

The intelligence of plants: A new narrative?

Notes on a contemporary cultural phenomenon

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Abstract

This article explores the development of a new vision in French media productions of plants as beings with intelligence and sentience. The first part of the article presents data on the increase in the number of media about plants and, particularly, plant intelligence and sentience, in France, between 2014 and 2020. A multimedia corpus composed of books, magazine issues and documentaries is the basis for this assessment. The second part proposes an observation of a part of this corpus, aiming at identifying some specific visual and textual devices related to the staging of the intelligence and sensitivity of plants. The third part proposes some theoretical observations concerning the semantic work involved in the new narrative of plant intelligence and sensibility and its implications for the Western vision of plants. The article shows this new narrative has challenged Western *naturalism*, as defined by Descola, and shaken its ontological structure.

Keywords: plants, vegetal, intelligence, sensitivity, media, naturalism, discourse

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Introduction

For a few decades, scientific literature (Calvo & Keijzer, 2009; Gagliano et al., 2012; Trewavas, 2016; Calvo et al., 2020; Parise et al., 2020) and general public literature (Pollan 2001; Tassin, 2016; Chamovitz, 2018; Wohlleben, 2017; Mancuso & Viola, 2018) have been increasingly talking about a new way of looking at plants. Discussions have focused on plant cognition (Segundo-Ortin & Calvo, 2021), intelligence (Trewavas, 2016; Calvo et al., 2020; Nick, 2021) and even consciousness (Segundo-Ortin & Calvo, 2021). Both texts and images used in these publications reflect new ways of understanding and thinking about plants (Baluska & Mancuso, 2020). This article aims to analyse the development of this new vision of plants, focusing on media productions in France, and concerning, in particular, the attribution to plants of cognition, intelligence and sensitivity, characteristics more often attributed to animals and eminently human beings. This paper focuses on books, documentaries and magazine issues, with English translations provided for titles and texts in French. Although limited to a corpus produced by French authors or translated into French, the results of this study can feed broader research on the presence of plants in culture and media, particularly on the theme of plant intelligence. The analysis revealed a polymorphous cultural evolution: narratives around the

plant, its intelligence and sensitivity circulate among different texts and constitute an interdiscourse, and the fabric thus woven is rich in teachings on human relationships not only to plants but also nature in general. Three analytical steps and sub-questions are proposed to answer the main research question: How does the theme of plant intelligence and sensitivity manifest in media productions in France?

First, the emergence of this theme is quantified to answer the sub-question: What is the quantitative evolution of the presence of the intelligence and sensitivity of plants in French media productions?

Second, an exploratory and inductive analysis, focused on a specific sub-corpus of popular science books and contents, is developed. This approach, inspired by semiotics, allows for an answer to the second sub-question: What are the visual and verbal multimodal specificities of media representations of plant intelligence and sensitivity in France?

The third sub-question is: What changes appear in the implicit ontological regime of French media productions? The study takes a semiotic and anthropological approach to examine the evolution of the ontological regime (Descola, 2005, 2021), which seems to appear in the observed and explored mediatic productions concerning the place of plants in relation to humans and animals. Preceding these three sections is a brief historical and cultural contextualisation of the presence of plants in Western culture and a literature review on plant intelligence and sensitivity. Then, there is an explanation of the methods used to answer the questions. Finally, the results of this inquiry concerning the three analytical steps are discussed and followed by a conclusion.

1. Historical context and literature review

1.1. Historical roots: An ambivalent perception about the place of plants in Western culture

Plants have an important place in religions. For example, different trees are prominent in the biblical book of Genesis or in the life of Buddha. As for Western philosophy, plants have been present in philosophical reflection, albeit in a minor way compared to animals, since the ancient Greeks. Throughout the history of Western civilisation, there have been tensions concerning the cognitive powers of plants, with plants relegated to a place of inferiority in relation to animals and humans as immobile beings without sensoriality. The birth of the modern vision of plants and botany is linked to the works of authors including Von Humboldt, Linnaeus, Jussieu, Rousseau, Ray, and Goethe. The French philosopher Descartes (XVII century AC) contributed to the construction of the modern mechanistic view of nature and

plants. On the contrary, Darwin (XIX century), in his book *The Power of Movement in Plants* (1880), likened the structure of plant roots to those of neural networks and studied carnivorous plants and plants that show visible movement.

There has been a successful development of botanical research on plant sensory, communicative and cognitive capacities, particularly since the 1990s. An international group of researchers, such as Mancuso, Gagliano and Baluska, among others, has developed this field, notwithstanding the opposition and criticism of other scientists. This development culminated in 2005 with the creation of the Society for Plant Neurobiology, later renamed as Society of Plant Signaling and Behavior (2009, <https://www.plantbehavior.org/about-us/>). This paper highlights some aspects of this contemporary cultural phenomenon concerning plant intelligence and sensitivity linked to the spread of new scientific results.

1.2. Literature review on plant intelligence and sensitivity

The notion of plant intelligence has been developed in particular, in recent years, by Trewavas (2003, 2016) and widely discussed by authors with different disciplinary origins and positions (Hendlin, 2022). A leading issue is the status of plant intelligence: Is it a metaphor or a reality (Cvrčková et al., 2009)? A recent polemic has opposed Baluska & Mancuso (2020), who exalted the role of plants in climate change mitigation, and Robinson et al. (2020), who criticised the application of words concerning intelligence to plant behaviour. French philosophers like Coccia (2016) and Burgat (2020) have discussed the transfer of categories traditionally reserved for humans and, to a much more limited extent, animals to plants (concerning French authors, see also Hiernaux & Timmermans, 2019, and Issue no. 20 of the journal *La pensée écologique*, 2020).

Members of the Society of Plant Signaling and Behavior, and those that publish in the journal *Plant Signaling and Behavior*, are actively spreading their ideas beyond the scientific sphere. Examples of such publications include *Brilliant Green* by the Italian researchers Mancuso and Viola (2015) and works by non-scientific authors like Wohlleben (*The hidden Life of Trees*, 2015) from Germany and Powers (*The Overstory*, 2018) from the United States. In the field of semiotic studies, phytosemiotics (Kull, 2000) has been developed as a branch of biosemiotics, focusing on how plants manifest forms of sign processes with specific vegetative sign systems (Faucher, 2014). Other fields have developed in the last decades, such as plant geography and the critical plant studies, which focus on themes like plant otherness, ethics and “plant-human attunement” (Lawrence, 2021).

Globally speaking, the communication studies approach to the themes of plant intelligence and sensitivity has still to be developed, and this paper is a contribution to that development.

Some researchers have explored communications involving forests and on forests, for example, concerning the promotion of reforestation (Chung et al., 2020), sustainability of the forest sector (Korhonen et al., 2016), and the relationship between humans and forests (Farcy et al., 2018). An International Communication Association (ICA) pre-conference recently held in France was dedicated to communication and plants (<https://vegetals.sciencesconf.org/>, May 24, 2022). But communication and discourses concerning specifically plant intelligence and sensitivity still deserve further explorations by communication scholars.

2. Methods

How does one observe a cultural evolution like the mounting number of discourses on plant intelligence and sensibility? The study could have focused solely on the quantitative and thematic evolution of media production via techniques such as content analysis and linguistic corpus analysis. The corpus could have been analysed with qualitative tools only, like those of multimodal or critical discourse analysis. Finally, the observation of the evolution of the Western vision of plants could have been made from an anthropological and philosophical point of view only, using some examples as starting points. Instead, this study attempts to combine these three complementary approaches to connect the reflection on the ontological implications of this cultural phenomenon with a concrete exploration of its mediatic incarnations. What follows has a structure that unfolds in three phases: a first one to quantify the cultural phenomenon; a second one that explores a part of these media productions to identify specific discursive patterns; and, finally, a third one that attempts to delve into the semantic work concerning plants in contemporary culture, with a consideration of the ontological implications.

Concerning the first sub-question (section 3), the quantitative evolution of the theme of plant intelligence and sensitivity was observed by collecting documents via research carried out using various search engines. Keywords used include *plants*, *intelligence*, *sensitivity* and *vegetation*. This list was applied to several search engines: *Factiva* for the press, *Ina* for the television archives, and the radio archives of *France culture* radio. A systematic analysis of the works published on Summon and Google Scholar, completed by a systematic review of *L'Ecologiste*, the French journal version of *The Ecologist*, was also carried out. The corpus collected includes 118 practical books, illustrated books, children's books, museum exhibitions, radio programmes, magazine features or special issues and television documentaries. The results of this data collection and observation, focusing on books and magazine features, is presented in section 3.

Regarding the second sub-question on specific multimodal patterns of the media representations of plant intelligence and sensitivity in France (see section 4), a sub-corpus of audiovisual documentaries and reports was selected: *L'intelligence des plantes* [The intelligence of plants] (Lucas, 2014), a French version of a 2009 BBC documentary; *Le secret des arbres* [The secret of trees] (Schapira & Barral, 2017); and *Le murmure de la forêt. Quand les arbres parlent* [The murmur of the forest. When the trees speak] (Höfer & Röckenhaus 2019), a French version of a German documentary; several books (Wohlleben, 2017; Tassin, 2016; Mancuso & Viola, 2018; and Chamovitz, 2018); and an issue of the popular science magazine *Science et Vie* (various authors, 2017). These contents were chosen because they are significant examples of media production in the French language or translated in French and broadcasted in France, between 2014 and 2020, and dedicated to the theme of plant intelligence and sensitivity. These contents were observed in an exploratory way without applying a predefined analytical grid. A reading or viewing of the media, to identify particular features related to the verbal and visual representations of plants, was carried out inductively. Inspiration for this type of exploratory observation stemmed from the semiotic tradition, which attempts to identify potential meaning, or the signified, and their visual and textual basis (the signifiers) (Barthes, 1977; Hébert, 2020; Catellani, 2022).

Section 5 develops the answers to the third sub-question concerning changes in the ontological regime of plants implicit in the French mediatic productions observed in the previous sections. This step is based on a theoretical observation of the whole corpus presented in section 3, with a specific focus on books; it is also based on the writings of other researchers who have contributed to the development of these themes. The main theoretical references of this section are the anthropologist Descola (2005, 2021) and the philosopher and semiotician Bordron (2011).

3. Diachronic analysis of the emergence of plant intelligence and sensitivity in the French public space

What is the quantitative evolution of the presence of plant intelligence and sensitivity in French mediatic productions? A diachronic analysis between 2014 and 2020 reveals a quantitative increased presence of plant intelligence and sensitivity in French general public media. From this, one can argue that a media and cultural trend has appeared.

As shown in Figure 1, the most visible increase is in the number of newspaper articles published¹.

Figure 1

Quantitative evolution of publications on the intelligence and sensitivity of plants between 2014 and 2020



The increase in the number of books started around the years 2014 to 2015 but was anticipated by some precursory French works like *Les langages secrets de la nature: la communication chez les animaux et les plantes* [The secret languages of nature: communication in animals and plants] (Pelt & Steffan, 2014, first edition 1996), and *L'intelligence émotionnelle des plantes* [The emotional intelligence of plants] (containing older texts by Cleve

¹ The focus is on the quantitative evolution of books and press articles. Complete information on data and treatment is available from the corresponding author. A complete quantitative survey of data on documentaries and exhibitions has yet to be carried out.

Backster, 2015) that delineated a new narrative and prepared a fertile ground for the emergence of plant intelligence and sensitivity in the public space.

Publications during 2017 marked a turning point: collections were launched, the world of plants was decoded from a multitude of different angles, and works of authors such as Wohlleben in Germany or Hallé in France became bestsellers. In this same year, 2017, publications of books such as *La vie secrète des arbres* [The secret life of trees] (Wohlleben, 2017, translation from German), *Ecoute l'arbre et la feuille* (The Songs of Trees, Haskell, 2017, translation from English), *Comment pensent les forêts* (How Forests Think, Kohn, 2017, translation from English), or an issue of the popular science journal *Sciences et vie* (various authors, 2017) mark a significant change.

Figure 2

Some major bestsellers books published in France in 2017²



An interdiscursive framework emerges in a cascading media dynamic: upstream, there are books, often translations of international bestsellers, which are more successful in France than in other parts of the world (cf. Wohlleben's book³). These works paved the way for other publishers, who, in the following years, released other works on plants, gardens and forests. The year 2018 is in line with 2017, with many books digging the furrow of the intelligence of plants and their sensitivity: *L'intelligence des plantes* [The intelligence of plants] (Mancuso &

² Credits: covers by kind concession of the copyright's owners. In particular: E. Kohn, *Comment pensent les forêts*, Zones sensibles, 2017, cover. *La vie secrète des arbres*, Peter Wohlleben, © Les Arènes, 2017.

³ The book has sold more than 1 million copies worldwide: 700,000 copies in Germany and 250,000 copies in France (as much as the book that received the Goncourt prize). https://fr.wikipedia.org/wiki/La_Vie_secr%C3%A8te_des_arbres

Viola, 2018, translation from Italian); *L'intelligence des plantes* [The intelligence of plants] (Daugey, 2018); *La vie secrète des plantes* (The secret life of plants, Tompkins & Bird, 2018, translation from English); *Les émotions cachées des plantes* [The hidden emotions of plants] (Van Cauwelaert & Clerc, 2018); *Le langage secret des arbres* [The secret language of trees] (Thoma, 2018, translation from German); *Penser comme un arbre* [Think like a tree] (Tassin, 2018); *La plante et ses sens* (What a Plant Knows, Chamovitz 2018, translation from English).

Figure 3

Major Bestselling Books Published in France in 2018⁴



The years 2019 and 2020 saw more publications continue to enrich the interdiscursive framework on plants, allowing each media genre to appropriate its different literary angles: examples of the heroization of the struggle for plants can be found in novels and children's fiction, scripted and magnified investigations in the illustrated books, practical care books and publications that mix legendary and scientific considerations. Popular science books, for example Hallé's *Mais d'où viennent les plantes?* [But where do plants come from?] (2019)

⁴ Credits: covers by kind concession of the copyright's owners. In particular: A. Mancuso & A. Viola, *L'intelligence des plantes*, éditions Albin Michel, 2017; D. Haskell, *Ecoute l'arbre et la feuille*, © Flammarion, 2017; F. Daugey, *L'intelligence des plantes*, Ulmer, 2018.

were being published at the same time as illustrated books, such as Jean's *Fleurs théâtrales* [Theatrical flowers] (2019). This flux of new literature about trees and plants was aimed at new audiences, as in the case of children's literature, like Benoist and Gastaut's *Un arbre, une histoire* [A tree, a story] (2018). Reports that develop a political rhetoric, discuss the economics of plants and highlight the heroic struggle of some humans find their audience too (see, for example, Magdalena, 2018).

A whole literary, written and visual field with its own codes has emerged, followed by exhibitions and special issues of magazines, such as those in *Sciences et Vie* (various authors, 2019) and several issues of the magazine *CERES* on the imaginary world of cereals. Finally, there have also been audio-visual media contributions: many docu-features have allowed for the perception of the odd tempo and rhythm of the plant (see 2.1).

This emergence of works, which pollinates all written, literary and audio-visual media, marks the years 2017 to 2020. The interests in plants include a specific flow of media that focuses, in whole or in part, on plant intelligence and sensitivity. The data collected, as shown in Figure 1, also show that translations from English and other languages to French have played a significant role in the emergence of the theme of plant intelligence in France, suggesting that this movement in France is connected to a larger and earlier phenomenon. The following section focuses on essential semiotic aspects that characterise these discourses on plants, their intelligence and their sensitivity.

4. Plants in books, magazines and documentaries: Verbal and visual features

An exploratory analysis has been applied to a subset of documents to answer the question: What are the visual and verbal multimodal specificities of media representations of plant intelligence and sensitivity in France? The focus is on visual patterns, such as specific visual effects present in still and moving images, and on linguistic patterns.

4.1. Visual features: Acceleration, close-up, and animation as *spectacular othering*

The analysis revealed the centrality of three visual features: acceleration, close-up and animation or special effects.

Wohlleben (2017) and Mancuso and Viola (2018) are clear in their books: a major obstacle to the perception of plants as active, intelligent and sensitive beings, as well as the improvement of their position on the hierarchy of living beings, is their apparent immobility, which renders them nearer to non-living beings. Therefore, it is not surprising that the acceleration of plant movements is used in documentaries like *L'intelligence des plantes* and *Le murmure de la forêt*.

Quand les arbres parlent. In *L'intelligence des plantes*, for example, the growth of ivy on a trunk is accelerated, and the result is a sort of zoomorphic visual transformation (Lucas 2014, from minute 5 to 7).

The plant's spikes, waving like the fingers of an animal, are filmed at a very close distance. The seemingly silent gestures in fact make a creaking sound, amplified to emphasise the plant's movements. The verbal text exercises its typical function of what French semiotician Barthes (1977) called *anchorage*: "[L]ike fingers looking for a hold, the spikes of this ivy stick to the bark". The documentary is at times macabre, notably at this particular juncture and later in the sequence dedicated to carnivorous plants: plants appear as powerful and somehow menacing beings, contributing to the construction of an empowered image of plants and operating as a factor of the spectacular reading contract, one offering entertainment and pleasure, established with the viewer. The power to kill animals is added to the movement, revealed through acceleration, as two aspects of a zoomorphic change in the image of plants. Acceleration is also signalled by Gagliano (2015) as an important tool to overcome the traditional and Aristotelian idea that plants cannot move and, so, they are not active:

Indeed when considered in animals including humans, behavior generally implies movement (action) and cognitive capacity (agency). Currently, this consideration is not usually extended to plants because evidence for both action and agency has gone undetected until the recent advent of advanced high-speed cameras, for example, allowing us to shift our perceptual range into one that relates to plants. (p. 5)

Close-up images are an obvious complement of acceleration to reveal the new face of plants. In the documentaries, close-ups position the focus on plants and evoke the senses of proximity and intimacy, resulting in the familiar and often unobserved beings (plants) becoming unusual, as in the case of the ivy spikes. One could call it a *spectacular othering*: the familiar becomes different with spectacular effects. Speed (or slow motion) reveals movement and close-ups contribute to a semantic change.

Another semiotic tool used for this semantic transformation is animation. In the documentary *Le murmure de la forêt. Quand les arbres parlent*, there are many sequences in which animation is used to get the observer to see beyond the ordinary appearance of plants. For example, the circulation of electrical signals in the tree trunk and between trees via the mycorrhiza, the underground network of roots and fungi connecting the roots of different trees to each other, is represented by rhythmical light impulses. Combining photographic images with animated effects is a recurring stylistic feature in this documentary. *Le secret des arbres*

(2017) is another such film using this technique. Artificial colours, lights and images are used to make visible the spread of pollen by conifers or the effects of pests on weakened firs.

Combining these special effects with ordinary or non-modified images create, at the same time, a) an effect of wonder or spectacular and b) a cognitive effect of pedagogy and of deep penetration into the essence of things. Artificial images operate as a visual prosthesis removing perceptual and cognitive limitations and giving the observer the power to watch the world from inside and outside. The empowerment of the observer correlates to that of the plants themselves; images acquire a specific cognitive power.

Technical features are necessary to alter the restrictive and established vision of plants, with the aims of changing the cognitive and cultural schemes and of playing on the registers of the marvellous and spectacular to create the “*plaisir du texte*” [“pleasure of the text”] in Barthes’ words, which is also the basic goal of media and cultural industries.

4.2. Verbal features: *Intentionalism*, metalanguage and polemic

The first verbal feature identified in the sub-corpus is the use of anthropomorphic and zoomorphic vocabulary. The established structure of semantic fields is distorted to make space for a new vision of plants and their capabilities and properties. This phenomenon is highly present in all media types, be they magazines, books or films. For example, the *Science & Vie* issue (Various authors 2017) opens with the headline “They think!”, and the first sentence of the main article of the issue says: “gifted with memory, capable of making decisions and even learning: plants demonstrate cognitive abilities as exceptional as those of animals” (p. 45). In the Wohlleben book (2017), one reads that “plants are perfectly capable of distinguishing their roots from those of different species”. And the documentary *L’intelligence des plantes* (Lucas 2014) includes this sentence: “The plant has apparently found an ingenious solution”.

Entire lexical fields are transferred from humans and animals to plants, particularly words concerning cognitive capabilities: *memory*, *intelligence* and *communication*. It also includes different types of sensoriality (sight, hearing, taste, smell), sensitivity, and the capability of being an *actor* that carries out actions based on knowledge and reflection.

The related discourse can be called *intentionalist* because plants, especially trees, appear to be endowed with concepts and abilities usually attributed to humans and, to an extent, superior animals (will, duty, strategic thinking, memory) and by marks of intentions and intentional acts (liberate, foresee, test, strategise). The book by Wohlleben (2017) is full of this kind of vocabulary: “[T]he trees avoid resting on the only way of the air... they prefer to secure their backs by also sending their messages to the roots” (p. 22). “A forest also shelters loners

and individualists refractory to any idea of collaboration” (p. 23). Species of trees each have their own “germination strategy” (p. 41). Trees and other plants, particularly those uncultivated, communicate and exchange information and signals not only with each other but also with animals. In the *Science & Vie* issue, titles are very *intentionalist* on plants: “they make choices and make real decisions” (p. 50), “they are gifted with memory” (p. 52), and “they learn from their experiences” (p. 54).

In their book *L’intelligence des plantes*, Mancuso and Viola use this type of vocabulary in a deliberate way:

Today, almost a century and a half later [in relation to the seminal researches of Charles Darwin on plants], an impressive body of research has shown that plants are indeed intelligent, *i.e.* capable of receiving signals from their surrounding environment, processing the information obtained and calculating solutions adapted to their survival. (2018)

The authors must manage the *intentionalist*, anthropomorphic and zoomorphic discourse in order for it to become acceptable to the intended reader. To do that, two strategies are used. The first is typical of texts like the book by Wollheben (2017) and the documentary *The intelligence of plants* (2014): intentionalist language is used without mediation, modulation or moderation. In other cases, it is introduced and commented on via meta-discursive texts referencing to other parts of the same text or the functioning of discourse and language (Hébert, 2020). Some authors intensely use the meta-discursive function of language while talking about plant intelligence and sensitivity: they try to negotiate meaning.

How can we apply words like *intelligence* or *communication* to plants: Is it a form of equivocation and multivocity in which the same term, like *intelligence*, is used in a completely different way; homonymy, such as thinking that plants are intelligent in the same way as humans or some animals or analogy, with the same term used in different interconnected ways for different beings? Authors must take a position to create a reading contract with the reader. As Tassin (2016) writes in the foreword of his book: “Plant nature, though omnipresent in our environment, is invisible to us. We have given it many names and identified some of its own mechanisms, but we hardly know what it is [...]”. Tassin compares the experience of finally connecting with plants to a long journey. “And we’ll have to walk a long way, out of our bearings. Then, huddled against its sidewalk, the plant will perhaps finally reveal to us, free from its veil, its true face”. Analogy and the image of an initiatory journey, also present in the foreword of Mancuso and Viola’s book, are old rhetorical tools used also to talk about the

divine (see Ashworth et al., 2017, on medieval analogy). These tools are used to develop the narrative of plant intelligence and to deal with the *otherness* of plants.

Different metalinguistic strategies are also employed. Mancuso and Viola use rhetorical questions and the rhetorical topos of definition, or managing the meaning to make an argument acceptable:

How can we deny their intelligence under these conditions? In the final analysis, it is all a matter of terminology and everything depends on the meaning that is given to this word: [...] we will see that it can be understood as the "capacity to solve problems", and we will see that if we retain this definition, plants even reveal a brilliant intelligence in the choice of solutions to adopt in order to face the difficulties linked to their own existence" (2018, empl. 88, foreword).

And Thellier, a researcher interviewed for an issue of *Science & Vie*, uses the topos of comparison, affirming that "[i]t seems no more shocking to me to talk about memory for a plant than for a computer" (Various authors 2017, p. 52).

Other authors, such as Chamovitz and Tassin, are more cautious. In the foreword to his book, Chamovitz asks the reader for permission: "Even if it is of course impossible to equate the functioning of plants with human behavior, I would nevertheless ask you to allow me to use, throughout the book, a vocabulary generally reserved for human experiences" (p. 5). The humbleness carried by these words represents a form of *captatio benevolentiae*, "capture of goodwill", thereby opening a space for change without creating tension with the established linguistic habits. Chamovitz often uses concessive forms, in this case, "even if", as a tool to manage polyphony and the co-presence of different types of discourses. The move is different from that of Mancuso and Viola, who much more directly attack what they represent as "prejudices and dominant ideas" (2018, empl. 52).

These examples show that there are different forms, types and gradations of intentionalist discourse, metalinguistic strategies and polemic intensity. For Chamovitz the intentionalist, or anthropomorphic, language has a lower status as a (metaphorical) medium of expression; for Mancuso and Viola, it is a rhetorical tool for revealing truth, even if definitions have to be adapted, as in the case of intelligence. All these rhetorical metalinguistic manoeuvres and devices, together with the visual features (acceleration, close-ups and animation), make evident the semiotic tensions created by polyphony and semantic innovation concerning plant intelligence and sensitivity.

5. Plants, humans and other animals: Ontological tensions

The media productions analysed in the previous section can be seen as a mirror of a new way the dominant Western culture perceives and relates to plants. How do the results of this research concerning plants in media culture show new forms of relationships (Baluska & Mancuso, 2020) or even an ontological transformation? What changes appear in the implicit ontological regime of French media productions? How does the regime of naturalism defined by Descola (2005, 2021), the very one that attributes only to the human an *interiority* - that is to say, a consciousness, a soul, an interior activity - is questioned and challenged? This attribution of interiority, traditionally reserved to humans (and animals to an extent), to plants reconfigures the categorisation of plants as *actant bodies* (in the sense of bodies having an autonomous power to act, see 5.1) and is still highly disputed. In the next section, these semantic and ontological changes are defined based, in particular, on the content in the books and other publications included in our corpus as well as the writings of other researchers who have contributed to developing these themes.

5.1. Plants as actant bodies

Discussing the perception of plants and the new way of qualifying them in Western societies, and particularly in France, invites questions about how to know the unknown; how plants acquire the status of intelligent beings or, at least, cognitive beings; and how this research reconfigures the human/plant collective?

The sociology of actor-networks (ANT) highlights the notion of "actant", because it integrates both humans and non-humans into an "active collective" (Callon, 2006). It emphasises "the capacity of each entity, especially non-human entities, to act or interact in a specific way with other humans and non-humans" (Callon, 2006, our translation). To this end, the notion of actant is fundamental to highlight the active nature of the entities that make up a networked collective: Non-humans act [...] The notion of a society made of humans is replaced by that of a collective produced by humans and non-humans (Callon, 2006, our translation).

According to Greimas and Courtés, semioticians active in France in the 20th century, the actant is seen as an entity that assumes a "certain number of roles" ((1993, pp. 3-5). It is defined by its "modal investment"; this means that an entity, as an actant-subject, is endowed with modalities: a will-to-do, a know-how, a power-to-do, or a duty-to-do. In this way, this entity acquires a modal competence, which is a prerequisite for an (intentional) performance.

Traditionally, plants have been granted a utilitarian, and culturally anchored, function in agriculture, amenity, decontamination, construction, heating or in the production of oxygen

through photosynthesis, thus allowing them to obtain the status of actant. But in the light of the work of Descola (2005, 2021) concerning Western naturalism, plants are endowed only with “physicality”: they are characterised by their physico-chemical properties that allow us to, among other benefits, feed, heal ourselves and derive pleasure. Consequently, plants can only perform as actants at this level, that of physicality.

But, as seen previously, for several decades, academic research has attributed to plants capacities, such as the ability to learn, memorize, and communicate (Calvo & Keijzer, 2009; Gagliano et al, 2012; Trewavas, 2016; Tassin, 2016; Chamovitz, 2018; Calvo et al., 2020; Parise et al, 2020), traditionally attributed only to humans or possibly to certain animal species. This change can be described as the attribution to plants of a "form" or essential identity that includes interiority; this attribution is realised through the application of an intentionalist lexical field of human and animal origin (see section 4; Descola, 2005; Cholet, 2021). This attribution enriches the actantial status of plants, that is, their roles in the relations they maintain with other actants, especially humans; it also weakens the classic dichotomous paradigm between the human as a subject and vegetal nature as a passive, dominated and commodified object.

This new valuation of plants, via a new semantic qualification and endowment of an *interior* form and intentionality, upsets the perception of plants inherited from the Aristotelian and, especially, Cartesian or mechanistic vision and is highly disputed (Dortier, 2020; Burgat, 2020; Mallatt et al., 2021; Robinson et al., 2020). Linguistic and visual constructions analysed above (section 4) are the expression of the tensions created in media culture by this change.

5.2. A new semantic constitution of plants

For the past few decades, to understand the inner forms of plants, researchers have been describing them from their senses (hearing, touch, sight, smell and taste) and mental faculties (memory, learning and will). For example, for Trewavas, plants make "decisions that balance [their] well-being with [their] environment" from their senses (2016, p. 549). Biologist Mancuso considers plant photoreceptors as "primitive eyes" of plants (Mancuso & Viola, 2018). Plants are also gifted with tactile sensitivity. While touch is allowed in humans by multiple receptors, of which there is no known equivalent in plants, this does not prevent them from reacting to even the lightest tactile stimuli (Tassin, 2016).

All these aspects show that plants are much more complex than previously believed and support the attribution of the status of actant also on the level of interiority, in a similar way to humans and other animals (Trewavas, 2016; Segundo-Ortin & Calvo, 2021). This plant interiority is drawn from the multitude of behaviours observed in the plant world and defined by these authors as intelligence, that is, capacities related to communication, sociability,

memory, proprioception, anticipation, cooperation, mutual aid and even, in some form, of consciousness. This multitude of observed behaviours presented itself as an undefined reality that had to be named to anchor them in manageable semantic categories.

This new semantic constitution transforms, not only the way of understanding plants but also the regime of identification in which this form of understanding is situated: naturalism (Descola, 2005, 2021). But before arriving at the ontological level, the process of grasping and interpreting the plant at work, the one that follows the act of perception and by which a certain number of researchers defend plants as body-actors endowed with an interiority, should be underlined. The major difference between the authors advocating elaborate cognitive activity in plants and those advocating only automatic reactions seems to lie in the process of meaning production; that is, in the conceptual stabilisation of the observations made on plant behaviours and reactions. This process can lead to affirming or denying the existence of an interiority of plants behind the observed phenomena. It is a process essential to advancing the hypothesis of an ontological transformation.

5.3. Transformation of naturalism: Interior forms to be stabilised

To study this process of conceptual stabilisation, several levels of analysis are distinguished: (i) a perceptive and sensitive level, or seeing and experiencing the plant and its behaviour; (ii) a level of ideation of entities, which is a process of understanding and semantic interpretation of the experience; and, finally, (iii) a linguistic level, written or visual, corresponding to the manifestation of the accomplished semantic process (discourses and media on plant intelligence)⁵. Together, they constitute the process of meaning production and invite discussion of the ontological dimension. For this paper, the focus is on levels (ii) and (iii).

Concerning linguistic level (iii), there has been a semantic debate with meta-discursive devices being played out to examine this unknown and far from fully explored world (see section 4). This debate also stimulates reflection on the problematic of the unknown and the otherness, its qualification, in connection with the advances and the discoveries made concerning plants. The authors mentioned here, such as Mancuso, A. Trewavas, Gagliano, Chamovitz or Tassin, use the same lexical fields as those used to talk about humans and other animals. These fields are used to consider the world of plants and their inner forms while underlining, however, their profound otherness with the animal kingdom; it is intentionalist language combined with the effect of spectacular othering. Plants see, but not in the same way

⁵ Bordron (2011) connects these three levels to the three types of signs proposed by the philosopher Peirce in his semiotic theory, index, icon and symbol.

as a mammal with two eyes; they hear, but not as a being with a pair of ears does. This argument goes against that of other authors (Dortier, 2020; Burgat, 2020, Mallatt et al., 2021, Robinson et al., 2020) who seek to nuance the claims about plant intelligence. For example, Dortier considers the affirmation that plants are intelligent poses a "risk" of creating "confusion", arguing that in doing so, one could no longer delimit "neither its forms nor its degrees" (2020). Regarding the term *intelligence*, Dortier prefers the term *adaptation*; to that of *perception*, he prefers *sensation*; and to *memory*, *elementary habituation*. Everything would be a matter of degrees and nuances. This linguistic posture distances, at least concerning their interior forms, the animal kingdom from the plant kingdom. These examples show that the description of plant cognition, poorly known, poses terminological problems similar to those of discourses on transcendence (see section 4).

This leads to an examination of linguistic level (ii), a level of study on plant cognition corresponding to the ideation of perceptual experience. As mentioned previously, the discussion can be based on Bordron's theory (2011), which draws not only on the writings of Kant (in particular, the *Critique of Pure Reason*, 1787, and the *Critique of Judgment*, 1790) but also on Peirce's triadic approach. The media productions studied here are the results of a "genesis" (Bordron, 2011, online) that challenges established categorical boundaries. This genesis shows how intelligence, sensitivity or consciousness emerge as categories from the "substances or flows" (Bordron, 2011, online) of experience. The authors seek to describe qualities without making immediate reference to the human model of intelligence. Notions such as communication or memory would no longer be a human prerogative. It is no longer about who has the right to be defined as "intelligent" in comparison with the human. It is rather about exploring the different forms of intelligence, of which the human is only one case among others given the diversity that the term *intelligence* can cover today. From this perspective, the observed movements and behaviours of plants allow these authors to attribute new semantic content to plants.

This process of meaning-making, defined as "compositional" by Bordron (2011), involves the conversion of one's perceptual experiences of entities in the world, in this case, plants, into signs: this conversion allows plants to be endowed with complex capacities such as communication or memory and thus enrich their identity. The body-actant plant is metamorphosed; its form is enriched with an interior dimension. To adjust to this new extension of the actant plant, the process of meaning production creates tension around notions such as intelligence, which becomes practically coextensive to the living being as a whole. According to Gagliano, the human must no longer constitute the prototype of cognitive activity:

[C]ommunication should not be held as a 'property' of an organism, but rather as a dynamic 'process' of interaction within the organism/environment system." (Gagliano, 2018, our translation).

The meaning-production process is no longer based on the reference to a prototype or model (for example, the human to embody intelligence) but on the perspective of a world composed of a great plasticity of interacting forms. It is up to the researcher or expert to show how this set of interacting entities takes on "form, stability and consistency" in order to be organised into a language system (Bordron, 2011, online). This way of understanding and knowing the living makes categories more complex (a plant, for instance, becomes intelligent and communicates, albeit differently) and allows for the comparison of entities from a cognitive point of view. This situation encourages a stronger ontological continuity between humans and non-humans, which in this case is plants.

These considerations lead towards an additional level of study concerning ontological order. They invite us to question the positions of Western industrialised societies towards non-humans. During this age of the biodiversity crisis, these positions are being shaken (IPBES, 2019). Our research seems to confirm a tendency towards a renewal of naturalism (Descola, 2005, 2021) by fully opening the semantic category of interiority to plants. This renewal starts from the phase of apprehension of the entity "plant", because the media productions studied above are the result of a mode of understanding data concerning plants other than the one based on a model (the human being). An ontological reorganisation between humans and other living beings is created and welcomes the birth of a sort of *post-naturalism*. This renewed exploration of the plant world contributes to taking the human being out of relative isolation. Intelligence and capacities such as communication or memorisation are no longer solely reserved for human beings or certain animal species: they become more inclusive and articulated into different variations, opening up new questions concerning the qualification of what is specifically human.

Conclusions, limitations and future research: Towards a new naturalism?

The main research question posited in this article is: How does the theme of plant intelligence and sensitivity manifest itself in mediatic productions in France?

This main question was addressed by identifying three sub-questions:

- What is the quantitative evolution of the presence of the intelligence and sensitivity of plants in French media productions?

- What are the visual and verbal multimodal specificities of media representations of plant intelligence and sensitivity in France?
- What changes appear in the implicit ontological regime of French media productions?

The answer to the first sub-question was a quantitative assessment of the media push of contents concerning plants, and plant intelligence and sensitivity in particular, taking place in France between 2014 and 2020. This assessment was based on the constitution of a multimedia corpus mainly of books and magazine issues. The answer to the second sub-question consisted of a qualitative and inductive observation of a section of this corpus. It led to the identification of some specific semiotic devices linked to the staging of the intelligence and sensitivity of plants: acceleration, close-ups and animation concerning the visual, and analogy, an intentionalist type of discourse, a spectacular othering, and specific metalinguistic strategies concerning the verbal. The third stage, related to the last sub-question, was a more theoretical observation of the semantic work implied in the new narrative of plant intelligence and sensitivity and its implications for the Western vision of plants. Through this work, the traditional (modern) Western naturalistic attribution of interiority, as described by Descola, to humans and a limited selection of animals, is put under pressure when the attribution of interiority to plants is proposed, staged and discussed. Western naturalism is questioned and the foundation of its ontological structure is shaken, resulting in a sort of post-naturalism or new naturalism.

Will this cultural and ontological evolution become mainstream? How can one affirm the appearance of a new ontological structure? It is clear that only preliminary assumptions about the overall evolution of the approach to plants in France and other Western countries can be made; further research and evidence are needed. Nevertheless, the success of sales and the proliferation of media outlets, both translations and original works, seem to corroborate the idea that this trend is not anecdotal. Moreover, we consider that this new vision of plants is in line with a series of phenomena and cultural trends present in France and the West in general, such as: anti-speciesism (Singer, 1977), deep ecology (Naess, 1973), veganism and new perceptions of animals (Morizot, 2020), the broader environmentalist and ecological currents, and the search for a new "resonance" with the world (Rosa, 2019). A new vision of plants as sensitive and intelligent beings seems indeed in tune with these and other contemporary cultural movements as part of a far-reaching cultural evolution concerning the relation between humans and other living entities.

Through this study, which deserves to be continued, we can see the complexity of addressing the emergence of new actants with inner forms, such as plants, and the multiple implications of these changes. Interdisciplinarity is necessary for further exploring and understanding the plant as an actant with inner and outer forms. The human and social sciences are relevant to feeding and extending this discussion to explore the effects of the evolution of Western naturalism on the perception of the human being and its place in the world of the living. This evolution also has important ethical implications. Many authors, for example, Cañada, Sariola and Butcher (2022), have already explored the notion of a “more-than-human ethics” system, though more should be done concerning the exploration of interactions between humans and other living beings in the era of the Anthropocene.

Indeed, this research has its limitations. On the one hand, it focuses on a short period of time and concerns only one European country. On the other hand, the focus is on a limited sub-corpus for (i) the qualitative observation of verbal and visual features concerning plants, and (ii) for the final discussion. Further research - with other corpora, other approaches, and in other parts of the world - is needed for a comprehensive analysis of the relations of Western societies to plants.

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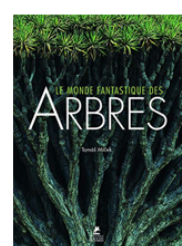
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Figure 1 *Quantitative Evolution of Publications on the Intelligence and Sensitivity of Plants Between 2014 and 2020*

Figure 2 *Examples of Major Bestselling Books Published in France, in 2017*

Figure 3 *Major Bestselling Books Published in France, in 2018*