Article

Urban Forest Tweeting: Social Media as More-Than-Human Communication in Tokyo's Rinshinomori Park

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Abstract: Urban parks are places that have significant impact on the physical and mental health of citizens, but they are also for safeguarding biodiversity and thus fostering human–nature interactions in the everyday landscape. The exploration of these spaces through social media represents a novel field of research that is contributing to revealing patterns of visitor behavior. However, there is a lack of comparable research from a non-anthropocentric perspective. What if we could use social media as a more-than-human communication medium? This research aims to reveal the possibility of communicating the urban forest's voice through the examination of the official Twitter account of a metropolitan park in Tokyo. To this end, an analysis of the content of the messages is carried out, focusing on the narrative voice from which the message is told, the protagonists, the action performed, the network of actors deployed, and the place where it occurs. It is found that the majority of these messages are delivered from a non-human perspective, where plants, animals, or meteorological agents behave deploying complex networks of more-than-human interaction. The current study reveals the latent potential of non-humans as possible agents within the realm of social media, which can mediate the relationships between humans and their environment. It introduces a layer that can be incorporated into future lines of research, as well as provides a model case that illustrates a good practice in the management and communication of urban green spaces.

Keywords: twitter; more-than-human; urban forestry; urban park; Tokyo

1. Introduction

The climate emergency is driving a growing academic momentum in the more-than-human dimension across disciplines such as urban planning, environmental studies, communication, and urban geography. The anthropocene is the new geologic epoch that recognizes human activity as having a major impact on geological time. Nevertheless, the management of the planet is intertwined with forces conceived as both human and natural, as different species have evolved co-constitutively with human communities [1]. As urban populations continue to grow, an exponential number of publications are exploring the importance of natural environments within cities. This ethical–political approach urges abandoning the conception of cities as the antithesis of nature and considering them as part of a "metabolic" relationship between society and nature, the city as an ecological space [2]. The current study engages with such context exploring the perspective of the urban forest itself. To aid a conceptualization that transcends the human as the reference, this introduction provides a theoretical overview of the ecofeminist framework and the philosophical background of co-producing urbanism with other species. Then, the literature on the intersection between social media and green spaces, and specifically Twitter, are reviewed as novel tools for understanding the relationship with nature in the city.

1.1. An Ecofeminist Perspective: Framing Communication beyond the Human

Transcending the anthropocentric worldview, ecofeminist thought adds a layer of consciousness that contributes to creating a reality with greater awareness of recording actions beyond the human. Haraway calls for creating a kinship with all forms of life, including those agents of the environment that are co-shaping and co-creating our habitats [3]. Communication scholars such as Plec highlight the "role of communication in the construction and transformation of human relationships with the more-than-human world" [4]. Rethinking conventional modes of social interaction, she criticizes the modernist paradigm that denigrates narratives linked to other beings on earth.

Until this day, rhetoric based on technological progress points to humans as the only ones capable of communicating. However, other forms of life constitute our environment and constantly speak to us. Plec suggests "internatural communication", an alternative and inclusive significance that embraces other possibilities beyond human life forms. Puig de la Bellacasa and Bennett bring to the forefront of the discussion notions of care that, in conjunction with the co-production of the public sphere and its eco-social realities, can engender new models of coexistence beyond human exceptionalism [5,6]. From multi-species geography, Pitt proposes to engage more directly with plants and how they perform to clarify "not just what plants mean to people but how they contribute to gardens" [7].

1.2. Co-Producing Urbanism with Other Species

New planning theories analyze multi-species use and occupation of space, recognizing the capacity for action of other non-human entities. Various bodies co-produce our urban spaces, and these bodies have diverse material dimensions. Their ecologies condition and question conventional city planning that fabricate policies based on the culture-nature separation. Urban planning continues to address ecology from a human angle, focusing on establishing measures solely according to the human population [8]. Conceiving human beings as part of a larger web implies generating new vocabularies and practices challenging the dominant ways of knowing, towards more inclusive trans-species urbanisms [9].

The creation of multispecies planning tools and narratives would support the realization of diverse urban futures that are more socially and environmentally just [10]. Empathetic imaginaries of everyday practices and trans-species encounters emerge from examining the city, vividly expressed by Gruen's "entangled empathy" to create more-than-human urban environments [11]. This notion urges us to reconsider what counts in urban planning, going beyond "homo urbanis" as a benchmark for ethical action. It is necessary to assume responsible interactions of care attuned to the urban ecosystem inhabited by diverse beings [12]. To analyze the interactional phenomena between nature and humans, urban green spaces present a unique field of work to provide new theories and methodologies.

1.3. Social Media for Researching: Urban Green Spaces

Urban planning research has consistently focused on green spaces as essential elements for human well-being [13]. Some of the main avenues of scholarship regard their impact on health, sense of place, and community interactions—or their usage, in terms of when and how people interact, as well as identifying barriers to their accessibility [14,15]. Emerging technologies are advancing techniques for assessing human interaction with urban green spaces. The evaluation of these relationships can be from an observational approach or through technological devices that operate with big data. Social networks are a clear example of the application of crowdsourcing methodologies, as they allow anyone connected to the Internet to produce information. Recent studies on the intersection between the performance of nature and user experience in urban parks demonstrate that social media is potentially an effective evaluation tool for public park management [16]. User-generated content serves as a vehicle for conveying visitor feedback to park staff, accessing opinions about the use of a place, emotions, or the movement of people in a space [17].

Since 2018, among the emerging social networks in the research of urban green spaces, Twitter appears as a powerful source to understand citizens' feelings, satisfaction levels,

and behavior [18]. It allows communication of free statuses and messages with other users connected to the network, with a limit of 280 characters per text, having open access to different accounts. The ease of getting public data and a large number of users have presented Twitter as a source valid and desirable [19]. Twitter data have contributed to gaining insight into the sentiment variation between urban and natural land cover types [20]. Geo-referencing tweets at the urban park scale also allowed linking well-being to specific spatial and user characteristics [21]. Adding a cross-linguistic perspective, other scholars have compared human demands and emotions in different cultural contexts [22].

There is a body of research using Twitter data to understand liveliness in public parks, associating density, diversity, accessibility, travel demand, and human behaviors. To assess the quality of urban green spaces, Twitter data are discussed concerning the morphology of the built environment, pedestrian routes, and the variation in demographic characteristics of visitors, whether gender, age, or ethnicity [23]. Some studies link large-scale geotagged data to reveal temporal and spatial patterns and infer activity purposes [24]. Others identify Twitter as a source for comprehending spatiality in urban parks and the ability to bond people from various neighborhoods [25].

Most recently, in the wake of COVID-19, there has been a proliferation of studies using Twitter to examine the interaction with urban green spaces during the pandemic. Researchers found the potential of Twitter as a source of real-time information to enable quicker engagement in emergencies, as well as a snapshot of the challenges faced by park administrators. Some focused on the contested opinions on regulations in different countries, detecting the frequency of topics, and manually sorting the opinions by the research team [26]. Other studies collected park-specific values, emphasizing the importance of users' behavior in informing management strategy [27].

1.4. Twitter, An Emerging Tool for Exploring Biodiversity

Twitter-based biodiversity research includes studies that utilize geolocation methodologies similar to those observed in the analysis of urban parks. For instance, this includes applying them to assess the risk posed by visitor pressure in protected areas [28], or to clarify user sentiment and characteristics in national parks [29]. Further research focuses on the evaluation of certain keywords to establish indicators of interest [30], to illuminate the main actors around specific topics [31], or to determine the popularity of species both endangered [32] and familiar [33]. Several studies have also explored the utility of Twitter as a tool for the identification and monitoring of both invasive [34] and endemic species [35]. When it comes to monitoring, Twitter serves as a powerful resource for getting citizens' views on park policies. It can magnify controversies or spark public discourse about biodiversity management [36].

However, as previously reviewed, digitized information generated through devices, applications, sensors, or platforms is mainly person-centered. Lupton questions this human-focused approach, reclaiming the collection of digital technologies as a registry of knowledge forms about different aspects of life, including non-human ones [37]. The current study aims to add to the social landscape of cities by exploring urban green spaces from the perspective of the non-human. It contributes to filling the gap in the literature that uses Twitter as a data source to explore the more-than-human world that speaks to us. Understanding data as phenomena endowed with vitality, the critical curation of Twitter can create an awareness of the natural realm of our parks, contributing to a better sense of the biodiversity in the city.

2. Materials and Methods

2.1. Case Study

In this scenario, Japan arises as a fruitful context that transcends the anthropocentric worldview, presenting relational and ontological models that consider human and non-human beings as interconnected and trans-agential. Shinto heritage and folkloric traditions bridge boundaries between the human and the non-human, considering them together as participants in collective life [38]. Japanese animistic cosmology overturns classical Western dichotomies between what constitutes otherness, culture, nature, subject, and

object. Japan subverts the hyper-stratified categories of knowledge in dualistic assumptions that conceive humans as different and superior to other beings [39].

Despite being a country with an impressive presence of nature, two-thirds of its land is forest, and the anonymous urban green spaces that serve populated neighborhoods of its major city, Tokyo, often go unnoticed [40]. Close-to-home parks, elements that provide contact with nature and allow recovery in case of emergencies, have proven to be essential in planning [41]. Rinshinomori Park, a neighborhood-scale green space presents an ideal case study to explore the intersection with nature in a dense urban fabric. Nestled in central Tokyo, Rinshinomori Park has a great diversity of flora and fauna across its 12 hectares. Additionally, it is also selected for its background as a center of experimentation in forestry, which has produced a particularly biodiverse forest, with century-old tree species and a significantly high canopy density. The park workers, who take care of the relations between natural resources and citizens, are often invisible to the public eye [42]. However, they have found in social media a way to narrate the spatial and temporal rhythms of green space management and the life of other beings that inhabit the urban forest.

The Rinshinomori Park Twitter account, @ParksRinsi, presents a single voice, that of the park, which in turn brings together multiple perspectives. Other Tokyo Metropolitan Park Administrations also manage similar Twitter accounts, some of which started tweeting even earlier, have gained a larger number of followers, or are more prolific in their posts. However, by voicing tweets from the perspective of different urban forest actors, the Rinshinomori Park Twitter account is representative of how social media can serve as a more-than-human praxis. Park staff act as mediators, tweeting to give voice to those agents who do not usually communicate, such as plants or animals that inhabit the urban forest. They make visible all the beings beyond the human, including them, but also other phenomena, such as meteorology or latent emergencies related to catastrophes. Through consistent analysis of the short texts and images, it is possible to know who is exercising the action and what is being represented, combining quantitative and qualitative evaluation. The park's Twitter account, as the object of study in this article, is a novel case study for reporting on environmental issues that transcend the human-use perspective, and illustrate how the park is a multi-species habitat.

2.2. Methodology

The existing body of scholarship provides several methods to deal with Twitter data. A spatial–temporal investigation based on the geolocation of tweets is among the most common ones [43], which can also be cross-referenced with other demographic [44] or ecological data [28]. Other publications complement this analysis by focusing on the content of the message, which can examine the appearance of certain keywords [45] or the feelings and emotions evoked in the tweets [46]. Besides the studies purely based on sentiment analysis [29], other works focus on the network generated by the messages [31], on their popularity, or on the engagement they foster [47]. This article grounds the exploration of urban forestry as more-than-human practice through the examination of the contents posted on the official Twitter account of Tokyo's Rinshinomori Park: @ParksRinsi. The investigation follows content analysis methodologies, focusing on semantic aspects, distinguishing more-than-human terms [48], the analysis of the narrator's perspective, and identification of the actors' network evoked in each message.

In comparison to the outreach levels of other parks within Twitter, such as Central Park in New York with more than 200 thousand followers, @ParksRinsi has a local impact profile, with around three thousand followers to date of this article, a number similar to the rest of the Tokyo metropolitan parks. The account has been active since March 2016, posting its first and representative message on Friday, April 1 of that same year: "Cherry blossoms are in full bloom". The current study will examine all tweets published since then, until 25 June 2022, the date on which the first abstract of this article is prepared.

Among the total 1333 messages published during this period, 311 retweets and 14 replies were excluded, to focus on the 1008 tweets with original content (Figure 1). All tweets were

downloaded using Twitter API and sorted by date of publication. Then, each message was translated from Japanese to English using DeepL API, and Google Translate for cross-checking. The accompanying media—images and videos—were also downloaded to support the text analysis. The content of each tweet was analyzed manually according to the following categories: *narrative voice*, *main actor*, *action*, *actor-network*, and *place*. The *narrative voice* is considered as the grammatical tense in which the action takes place—past, present, future—in conjunction with the grammatical person—first, second or third, and singular or plural; it is taken as an indicator to register the plurality of points of view registered in the different tweets. Whether the *main actor* in each tweet is human or non-human is recorded as a critical factor for identifying the type of relationship that unfolds. The *action* described in the tweet is also documented, noting whether it corresponds to an anthropocentric view. Then, the number of actors mentioned in each tweet is noted as the *actor-network count*, regardless of their human or non-human character, to know the extent of the network implied by the tweet. Finally, it is recorded whether the text mentions the specific *place* within the park, since in some tweets it emerges as a determining factor that conditions the message. Once this analysis is done, the patterns of more-than-human relationships found are extracted based on the main actor and the network of actors involved in the tweet.
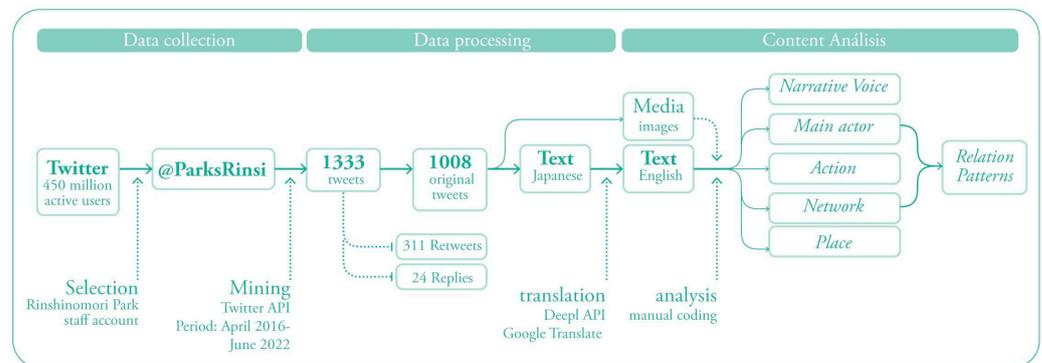

Figure 1. Flow diagram of the methodology.

2.3. Analysis Example

If we take as an analysis example (Figure 2) the tweet of Thursday, 20 January 2022, we can observe that the message is narrated in the present tense and in the first person singular from the point of view of a non-human main actor: the aerial root. The central action is to see, to notice, and a network of five actors is deployed: the swamp cypress itself, the winter, the observer, the other two parks in Tokyo where it is possible to find the same phenomenon, and the place within the park itself—the pond.

Figure 2. Analysis example. Original tweet in Japanese, English translation and categories.

3. Results

3.1. Content Analysis Categories

Narrative voice. As noted above, the narrative voice refers to the time and the point of view from which the action is narrated. It is crucial when dealing with an urban forest, where multiple temporalities differ depending on the perspective of each constituent subject. The analysis shows that the narration can happen in the present, such as the appearance of a certain flower, or it can herald future events, like upcoming neighborhood events or potential weather disasters, as well as recall the historical past of Rinshinomori when it used to be a public research facility (Figure 3). One of the characteristics found in the Rinshinomori Park account is that every possible narrative voice can be found along its timeline.

> @ParksRinsi　　　　　　　　　　　　　　　　　　　　　　　　　19 April 2016
>
> 【林試の森公園情報】　　　　　　　　　　[Rinshinomori Park Information]
>
> 試験場ができる前からある巨木、スズカケノキ、モミジバスズカケノキ、アメリカスズカケノキ、広い公園の中のごく一分です。
>
> These giant trees existed before the experimental station was built: the Oriental planetree, London planetree and American planetree, These are just a few of the trees within the large park.

Figure 3. Narrative voice. This tweet talks about the history of the park through the trees. Original Japanese text and English translation.

Main actor: Identifying the protagonist was key to this analysis and required a detailed breakdown of all messages. A total of 1097 protagonists were found (Table 1), which implies that in a small but significant portion of tweets we can observe two protagonists. As established earlier, two main categories were distinguished: human and non-human. This division reveals that the majority of the messages, 57.2%, are performed by a non-human protagonist, a significant result that reinforces the more-than-human communication approach of this account.

Table 1. Main actors count.

Human Main Actor				Non-Human Main Actor							
Professional		**Non-Professional**		**Plants**		**Climate**		**Animal**		**Others**	
staff/municipality	385	neighbors	49	plant	160	rain	39	bird	31	festivity/event	23
		children/students	20	tree	129	temperature	27	insect	35	facility/furniture	13
		volunteers/association	16	flower	22	wind/typhoon	21	reptile	9	park	9
-	-			fruit/seeds	18	season	20	fish	5	covid	10
		-	-	leaves	17	sun/sky	14	amphibians	3	pond	5
				fungi	9	ice/snow	7	mammal	1	-	-
(81.9%) 385		(18.1%) 85		(56.6%) 355		(20.4%) 128		(13.4%) 84		(9.6%) 60	
	(42.8%) 470					(57.2%) 627					
				1097							

Regarding the Human group, several recurring actors emerge: park staff, neighbors, volunteers and associations, or students and children. Within this group, there is a clear division between professionals and citizens, with 81.9% of the human protagonists featuring park workers. This outcome is partially explained by the fact that the Twitter account is managed by the park administration, but also underscores the existing barrier for citizens to access natural resources. Still, it is noteworthy that 18.1% of the human main actors are

neighbors, volunteers, or students. If we consider the Non-human group, the following actor subgroups can be distinguished: plants, animals, climate and meteorological agents, spatial elements, and others. Among these, the botanical realm appears most frequently as the non-human protagonist of the tweets (56.6%), which is logical given that there are more than 6100 large trees and most of the park's surface is covered by dense vegetation of great biodiversity. Of the remaining subgroups, 20.4% are related to meteorological and climatic elements, an understandable aspect when trying to inform potential visitors about the park's status. Similarly noteworthy is the 13.4% of animal protagonists, where birds and insects are the most representative. This might respond to the interest shown from the neighbors' side, since there is a community of enthusiastic wild bird photographers and, especially in summer, local children go out in search of beetles and cicadas to capture (Figure 4).
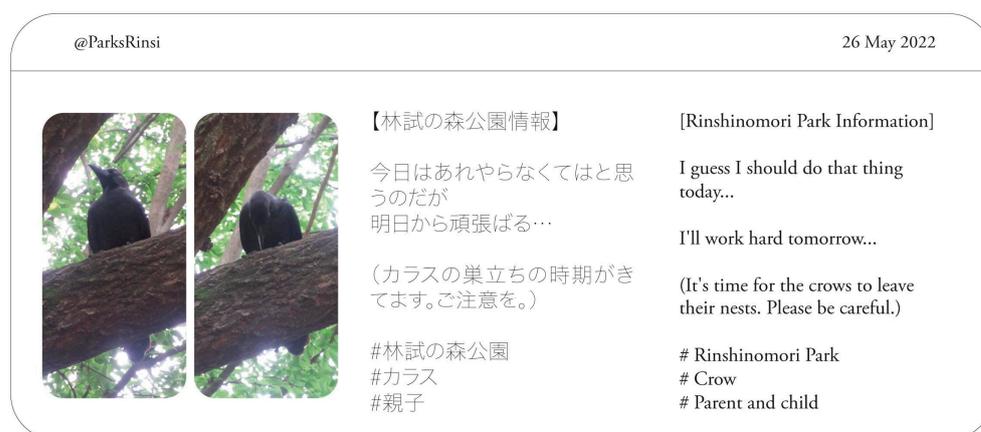
Figure 4. Tweet from the perspective of a crow. Original Japanese text and English translation.

Action. Considering the entirety of actions that appear in the park messages, there is a great diversity of outcomes. As would be expected, verbs associated with human activities appear repeatedly, for instance, those activities performed by the park staff that relates to the practice of urban forestry such as plant, care, prune, harvest, or repair, (Figure 5) or those related to the management of this kind of public space such as clean, organize, research, test, open, prohibit, make, protect, or inform. Others express the daily life of the park's neighbors such as visit, enjoy, like, celebrate, sing, photograph, exhibit, sell, etc., as well as their active involvement with the urban forest's inhabitants such as identify, participate, cook, help, or build.

Figure 5. Tweet expressing actions of care carried by the park workers. Original Japanese text and English translation.

Nevertheless, the frequent appearance of verbs related to non-human practices is also remarkable, such as the actions of the plant kingdom such as bloom, fall, take root, grow, sprout, or produce; or those performed by the animal community such as fly, hatch, eat, sound, nest, attack, breath, step, or feed; as well as the meteorological ones such as rain, blow, shine, change, rise, or destroy. It is worth mentioning the appearance of verbs that reflect a sensorial perception of the park such as hear, smell, touch, bathe, or play, which contrast with the strictly visual experience that has dominated 20th-century urban planning.

Actor-network. By counting the actors that appear in each tweet, besides the protagonist, the aim is to reveal the plurality of the network involved in each message (Figure 6). It is noteworthy that the vast majority of the tweets, almost 80%, deploy a network of at least two actors, thus establishing multidirectional relationships and diversifying their scope. This result is interesting when overlaid with the previous main actor category, indicating that most of the messages dealing with the urban forest deploy a more-than-human actor-network.
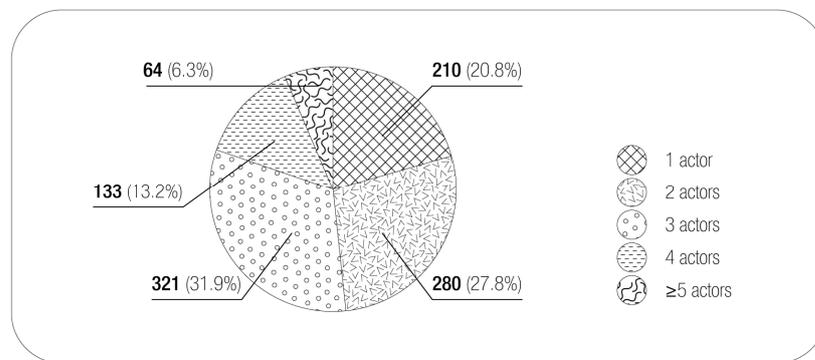
Figure 6. Percentage of the tweets according to the number of actors involved.

Place. Only one-third of the tweets include the location within the park as part of the message. By recording all these places, the following sets emerge: access, connections, open spaces, water bodies, service centers, and community gardens (Figure 7). All these sites have in common that they can be visited by neighbors, which indicates that the appearance of the place in a tweet is a human-oriented message, although most of the park's surface is covered by a mass of trees.
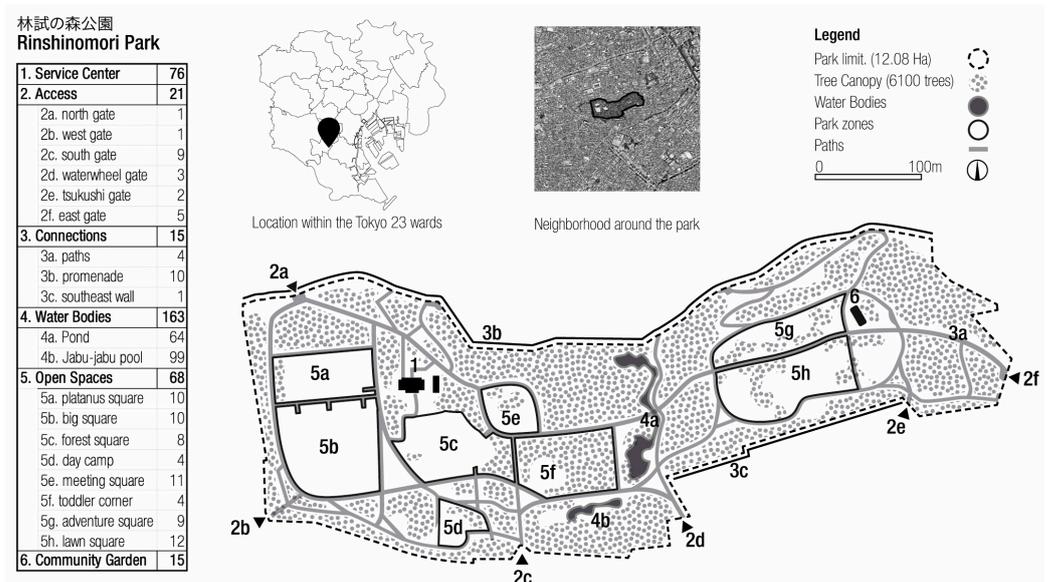

Figure 7. The number of times a specific place inside the park is mentioned in a tweet.

The most recurrent set is the water bodies. The jabu-jabu pool is a small outdoor pool for children which, besides operating exclusively in summer, is tremendously popular with the residents. The pond is a small ecosystem, and although it is not accessible to humans, it is a highly appreciated place in the neighborhood because it contains great biodiversity that changes throughout the year. The service center is one of the most repeated places, as it is where the park staff work, and also functions as an information and citizen center.

3.2. More-Than-Human Communication Patterns

Based on the categories of the main actor and the composition of the actor-network involved in the tweet, the following communication patterns were found (Figure 8):

Figure 8. More-than-human communication patterns. *Anthropocentric communication*: relation between only human actors; *Caring interaction*: communication from humans to non-humans; *Fostering participation*: a human protagonist that involves a more-than-human community; *Non-human agency*: the non-human actor that deploys a human network; *Interspecies conversation*: tweets depicting a strictly non-human conversation; *Forest collective voice*: an event triggered by a non-human, engenders a more-than-human actor-network.

Anthropocentric communication: This pattern reflects the communication from humans to humans, and therefore represents the conventional relations on Twitter. In our case study, this pattern is rather uncommon because it is easy for non-human actors from the park to appear in the post. Still, event announcements, upcoming activities, rules, and administrative information are some examples of this pattern.

Caring interaction: Another type of pattern observed is that in which humans address non-humans. Considering that non-humans cannot understand this kind of message,

it may still be a patronizing view in which a human speaks to a plant or animal from an intellectually superior position. However, the value resides in the fact that most of this group reports unnoticed everyday care practices performed by park workers. These messages also create a first layer of attention to other beings by placing them as an audience.

Fostering participation: Other tweets are transmitted from a human protagonist involving a more-than-human community of actors. This pattern contains messages that call for citizen participation in natural events that are occurring in the park. In this way, more-than-human interaction within a public space is encouraged or conditioned through a social network.

Non-human agency: As previously established, we discover a majority of tweets where the conventional sequence is inverted and non-humans have agency in the message. Within this condition, a pattern of tweets emerges where non-humans are the protagonists of an action involving humans. Paradigmatic instances are weather changes or possible natural disasters, which affect the community of neighbors and workers.

Interspecies conversation: In this particular pattern, humans are completely excluded from the message and purely non-human actors are recorded in the tweet. In these messages, forest communication is represented as we would perceive it if we were able to translate codes that are foreign to our species. Some of these registered interspecies conversations are flowering changes due to the advance of the seasons, or animals that share their eating habits based on fruits from the park.

Forest collective voice: A final pattern represents the highest expression of actor inclusiveness in the message. The main actor is non-human acting within a more-than-human network. Not only has the agency of the action been changed, shifting it to the non-human, but a community that is both human and non-human is involved in the message.

4. Discussion

Our contribution to the existing body of research is twofold: on the one hand, to reinforce Twitter as a fertile ground for research and, at the same time, to value the Rinshinomori park Twitter account as an example of good practice to foster more-than-human relations that can be extrapolated to the maintenance and administration of similar urban green spaces.

4.1. Twitter as a Research Tool

As reviewed in the introduction, the existing literature regarding the use of Twitter in the context of urban green spaces and biodiversity interaction is an emerging area of research. Thus, a large proportion of the existing work aims to demonstrate its credibility as a valid tool in the investigation of parks [49,50]. While other research has a more practical outlook, we are proposing the application of this instrument as potential support in the management of urban landscapes and ecosystems [51].

Already, an extensive body of scholarship is relying exclusively on the use of Twitter [52] or its Chinese counterpart Weibo [53] as the only material of study. However, it is equally common to find contributions that combine its exploration with other social networks such as Flickr [28] and Instagram [49], with demographic data [44], or with internet searches and digital newspapers [30]. Other authors propose to supplement its utilization with traditional sources such as field work [48], semi-structured interviews [49,50], or surveys [51].

The worldwide coverage provided by this social network allows researchers to analyze diverse case studies, situated on a broad range of spatiotemporal scales. Analogous to the present investigation, which responds to the specificity of a single urban green space, there are previous studies circumscribed to a single urban park [50,51]. Others use Twitter to analyze several parks in the same metropolitan area [52], based on the comparison of different cities in the same country [29], between countries [49], or even on a global scale.

Defining aspects when using Twitter as study material are the actors selected and how information is mined for subsequent analysis. The possibility of accessing a global

network has resulted in a tendency to deal with a large number of anonymous users [43]. To process an enormous amount of data, scholars frequently apply filters according to geolocation or specific content in the messages. To a lesser extent, there are fewer studies that use a single Twitter thread [48], or the content generated by a reduced number of specialized accounts [47]. Building along this line, the present study is the first that relies on the detailed analysis of the content generated by a single account, contributing with a novel approach to the existing body of research.

4.2. Rinshinomori Park Twitter Account as Good Practice for More-Than-Human Communication

The data processing procedure is consistent with existing research methodologies, with the automated steps first and then ending with authors screening tweets [27]. The vast amount of information provided by social networks and big data has led to a proliferation of automatic analysis methodologies [28] assisted by machine learning, which yield quantitative analyses. However, in this paper, as in others [45], the information is coded manually to perform a qualitative analysis that needs a fine-grained semantic understanding that would otherwise be very difficult to carry out automatically. On a different note, and in line with other studies [35], this article highlights the use of images associated with tweets as analysis tools, which are complementary to the textual content.

Twitter is an instrument frequently used by citizens to convey their demands to public decision-makers, resulting in a rich repository of policy-related opinions. For this purpose, previous studies systematically analyzed the textual content of the collected tweets following sentiment analysis modeling techniques [54]. The current study shares the intention to ensure that research results inform park managers. However, rather than inferring the specific needs of the public, the aim is to give visibility to non-human actors in a public park.

Other scholars have measured "urban life" by tracking the relationship between spatial structures and human behaviors via Twitter. Adopting a locally sensitive analysis, they have added data on points of interest and walking behaviors to the methodology, revealing hidden correlations between the shape of streets and their liveliness [55]. The current study adds to the responsibility of the ongoing reconstruction of planning theories by adding a hidden layer in the public sphere of members beyond the human realm.

Human-centered perspectives feature plants as mere background constituents of landscapes without treating them as individual entities [7]. As mentioned above, recent studies have used Twitter data as a source of information to examine the interaction between people and green city spaces [43]; however, the present study advances the discussion by using Twitter data to understand the "perspective of the urban forest" itself.

Previous research centers on events or uses where the human being is the focus [22]. In the current study, Twitter is explored as a means of creating a cybercommunity where voices of the more-than-human are recorded, moving from Twitter as "a data source to inform human use of urban green spaces" to a data source that informs about how the park behaves. Thus, times and events related to nature can be understood from its viewpoint, an alternative filter that disrupts the anthropocentric view of the urban environment.

While the use of Twitter intends to enable real-time response to urgent situations, allowing administrations and city planners to adapt their communication skills [54], the current study complements this approach by using Twitter data to understand the perspective of the urban forest as perceived by humans. Twitter analysis on how to communicate the voices of the more-than-human increases environmental awareness, not only among citizens but also among the actors involved in the design and management of public space. In addition to enhancing physical and mental health on a daily routine, such messages can serve to encourage greater citizen participation in the maintenance of urban forests, with better involvement in public maintenance policies.

Participatory observation elicits empathy and produces awareness, even if it does not lead to full understanding. The interpretation of animal communication has implications for the communicative relationships that mediate the public [56].

4.3. Limitations

Although the intent of our study was not to carry out a demographic sampling, but rather to show Twitter as a potential channel for raising public awareness of biodiversity and getting the park's voice heard, it may suffer from the biases pointed out in the previous literature. Twitter is a biased medium regarding gender, age, or nationality. The receptors of the "forest tweeting" would be the habitual users of this type of social network, young people and men, with an underrepresentation of other population groups such as elderly women or low-income earners [26]. In addition, the fact that the park staff are the ones that are tweeting brings the dilemma that arises when humans use their voice to humanize animals, treating them as people or speaking for them [57].

When it comes to language interpretation and translation, previous studies already found limitations in capturing nuances about sentiment and understanding perception. Automated sentiment analysis of big data was not sufficient, applying manual coding analysis, defining categories, and using a mixed qualitative and quantitative review [41]. We share with other studies the limitation that scarce information in short texts may lead to misinterpretation by the researchers, although human ratification brings a nuanced understanding of subtle language expressions as irony. As an improvement, the role of covariates such as seasonal rhythms could be included in the analysis to achieve high accuracy [20].

5. Conclusions

Taking a critical position nourished in the previous theoretical body around the role of social media in urban studies, this article has insisted on changing Twitter's conventional human perspective to a more-than-human one that allows us to generate a different world-view to inhabit the city as a shared space with other beings. For this purpose, the Twitter account of Tokyo's Rinshinomori Park was carefully selected as a case study because it is considered a valuable practice in communicating the voice of the urban forest. It was decided to meticulously analyze all the content published to date in a qualitative manner, in search of those characteristics that would allow us to understand how this practice is being performed. Following the analysis, the appearance of non-humans as protagonists in more than a half of the tweets is evidenced, thus conditioning the activities that are communicated. It is also revealed how, when tweeting, this urban forest deploys complex actor-networks, which connect a plurality of diverse agents and which manifest themselves in different patterns of more-than-human communication. This exploration has illustrated flora and fauna's agencies as producers of the urban milieu, revealing the park's voice in its own right. These tweets tell stories of interactions between various actors so that other social media users can unveil a latent layer that was otherwise invisible.

Additionally, the current study provides an innovative, replicable methodology that is consistent with the existing literature that uses Twitter as research material. It reveals the latent potential of non-humans as possible agents within the realm of social media, which can mediate the relationships between humans and their environment. This introduces a layer that can be incorporated into future lines of research, such as the possibility of combining it with citizen science methodologies based on sentiment analysis or geolocation, which would identify which particular park areas and attributes are more visited and represented to extract behavioral use patterns related to biodiversity. It could also be combined with social media engagement studies to detect species which appeal to the neighbors. This paper also illustrates a model case that could be extrapolated to other contexts as a good practice in the management and communication of urban green spaces. Joining the efforts of other researchers, we expect that the more-than-human perspective can serve as a basis for future planning guidelines that encourage biodiversity as a constituent part of park design. Through broadcasting the park's voice, the dynamics of the natural environment can be better understood, and Twitter emerges as a potential tool for urban design and planning. In this way, more-than-human interaction within a public space is encouraged through a social network.

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