# Companion Practice in between Dogs and Owners; Co-Designing Urine Marking in Urban Space

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Dog marking behavior in urban spaces is problematized as a factor causing corrosion of public property and soil damage. Conventionally, various solutions have been considered for this problem, including the application of repellents and water-flushable toilets for dogs, but all have remained human-centered approaches, consequently reducing dogs' place in urban space. Through four phases of prototyping, this study developed the "Dog-Pee Spot " a product that attracts and aggregates dog marking behavior. The prototyping process revealed complex dog agency where social behavioral patterns of dogs in outdoor spaces intersect with becoming-with owners connected through leashes. Furthermore, in Co-Design practice that considers this complex agency, single prototype interventions showed limitations, while effective problem-solving through interspecies collaboration was achieved by interconnecting multiple prototypes. This paper provides practical insights for More-than-Human Design in urban spaces.

***Keywords: Dogs; Urine Marking; Hybrid Agency; Co-Design***

## 1 Introduction

In recent years, in correlation to urban development, opportunities to encounter wild animals in urban spaces have increased. However, these encounters between humans and animals are generating conflictual relationships for both parties according to Human-Wildlife-Conflict (HWC) (Beeri, 2025; Abas,A,et al, 2025). The nature of these conflictual relationships lies not only in mutually disadvantageous oppositional structures, but also in their tendency to escalate into a vicious cycle, where each actor exacerbates the situation by prioritizing their own interests (Marchini, et al, 2021). Aggravating the matter further, this structural problem extends beyond wild animals, which are the primary focus of conventional HWC research, towards companion animals such as livestock and pets kept by humans in urban environments and developing relationships (Granai, 2024).

In response to complex structural issues, Human-Centered Design (HCD) has recently been adopted and has demonstrated certain short-term mitigation effects. However, these approaches often prioritize human convenience, which can result in sustained stress and deprivation for animals and

natural environments, ultimately exacerbating HWC in the long term. Recent scholarship has identified the precariousness of conventional HCD approaches becoming not solutions to problems, but problems themselves (Wakkary, 2021). Given these considerations, new design methods for humans and animals to coexist in urban spaces are urgently needed.

As reflection on HCD grows, attempts have been made to address urban issues through Co-design methodologies. This approach seeks to involve non-human actors as co-creators in the design process and thereby tackle these challenges（Chamaidi & Stavrakis,2024）. Gualtieri and Velzing have developed a framework based on participatory design methodology aimed at mitigating the impact of urbanization on biodiversity, positioning the flora and fauna inhabiting cities as active participants in urban design (Gualtieri & Velzing, 2023). At its core, Co-design is a framework developed to facilitate collaborative creativity that transcends the abilities or roles of individual participants (Elizabeth & Pieter,2008), and its extension to non-human actors is thus deemed justified. However, current efforts fail to fully account for the reality that the perceptual worlds of flora and fauna are fundamentally different from those of humans, and that their agency is deeply embedded within ecosystems and urban systems. In the future, for Co-design to adopt a More-than-Human perspective and aim for application to urban challenges, it is necessary to articulate concepts and experimental methods that can overcome interspecies frictions.

This study practiced Co-Design encompassing non-human existence in urban space through four phases of prototyping, targeting the resolution of public property corrosion and soil damage caused by dog marking behavior. Chapter 2 detailed that the current countermeasures of marking behaviour remain human-centered. Thus, flushing off scent marking creates latent violence toward dogs. In response to this context, we developed a pole-shaped product designed to attract and concentrate dog urination through marking behavior. Through the prototyping process, we sought to uncover the complex agency of dogs as it emerges in outdoor spaces, which is shaped by their social behavioral patterns and the co-producing relationship with their owners mediated by the leash. At the same time, we explored methods of Co-Design with such multilayered nonhuman agency. Chapter 3 specifically described the practical process and knowledge discovered during and after prototyping, based on reflective practice methodology (Schön,1983,1992). Based on the practical results obtained through prototyping, Chapter 4 discussed the core concept and urban intervention methods through integrating Co-Design and More-Than-Human Design. Through this paper, we provide insights and principles gained through practice regarding design methods for urban spaces where humans and animals coexist.

# 2 Conflicts between Dogs and Humans over Marking Behavior

## 2.1 Urban Impacts and Human Responses to Marking Behavior

This chapter provides a detailed examination of the conflictual relationships between dogs and humans in urban space surrounding marking behavior. Urine marking is one of the communication methods observed in most mammals, including dogs (Gosling and Roberts,2001). The released pheromones in urine contain information about the individual's age, sex, social status, and other characteristics, through which relationships with other individuals are established (Sharpe,2015). However, in urban environments, urine marking has increasingly been perceived as a threat due to its association with malodors, caused by ammonia, hormones, and bacteria, as well as corrosion of public

infrastructure and damage to vegetation through soil contamination (Fig.1). In response to such situations, some local governments have implemented regulatory measures. For example, in Kamakura City where we previously proposed our ideas, dog-prohibited areas have been established under the Kamakura City Urban Park Ordinances (Kamakura City Government, 2020). Consequently this regulation is encouraging highly aggressive exclusion methods by neighboring residents, such as spraying repellents on walking routes and installing spikes (Fig.1). These countermeasures not only restrict dogs' freedom of movement and physiological needs but also expose them to potential physical damage. Such one-sided approaches risk deepening interspecies divides and reinforcing harmful patterns of exclusion within the urban fabric

*Figure 1. Left: Base of Telegraph Pole Corroded by Dog Urine（Noriyuki Suou,2021） Right: Spike Mat to Prevent Dog Urination（Arisa Shirahama,2019）*

## 2.2 Hidden Violence embedded in Human-Centrism

The most generalized post-cleanup approach for urine marking is the removal of odors and stains through "water flushing." For example, local governments in Japan recommend pouring water from plastic bottles to wash away urination during walks. For instance, the official website of Ome City, Tokyo, states: "It is important not to allow urination or marking during walks. If it does occur, always carry a plastic bottle filled with water and perform treatment such as flushing with water" (Ome City Government, 2023). Bilbao in Spain also enacted an ordinance in late March 2025 imposing fines of up to €3,000 for leaving dog urine in public spaces, requiring owners to carry water, vinegar, or soapy water for cleaning (Bilbao Council, 2025). Similar regulations have been introduced and expanded in other cities including Seville and Barcelona (David León Himelfarb, 2025). In addition to such institutional frameworks, the practice of washing away dog urine with water as public etiquette has become widespread among many dog owners in recent years. However, pheromones contained in urine are used for individual recognition and social networking, thus such practices may place limitations on their forms of communication. Recently, water-flushable dog toilets (Fig.2) have also been marketed, and their increasing prevalence may further narrow dogs' position in urban space. This issue is deeply rooted in human social conventions, making its violent nature difficult to recognize and often overlooked as something latent. However, to achieve urban spaces that coexist with dogs, there is an urgent need to consider alternative solutions.

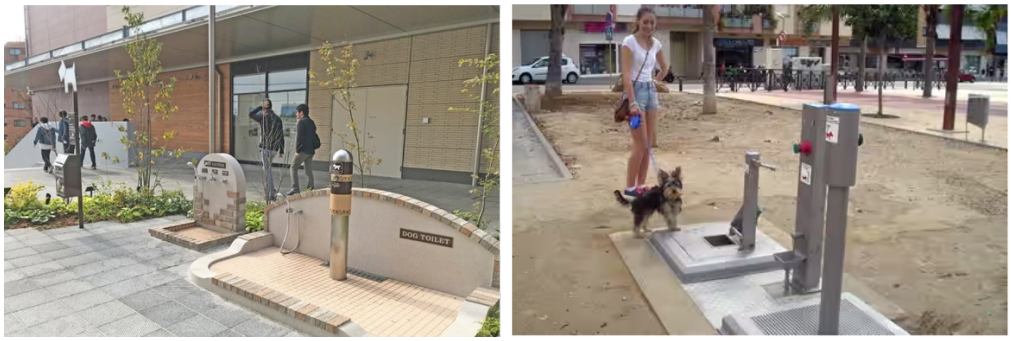


*Figure 2. Automatic Water-Flushable Dog Toilet Left: Japanese Case, Right: Spanish Case (Daisuke Itou,2022)(Burgen, S.,2014.)*

# 3 Intervening between Dogs and Humans through Marking Behavior

In this study, we developed the "Dog-Pee Spot (Pee-Spot)" a product designed to absorb urine from marking behavior. Unlike conventional approaches that focus on behavioral restriction or water-flushable dog toilets, our aim is to propose a more inclusive response that acknowledges dogs' presence in urban space. By designing urine absorbable materials and forms, Pee-Spot prevents urine from adhering to conventional urban elements and soil, while simultaneously retaining the scent marking as a medium of communication between dogs. This chapter decomposes the prototyping process of the Pee-Spot into four phases and reflectively examines them. The first two experiments discuss how complex urban animals (dogs) should be treated as design subjects, while the latter two verify what approaches should be employed for intervention after subject definition.

## 3.1 First Prototyping

In the initial prototyping phase, we installed the fabricated prototype along our own dog's regular walking route. This allowed us to explore how material and form influenced marking behavior, while also helping us observe dog behavior in urban space.

Although the results did not lead to the induction of marking behavior toward the fabricated object, we succeeded in attracting the dog's interest and obtained several responses, including sniffing behavior for several seconds. These responses revealed correlations of the material texture, form, and coloration as well the placement location and the scents that linger there.

During the prototyping, dogs displayed greater environmental awareness and a notably stronger focus on scents than they did in indoor settings. This behavioral pattern is deeply connected to dogs' sociality mediated through scent. Dogs indirectly acquire individual information left by other dogs' scent marking on urban space objects, constructing complex social relationships(Cafazzo, S, et al, 2012;Puurunen, J, 2020). Consequently, behavioral patterns specific to outdoor spaces emerge, and the necessity of designing based on these dog behavioral characteristics was understood.


*Figure 3. Prototype fabricated using Rice Noodles and Carbon Sheet, used in Experiments.*

## 3.2 Second Prototyping

Based on the observed outdoor-specific behavioral patterns of dogs in urban space, this prototyping phase focused on observing dogs during walks to investigate the relationship between marking behaviour and urban elements. Through seven days of fieldwork comprising a total of seven walks (average duration: 11 minutes), a total of 100 marking behaviors were observed. The primary marking targets were predominantly pole-shaped objects, such as utility poles and signage (54 times), followed by plants including grass and hedges (33 times).

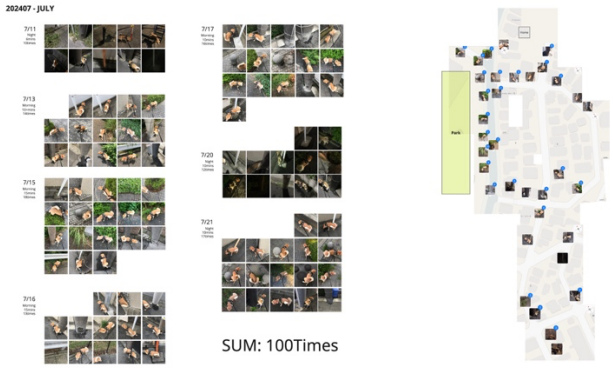


*Figure 4. Records of Dog Marking Behavior Conducted around the Home Area and Mapping of Marking Locations.*

While the observational data revealed urban elements related to marking behavior, no suggestive tendencies or correlations were found in relation to the characteristics of those elements. However, consistent patterns emerged in the exploratory process leading dogs to urine marking, advancing the previous discussion on dog sociality. As illustrated in Figure 4, dogs engaged in sniffing various scents throughout their movement in urban space, determining whether to engage in marking behavior based on these olfactory investigations (Biswas,S, et al, 2025; Bekoff, 2001). This model enabled us to understand that marking behavior is not merely urination but is induced through a series of actions including movement, sniffing, and judging, thereby expanding the intervention possibilities for prototyping.

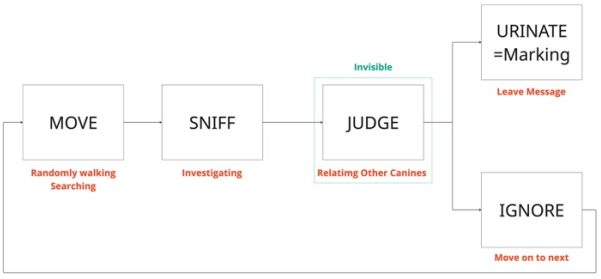


*Figure 5. Model Sequence of Dog Marking Behavior based on Observational Data.*

This investigation revealed that, in addition to dog behavioral characteristics, dog behavioral decisions in urban space are deeply interconnected with interactions with dog owners themselves. Since dogs and owners are connected via a leash, the owner's intentions can shape walking routes and influence which objects the dog pays attention to (Fig.5). During this study, we confirmed that “becoming-with” (Haraway, D, 2008) relationships emerge in marking behavior itself, such as owners being pulled by dogs' scent exploration that determines marking behavior, or owners restraining dogs in areas where urination is prohibited. This highlights the need to approach the dog and owner not as separate individuals, but as a single unit when designing for marking behavior.

## 3.3 Third Prototyping

In this prototype, based on the previous observational findings regarding the becoming-with relationship between dog owners and dogs mediated through leashes, we considered a design that treats both parties as a single unit rather than as independent entities. This experiment aimed to demonstrate the fabricated prototype’s practical functionality by installing it in a public urban park. We recruited new dog owner collaborators to ensure the objectivity of experimental results.

*Figure 6. Fabrication Process and Finished Product of the Third Prototype. Materials used included Carbon Sheet, Straw, Hemp Rope, and Felt.*

The prototype was designed based on references such as dog agility structures and public dog parks, allowing us to consider the needs of both dogs and owners.

In terms of form, we prioritized human-centered aesthetics, considering that the prototype would be placed in public space and found by dog owners. At the same time, we paid careful attention to dog-specific sensory traits such as olfaction, by wearing gloves during fabrication to avoid transferring the owner's scent (Fig.6). These contrasting considerations highlighted the difficulty of designing for

multiple interrelated agents as a single unit. We conducted experiments under conditions aligned with actual urban space, including installation at the center of the park to accommodate usage from all directions.

*Figure 7. Scene from the Third Prototyping Implementation.*

However, these design intentions and considerations failed to fully capture the interactions between dogs and owners, and the prototype was not used for marking behavior throughout the entire process. An unexpected factor on the day was the weather disruption due to light rain, which left the dog in an excited state. Even when approaching the fabricated prototype, after sniffing it, the dog shifted interest to other objects and ran away (Fig.7). Additionally, beyond our intentions, the owner attempted to hook the leash onto the fabricated prototype, causing an accident where the prototype toppled over. Ultimately, since the dog's marking occurred on trees and hedges where urine traces remained, it became evident that scent marking from other dogs' urine was essential for attracting marking behavior (Fig.7). As the prototype did not contain such pre-existing scents, it failed to draw the dog's interest. These observations revealed the limitations of intervening through a single product when addressing the needs of multiple interrelated agents, indicating the necessity of exploring new approaches.

### 3.4 Fourth Prototyping

This prototyping was conducted at "Inu Matsuri", an event for dog lovers held in Gifu Prefecture, Japan. While numerous dog lovers circulated through the venue with their dogs, urination traces were scattered across hedges and roads, revealing the manifest damage to the site caused by urine marking.


*Figure 8.a) Dog-Pee Spot, b) Toilet Sheets, c) Urination OK Signage*

In this experiment, we treated both dogs and dog owners as a single unit as design subjects, attempting to realize the induction of marking behavior. As the previous prototype revealed, single

product limits behavioral modification. Therefore, this iteration examined the induction of marking behavior by combining and arranging multiple prototypes. In addition to refinement on the Pee-Spot, this experiment explored ways to expand opportunities for urine marking and communicative permission by introducing other elements such as posters and toilet sheets. (Fig. 8).

Several hours after installation, a dog owner discovered the toilet sheet and encouraged their dog to urinate, immediately followed by the dog engaging in urine marking. A brief interview with the owner revealed this was preemptive urination in preparation for a long car journey, prompted by discovering both the familiar toilet sheet and the poster indicating that urine marking was permitted. Subsequently, the toilet sheet area attracted numerous dogs, and marking behavior was repeatedly observed. The Pee-Spot was then relocated nearby. As a result, splashed urine began to accumulate on the Pee-Spot, which in turn encouraged other dogs to use it as a marking spot. Dogs continued to be attracted even after the relocation, with an estimated 113 marking behaviors recorded during the two-day event.

As demonstrated by quantitative observational results (Table 1), the presence of other dogs' urine is essential for inducing urine marking. This condition was achieved through the addition of multiple prototypes alongside the Pee-Spot, creating functional interconnections (Fig. 9). The insight that effective problem-solving can be achieved through the mutual interconnection of multiple prototypes is applicable to other animals with complex agency in urban space and holds potential for Co-design applications.

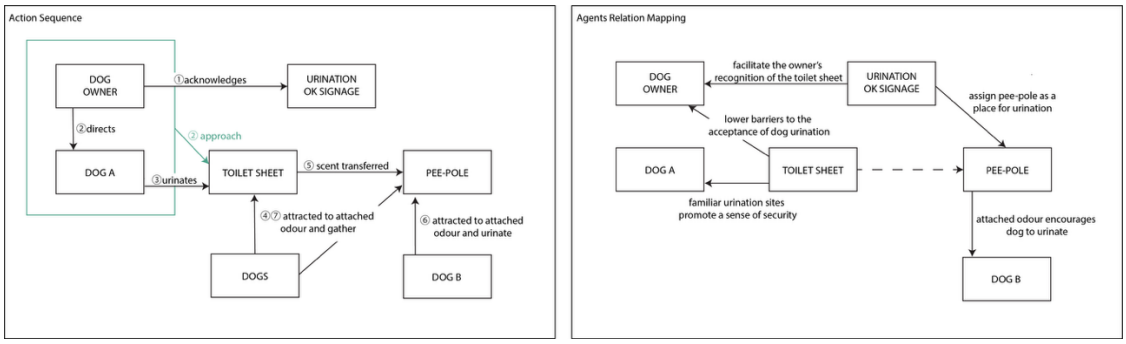


*Figure 9.Usage Transition Diagram of Prototypes at the 'Dog Festival' (Action Sequence) and Functional Interconnection Diagram of Products and Stakeholders (Agents Relation Mapping).*

| Condition | Sniffed (%) | Urinated (%) | Ignored (%) | Sample Size (n) |
|---|---|---|---|---|
| **Unscented Product** | 5%(0.66) | 0%(0.00) | 95%(12.5) | 20 |
| **Scented Product** | 42%(13.0) | 8%(2.5) | 42%(13.9) | 62 |

*Table1.Relationship between Dog Pee-Post Condition and its Usage Percentage.*

In this prototyping, we observed scenes where the companion species (Haraway,2003) relationship between dogs and dog owners deepened through marking behavior mediated by the Pee-Spot. As dogs were drawn to the scent of urine from other dogs and thoroughly sniffed around the product area, owners remained in place with their dogs and provided praise when marking behavior occurred.

These findings indicate that the prototype served not only to induce marking behavior but also to foster collaborative engagement between owners and their dogs. Thus, it became evident that the Pee-Spot serves as a mediator, creating new intimate becoming-with relationships between dogs and owners.

# 4 Discussion

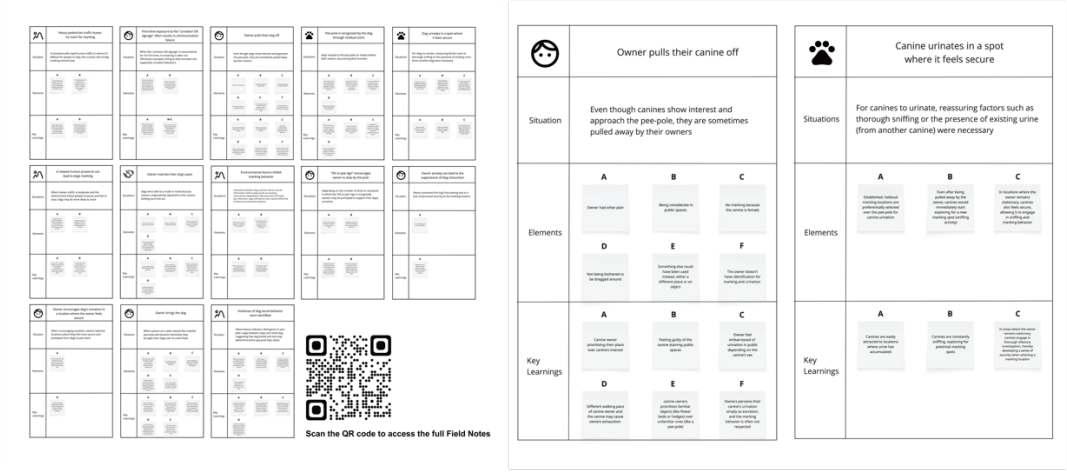


*Figure 10. Systematic Classification of Dogs, Owners, and the Environment involved in Urban Marking Behavior, based on Field Note-Driven Prototyping at the Dog Festival.*

This chapter discusses the contribution to prototyping design methodology based on analytical results of field notes from Inu Matsuri. Field notes were recorded simultaneously with the fourth prototyping and grouping analysis was conducted to understand interconnectedness of human and dog marking behaviour, and factors within the surrounding environment (Fig.10).

Through the first and second stages of prototyping, we revealed that dogs exhibit a hybrid agency (Latour.B, 2007) in urban environments, an entanglement of instinctual behavior and relational dynamics with their owners. Among these findings, the discovery of the becoming-with relationship between dogs and owners is particularly significant. This prototype revealed the possibility of moving beyond the conventional focus on animal agency in More-Than-Human Design by reframing the design subject itself and developing new observational perspectives. Thus, future explorations of hybrid agency in relation to other companion or wild animals will be requiring careful consideration of mediating interfaces, analogous to the leash in the case of dogs, that enable or shape interspecies interactions (Sadetzki et al, 2021).

In addition, the limitations of intervention through a single prototype, as observed in the third and fourth stages of prototyping, can be further examined through the field notes. During “Inu Matsuri,” effective design intervention could not be achieved by a single prototype alone. Instead, meaningful impact arose from the interplay of multiple prototypes where the Pee-Post fulfilled its intended function only when combined with toilet sheets and posters. The Field Notes for these situations include observations such as: “The ‘OK to Pee’ sign encourages owners to stop by the pole,” and “Environmental factors inhibit marking behavior,” highlighting how the function of the Dog-Pee Spot integrates with its surrounding environment. This insight is significant as it underscores a crucial consideration in co-designing with non-human actors that exhibit complex forms of hybrid agency in

urban areas. In the era of urgent need to consider living habitats of various agencies, reconsideration of interrelation of multiple products in urban space is demanded. We need to consider not only the addition of new products or media, but also how existing urban infrastructure and public objects can be relationally reconfigured within the networks.

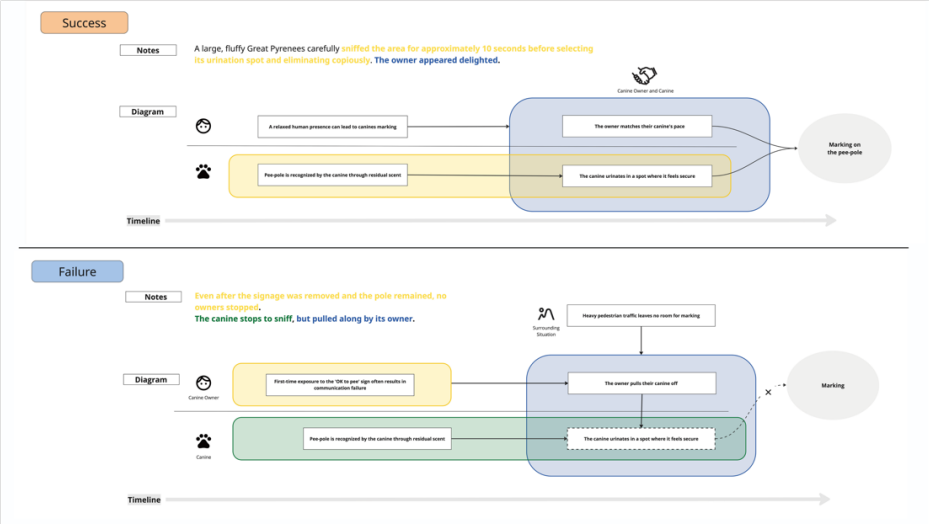


*Figure 11. Notation Analyzing the Mutual Influences of Owners, Dogs, and the Environment on Marking Behavior, based on Field Notes.*

Lastly, we address the key concept of "Companion Practice," which integrates perspectives from both Co-Design and MtHD, and has been developed based on our field notes on marking behavior. In this paper, we highlight how expanding the methodology of Co-design to include creative processes with non-human actors gives rise to a new domain of design that embraces their existence.

However, as this methodology is still in its developmental stage, a new conceptual framework is required to address the challenges arising from the fundamental differences between humans and the instinctive worlds of flora and fauna. In this regard, the notation observed in our study, where dog owners actively interpret their dogs' intentions and attune themselves to their world, offers valuable insight (Fig.11). This concept also resonates with Haraway's notion of Responsivity (Haraway, 2016). It signifies a transformation of agency that occurs as owners engage in the care of their dogs, gradually becoming interpreters of the dogs' worlds and acquiring new modes of perception. By naming this participatory state "Companion Practice," we aim to propose a dynamic ontology of participation that extends the conventional understanding of participation in Co-Design. Moving forward, we recognize the need to further explore evaluative methods of participation grounded in Companion Practice, particularly as a means of integrating the perspectives of More-than-Human Design into Co-Design frameworks.

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