Lac Baron à Lakefield. Ça c'est des beaux souvenirs passés avec la famille à manger des guimauves autour du feu, des saucisses à hot-dog.

that smoke smell reminded me of a typical bar that I use to visit.

I just smell something that reminded me of a mechanical shop.

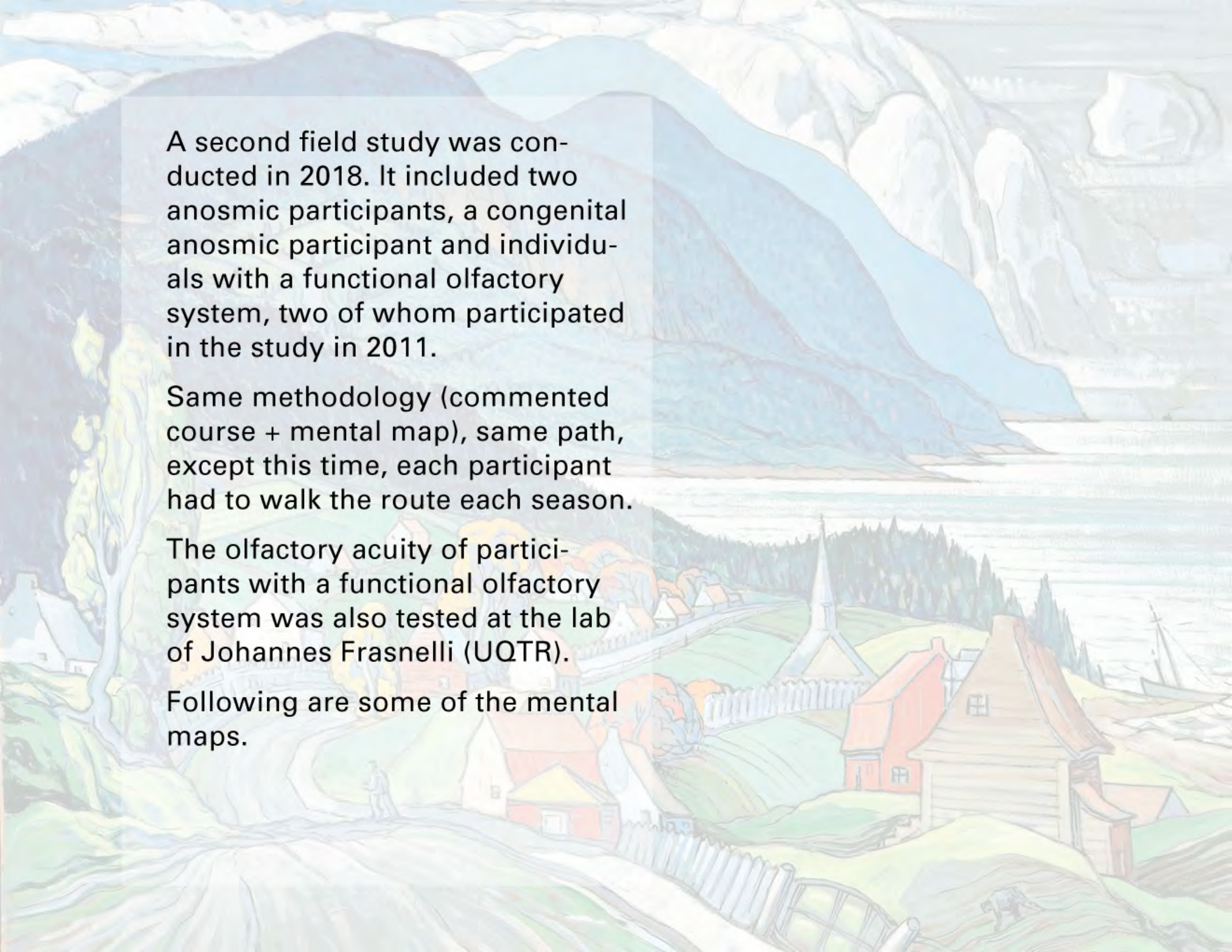
ça sentait comme du poulet grillé. Un oncle dans la famille avait une des premières rôtisseries à St-Jerôme. J'avais toujours plaisir d'aller manger mon poulet BBQ au Coq d'Or. Je remonte à longtemps! Des beaux souvenirs ça.

that smell reminded me of bread.

y'avait j'sais pas quoi là... aah! le café! oh! avec la cigarette, dé-gueu-lasse! c'est deux odeurs mélangées : superbe de café et l'fond de cendrier. Ça sentait comme des "botchs" de cigarette dans un seau avec de l'eau... quand t'ouvre ça ouach!

that smell I don't know but, it reminded me of... I don't know. I know that smell...



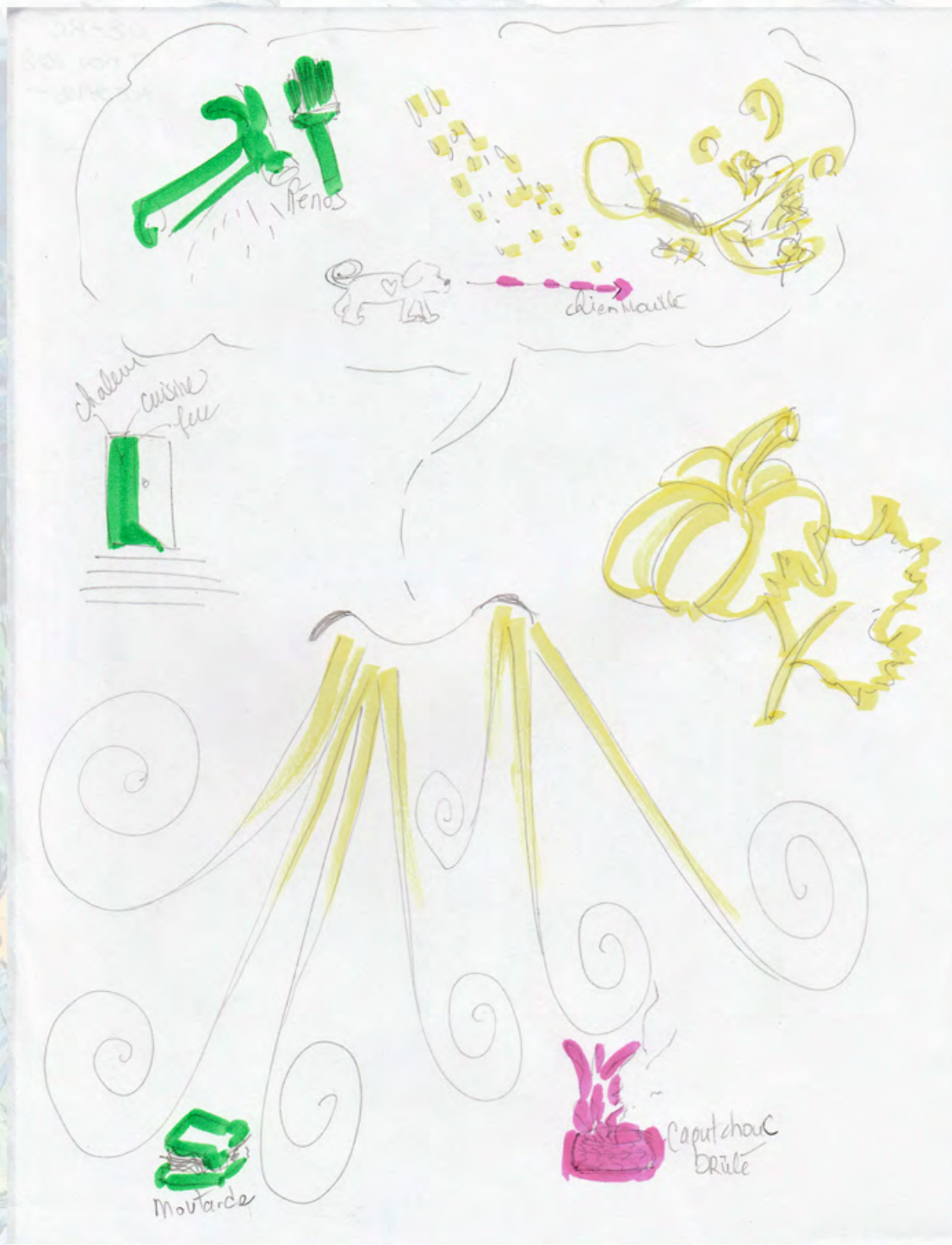


A second field study was conducted in 2018. It included two anosmic participants, a congenital anosmic participant and individuals with a functional olfactory system, two of whom participated in the study in 2011.

Same methodology (commented course + mental map), same path, except this time, each participant had to walk the route each season.

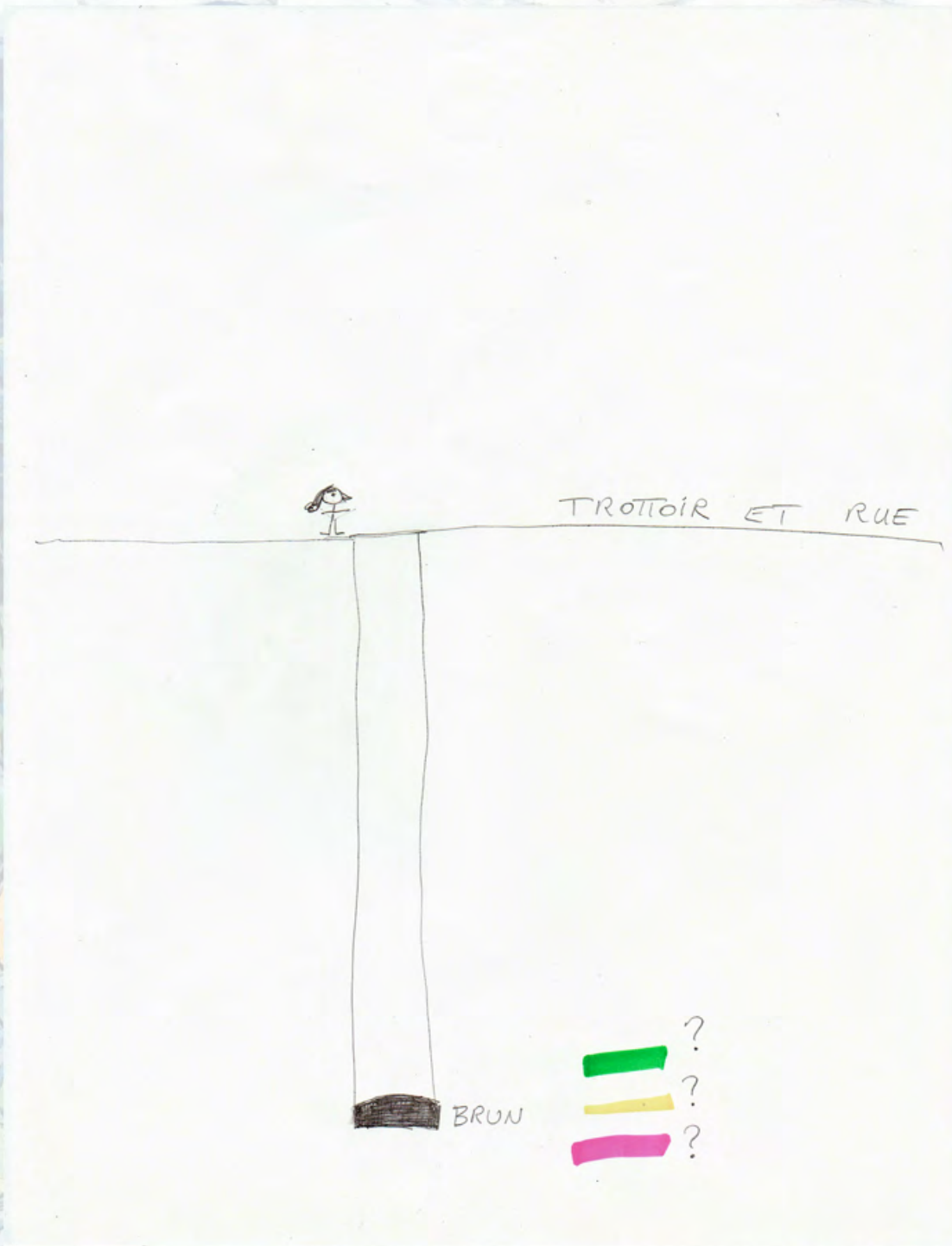
The olfactory acuity of participants with a functional olfactory system was also tested at the lab of Johannes Frasnelli (UQTR).

Following are some of the mental maps.



Drawn by a subject with a
functional olfactory system
/ Autumn

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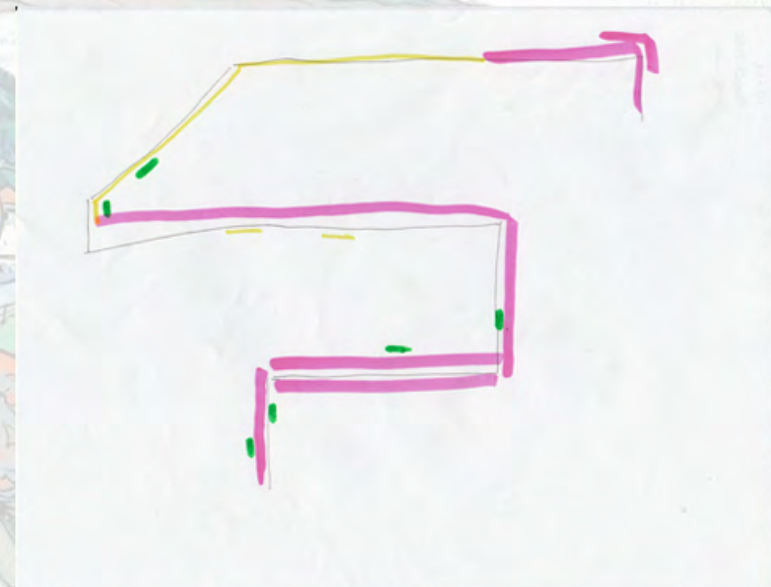
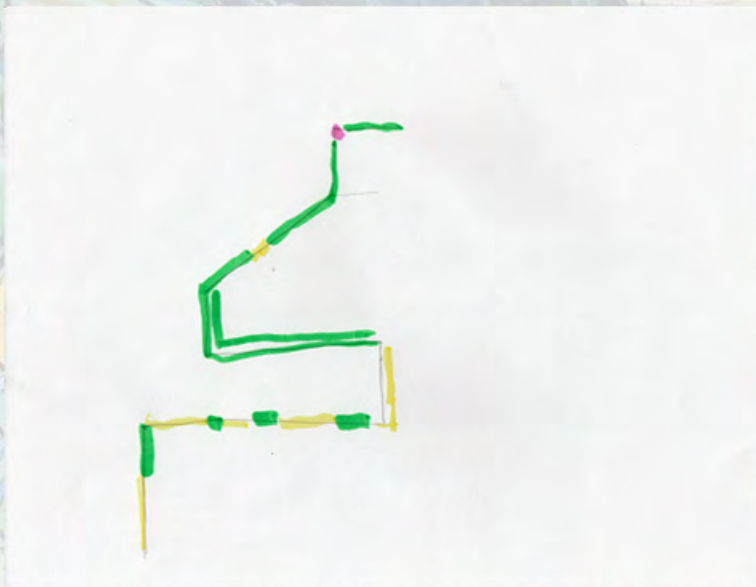
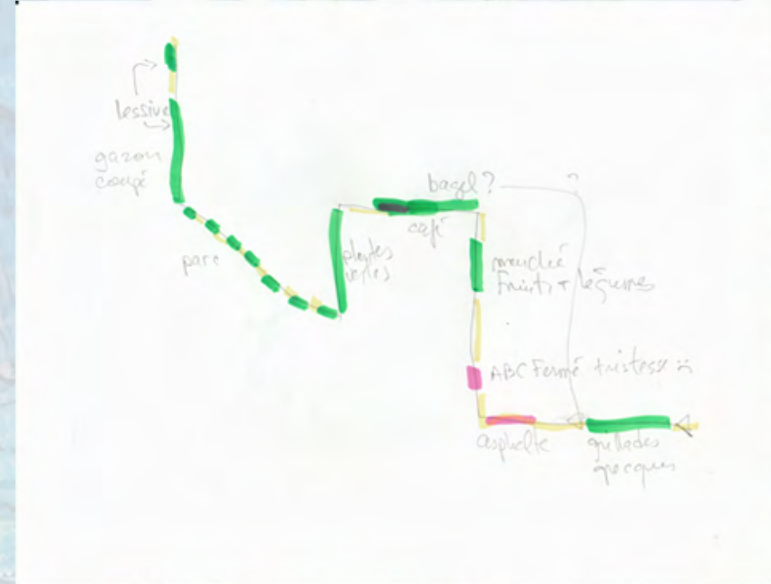


Drawn by a subject with a
functional olfactory system
/ Winter

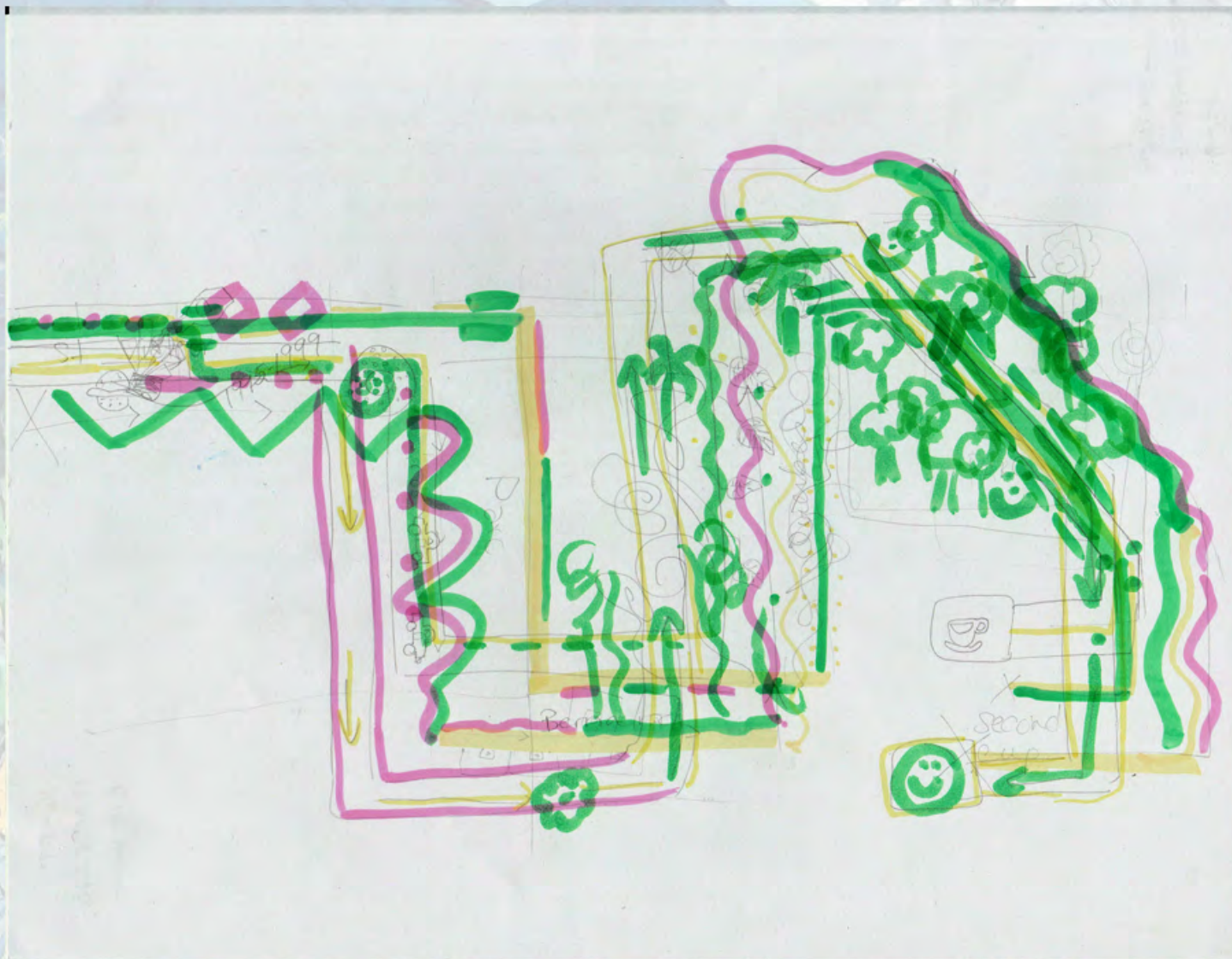
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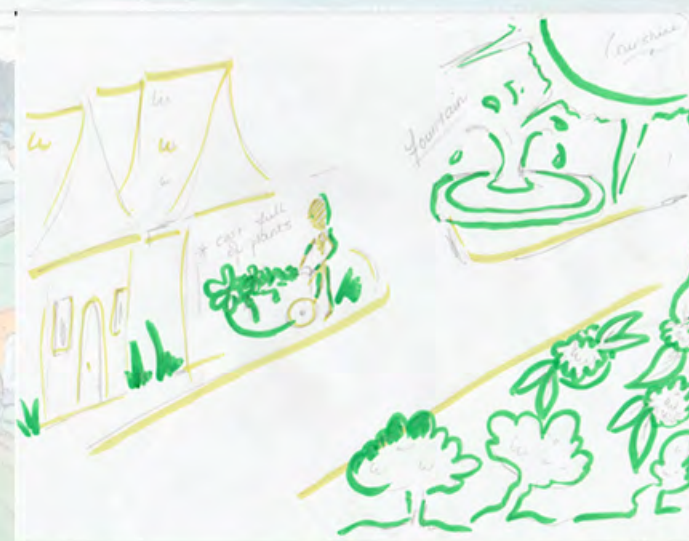
Drawn by a subject with a functional olfactory system / Autumn
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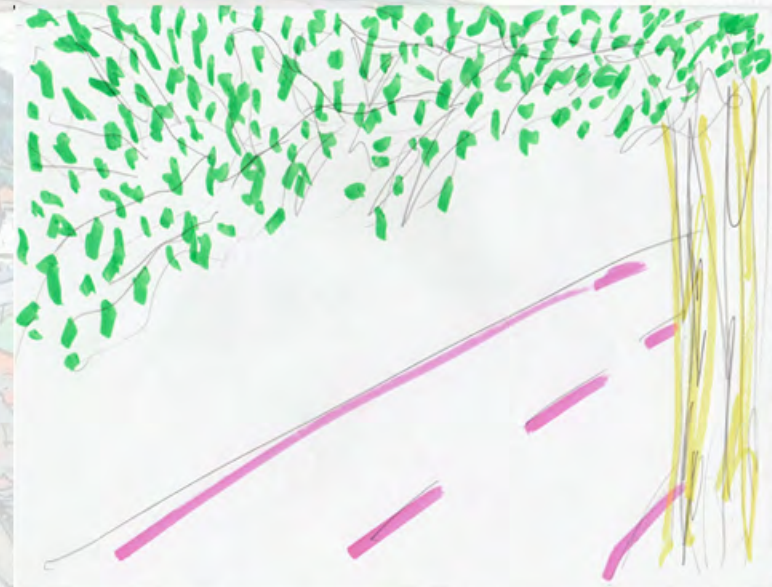
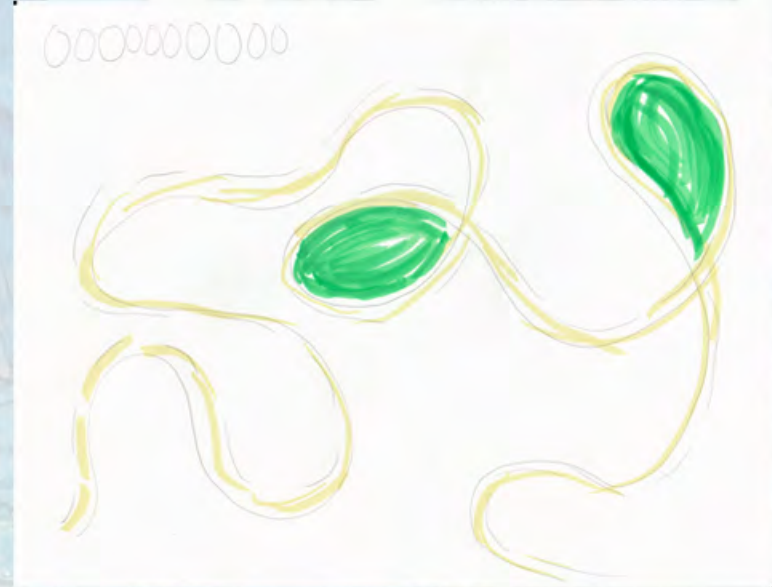
Drawn by a subject with a functional olfactory system / Every seasons
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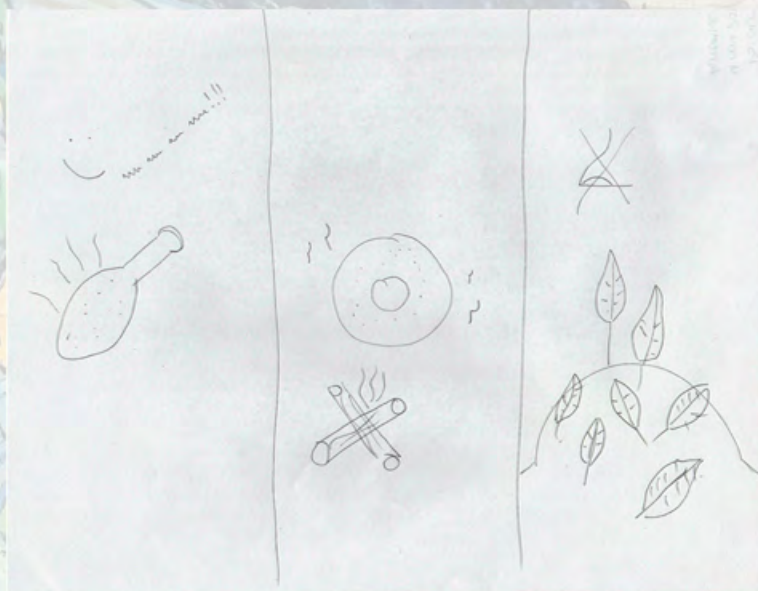
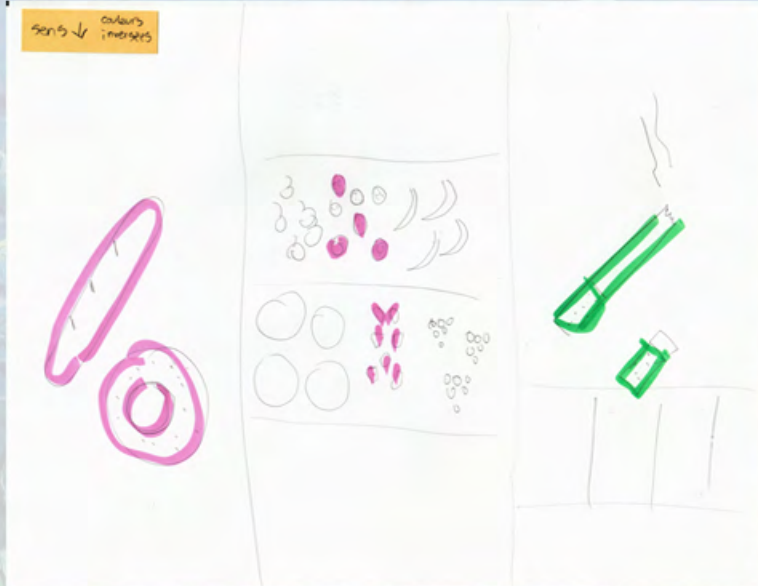
Drawn by a subject with a functional olfactory system / All seasons superimposed
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Drawn by a subject with congenital anosmia / Every seasons
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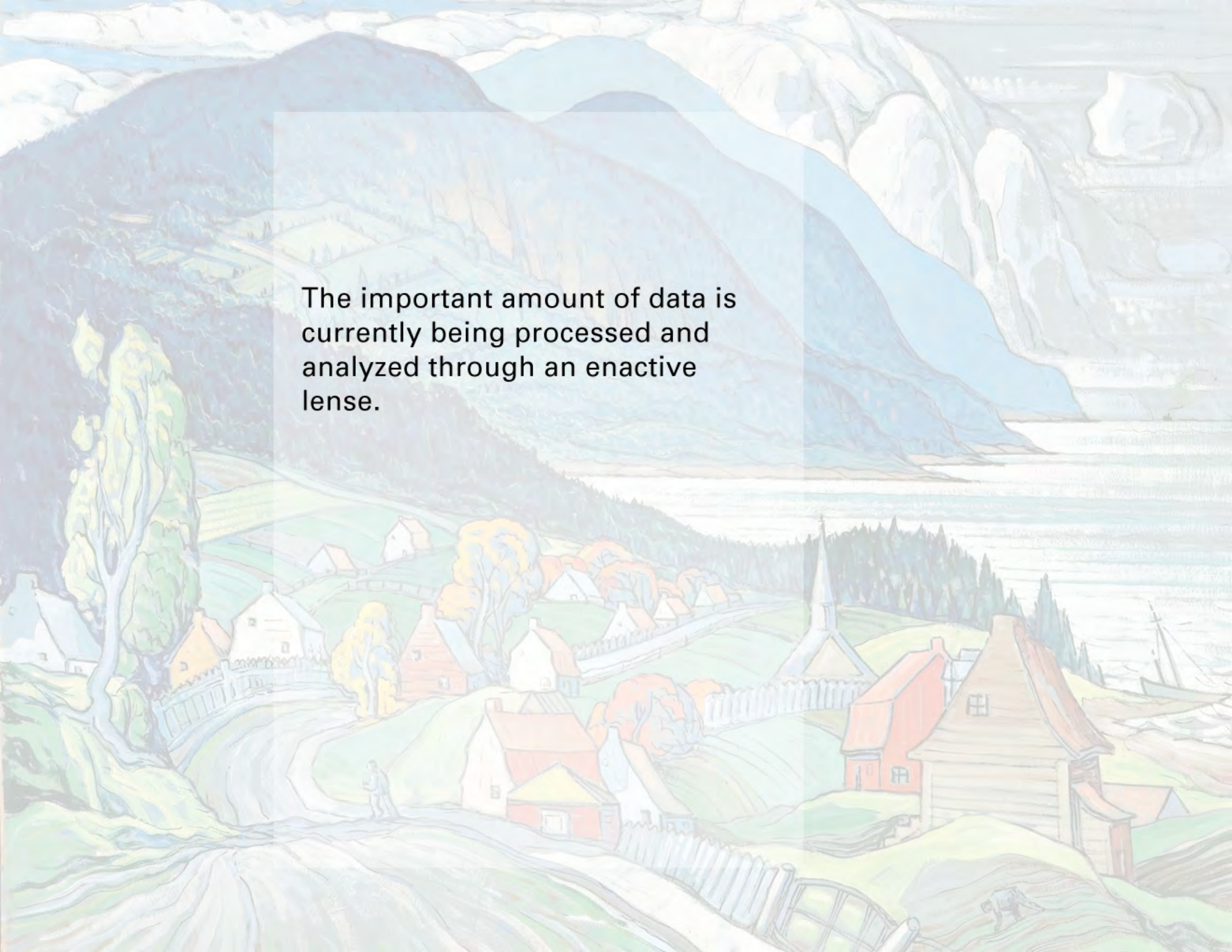
Drawn by a subject with anosmia / Every seasons
Le théâtre de la mémoire olfactive ©2018(2020) natalieb.ca



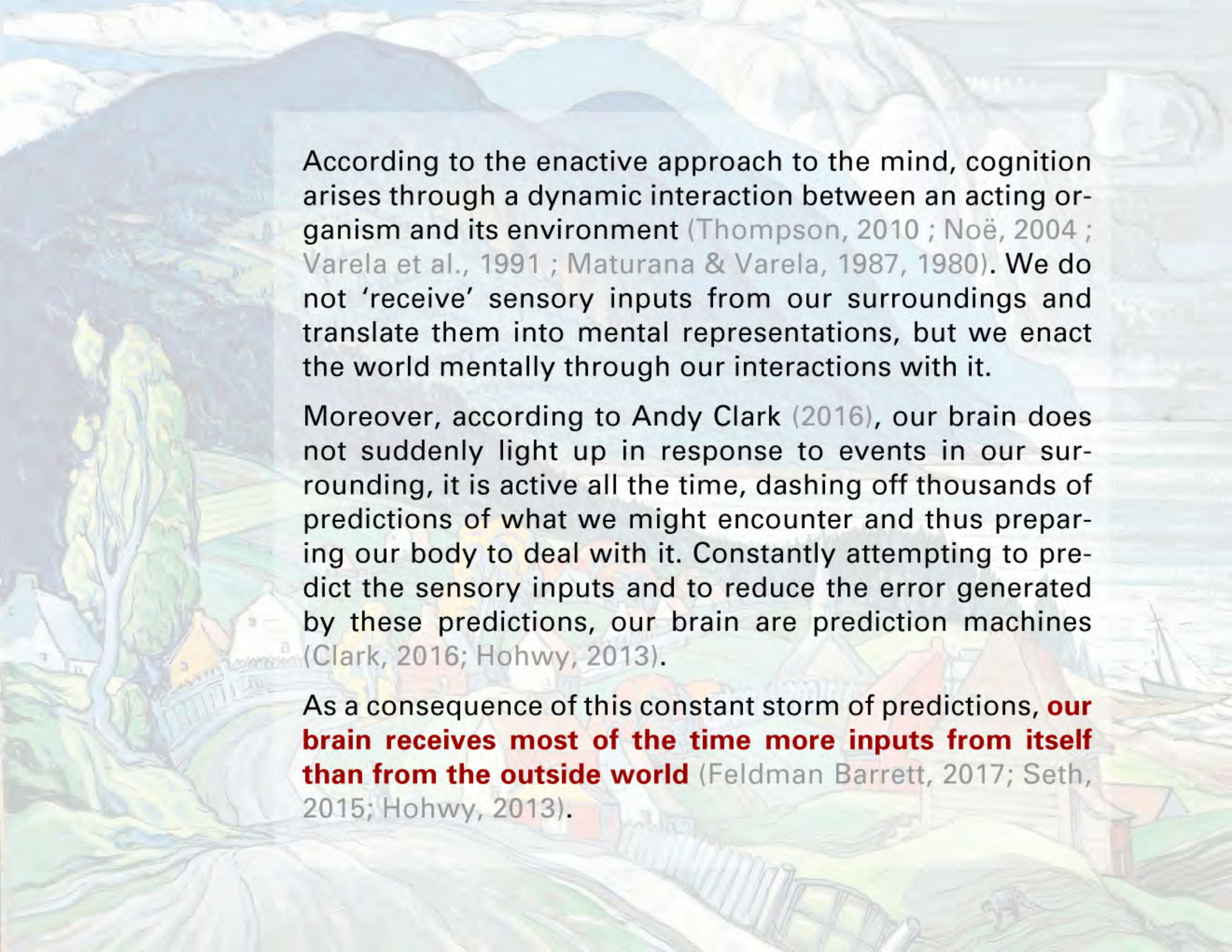
Drawn by a subject with anosmia / Every seasons
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Drawn by a subject with a functional olfactory system / Every seasons
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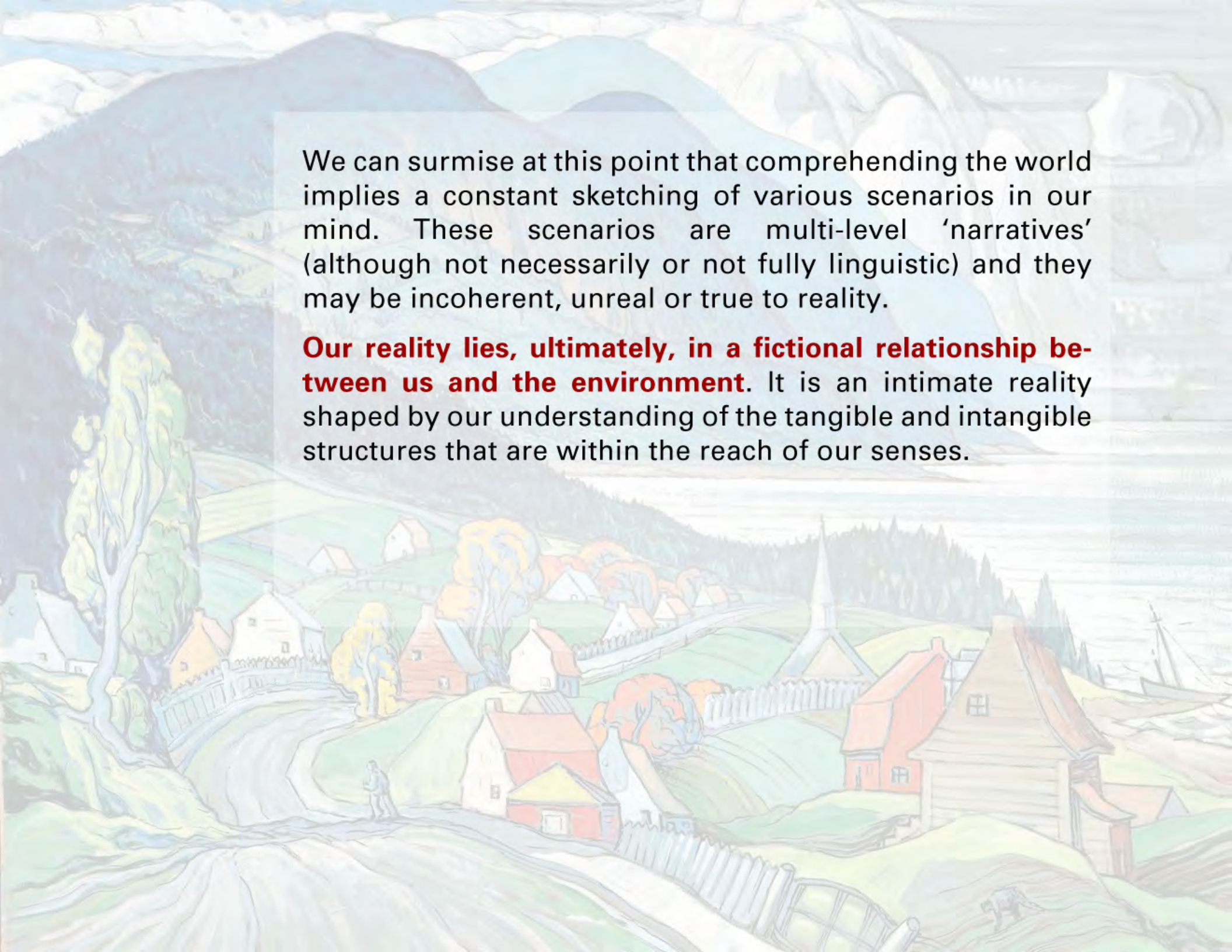
The important amount of data is currently being processed and analyzed through an enactive lense.

The background of the slide is a soft, painterly illustration. It depicts a landscape with rolling hills and mountains in the distance. In the foreground, there's a river or a path winding through a valley. On the left, a tall, slender tree stands prominently. To its right, a small village with several houses and a church with a steeple is nestled. The overall style is reminiscent of a watercolor or a soft oil painting, with a muted color palette of blues, greens, and earthy tones. The text is overlaid on a semi-transparent white rectangular area in the center-right of the image.

According to the enactive approach to the mind, cognition arises through a dynamic interaction between an acting organism and its environment (Thompson, 2010 ; Noë, 2004 ; Varela et al., 1991 ; Maturana & Varela, 1987, 1980). We do not 'receive' sensory inputs from our surroundings and translate them into mental representations, but we enact the world mentally through our interactions with it.

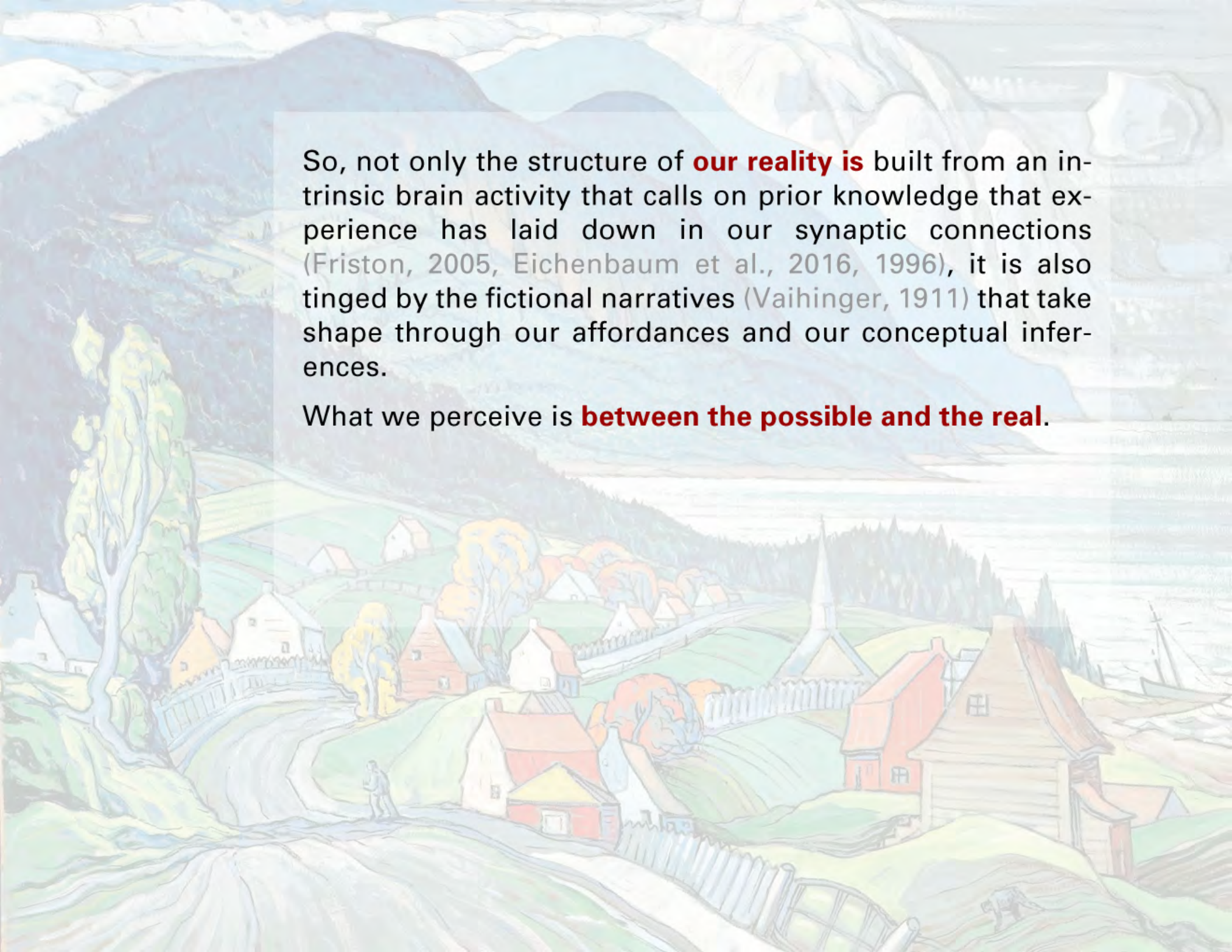
Moreover, according to Andy Clark (2016), our brain does not suddenly light up in response to events in our surrounding, it is active all the time, dashing off thousands of predictions of what we might encounter and thus preparing our body to deal with it. Constantly attempting to predict the sensory inputs and to reduce the error generated by these predictions, our brain are prediction machines (Clark, 2016; Hohwy, 2013).

As a consequence of this constant storm of predictions, **our brain receives most of the time more inputs from itself than from the outside world** (Feldman Barrett, 2017; Seth, 2015; Hohwy, 2013).



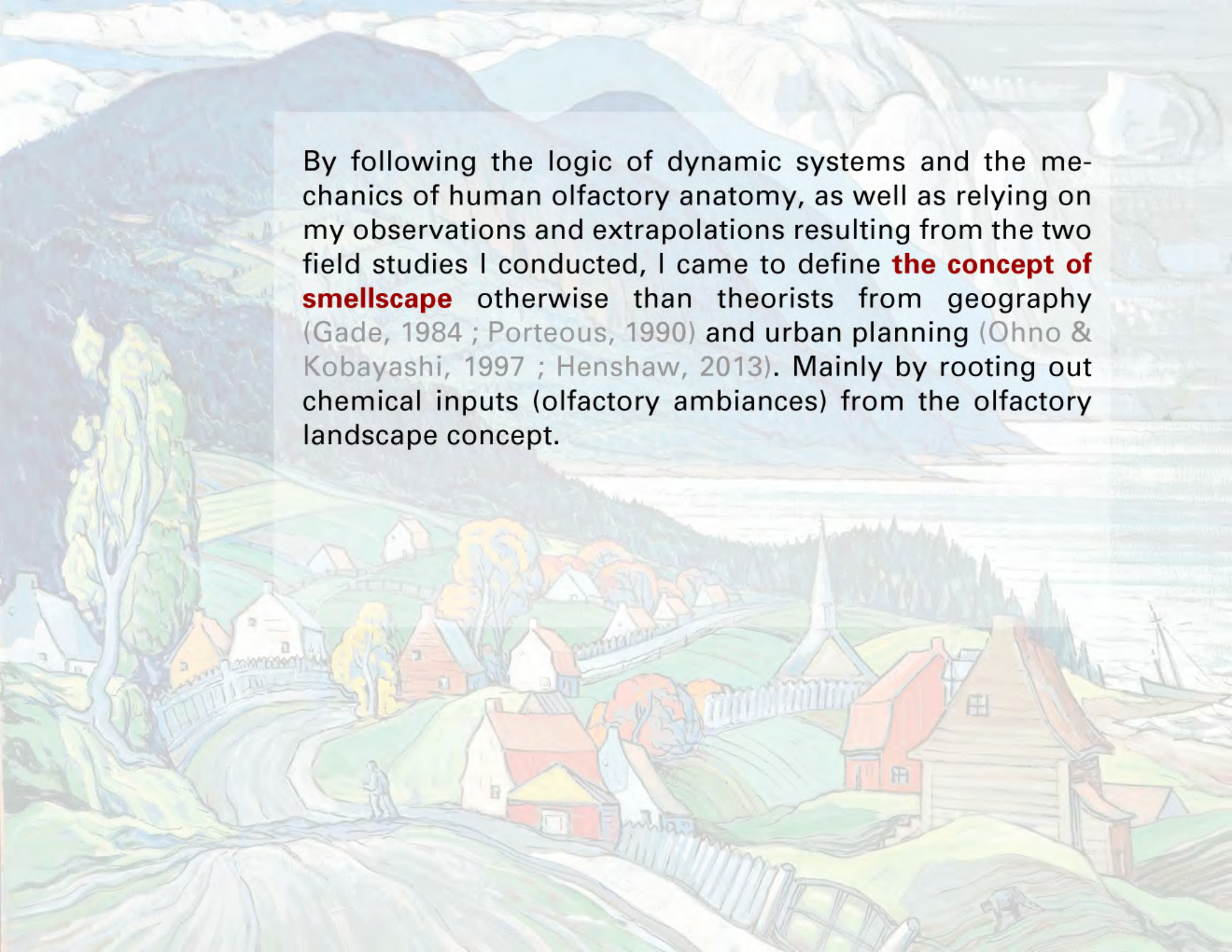
We can surmise at this point that comprehending the world implies a constant sketching of various scenarios in our mind. These scenarios are multi-level 'narratives' (although not necessarily or not fully linguistic) and they may be incoherent, unreal or true to reality.

Our reality lies, ultimately, in a fictional relationship between us and the environment. It is an intimate reality shaped by our understanding of the tangible and intangible structures that are within the reach of our senses.

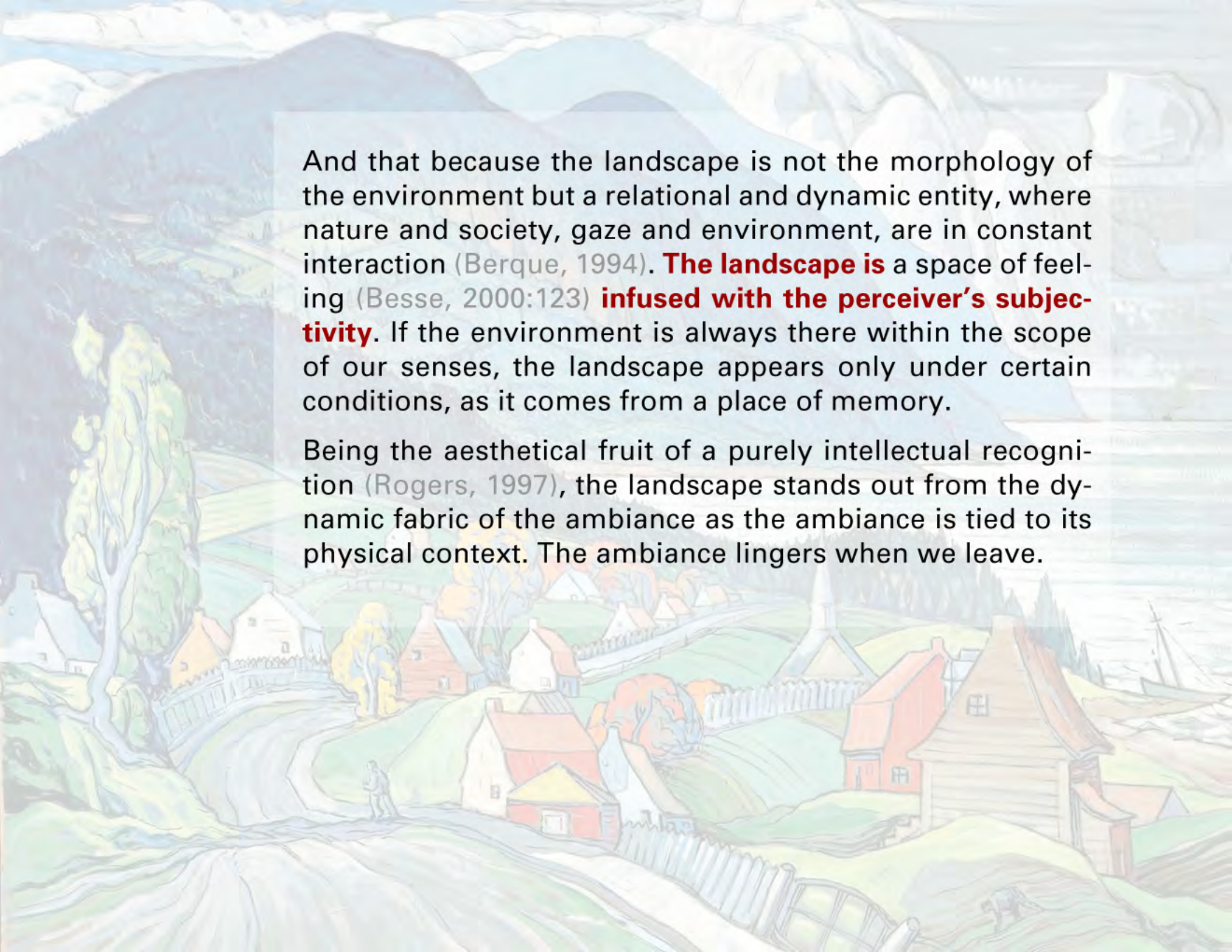


So, not only the structure of **our reality is** built from an intrinsic brain activity that calls on prior knowledge that experience has laid down in our synaptic connections (Friston, 2005, Eichenbaum et al., 2016, 1996), it is also tinged by the fictional narratives (Vaihinger, 1911) that take shape through our affordances and our conceptual inferences.

What we perceive is **between the possible and the real.**



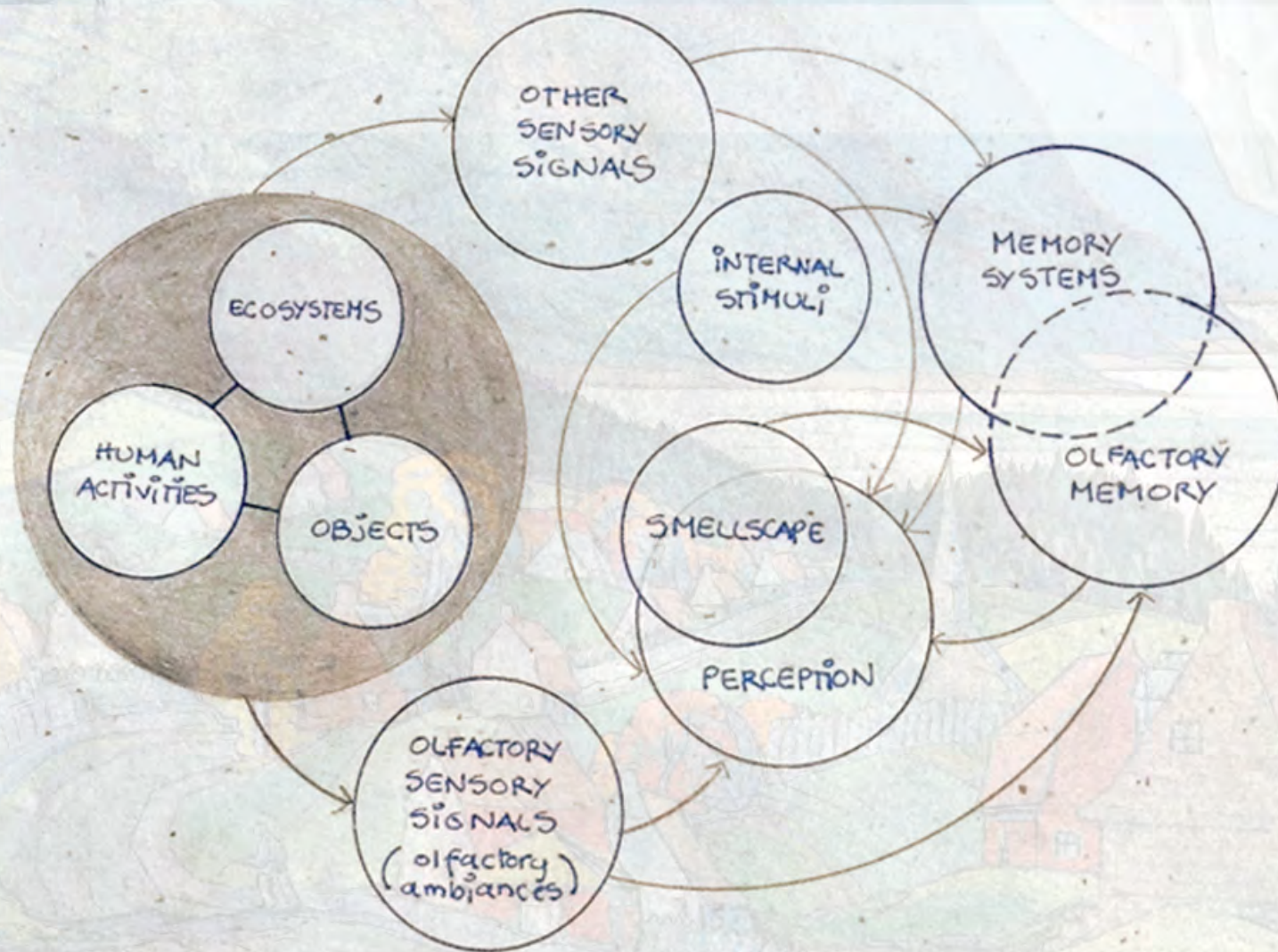
By following the logic of dynamic systems and the mechanics of human olfactory anatomy, as well as relying on my observations and extrapolations resulting from the two field studies I conducted, I came to define **the concept of smellscape** otherwise than theorists from geography (Gade, 1984 ; Porteous, 1990) and urban planning (Ohno & Kobayashi, 1997 ; Henshaw, 2013). Mainly by rooting out chemical inputs (olfactory ambiances) from the olfactory landscape concept.

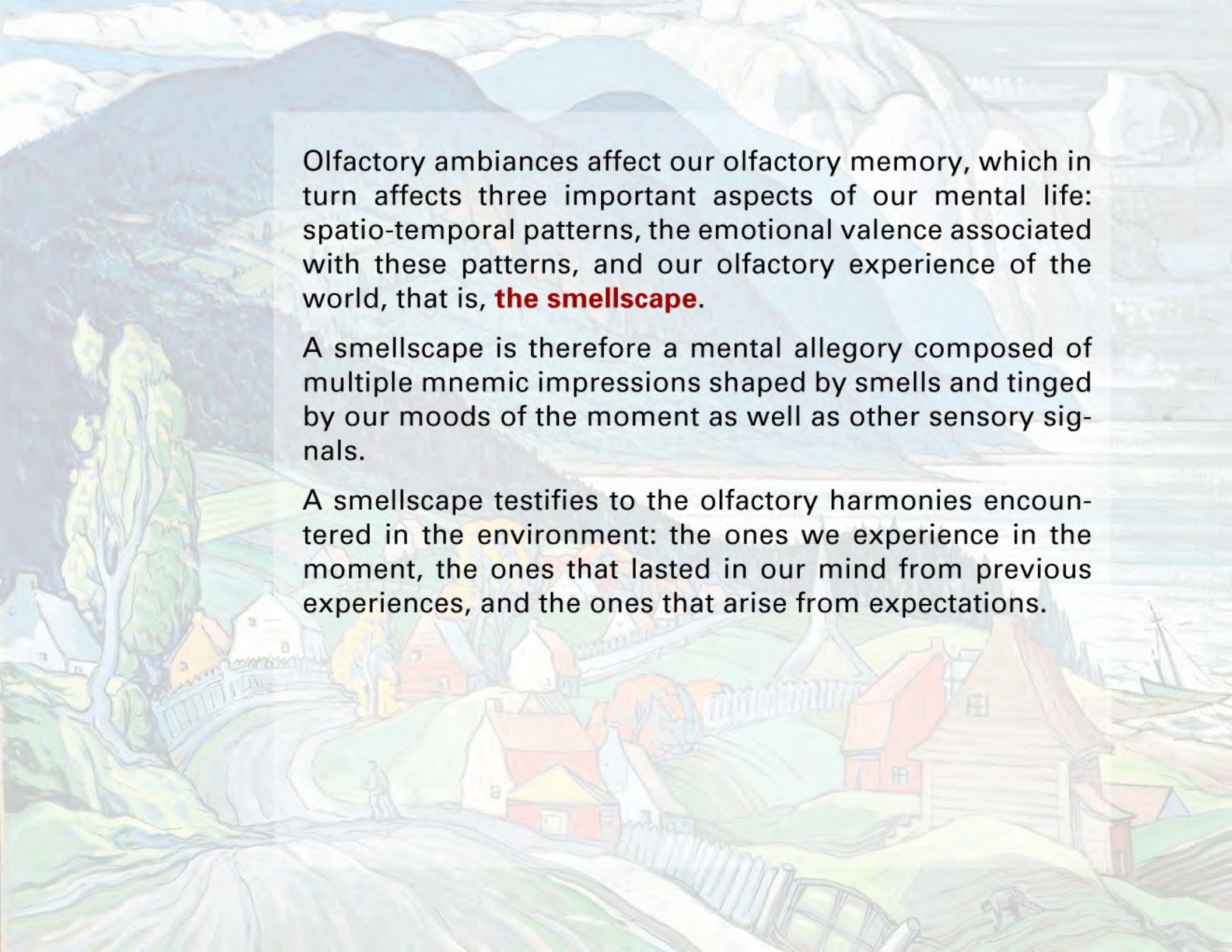


And that because the landscape is not the morphology of the environment but a relational and dynamic entity, where nature and society, gaze and environment, are in constant interaction (Berque, 1994). **The landscape is** a space of feeling (Besse, 2000:123) **infused with the perceiver's subjectivity**. If the environment is always there within the scope of our senses, the landscape appears only under certain conditions, as it comes from a place of memory.

Being the aesthetical fruit of a purely intellectual recognition (Rogers, 1997), the landscape stands out from the dynamic fabric of the ambiance as the ambiance is tied to its physical context. The ambiance lingers when we leave.

Here is **a model that represents** what I believe to be **olfactory perception dynamics** according to an enactive approach.





Olfactory ambiances affect our olfactory memory, which in turn affects three important aspects of our mental life: spatio-temporal patterns, the emotional valence associated with these patterns, and our olfactory experience of the world, that is, **the smellscape**.

A smellscape is therefore a mental allegory composed of multiple mnemonic impressions shaped by smells and tinged by our moods of the moment as well as other sensory signals.

A smellscape testifies to the olfactory harmonies encountered in the environment: the ones we experience in the moment, the ones that lasted in our mind from previous experiences, and the ones that arise from expectations.



thank you for your attention

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