
How We Own Drones: On the Sense of Ownership in the Drone Design

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Abstract

While HCI research on the sense of ownership over technological possession is actively developing, there is a noticeable lack of understanding of how users develop and experience ownership over social drones. In this position paper, we discuss how the specifics of drone technology, such as the possibility of autonomous operation mode, their ability to act as user's proxy on a distance, and users' tendency for anthropomorphization, might bring unique aspects to the user's sense of psychological ownership over drones compared to other technological possessions. Furthermore, we suggest that the sense of ownership is one of the fundamental questions in human-drone interaction and spans through major user-centered concerns in drone design.

Author Keywords

ownership; possessions; drones; values; social context.

CCS Concepts

•Human-centered computing → HCI theory, concepts and models;

Introduction

With the rapid development of the drone technology and its fast growing adoption in the global consumer market, the question of user's perceived ownership over drones becomes ever more relevant to the HDI community.

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The state, in which individuals experience a psychological connection with an object, feeling this object as “theirs”, has been defined as *psychological ownership* [3, 26, 11, 9]. Psychological ownership is conceptually distinguished from legal ownership based on its dual, cognitive-affective nature [10, 22]. This means, that besides the intellectual perception of some object as one’s possession, the psychological ownership also includes an emotional component [23], e.g. more favorable evaluation of the object [24, 19].

While the understanding of the sense of ownership is getting more and more attention in human-computer interaction in general [16, 5, 20, 13, 19, 14, 18], the specifics of forming the sense of ownership over drones, and especially social drones, are yet poorly understood. At the same time, as we demonstrate in this paper, there is a number of reasons to assume that the sense of ownership over this particular type of technology might have its unique aspects.

Key Specifics of Drones

For the purpose of exploring the potential unique aspects of ownership over social drones, here we discuss three distinguishing features of the drone interaction design: possible autonomy, ability to act as user’s proxy on a distance, and users’ tendency to anthropomorphize drones.

First, the unrivaled feature of drones is that, as technology, they encapsulate two possible modes of operation – autonomous, fully automated task performance (e.g. path following), and manual, real-time pilot-controlled task performance [7]. We suggest that the possibility of autonomous operation might potentially have an effect on sense of ownership of a drone, i.e. by changing the balance of the perceived decision-making responsibilities.

Second, unlike most of the technologies common in global consumer adoption, drones can perform their tasks on a

distance, and even without the direct input from their user. For example, FlyingBuddy robot [15] was designed to augment human mobility and perceptibility, including the scenarios where the drone could be flying to see things beyond the user’s field of view, or reporting accidents from above. Another project proposed using drone-based flying displays as personal companions (e.g., during sports), or as a way to actively support people in emergency situations (e.g., search and rescue) [25]. Such ability to perform tasks in a distance, and thus, to spatially augment human abilities, means that drones might become a proxy of their user, while still acting autonomously.

Finally, and in tight relation to the first two distinguishing aspects of the drone interaction design, many studies demonstrate the users’ persistent tendency to anthropomorphize drones. For example, previous research showed that people interact with drones as with a person or a pet [6]. Furthermore, the anthropomorphization through the perception of personality and emotions in robot’s behaviours is commonly deliberately designed into drones [8].

While these features are not the only unique aspects of drone design that distinguish them from other ubiquitous devices, in this particular paper, we specifically consider autonomy, ability to act as user’s proxy, and anthropomorphization of drones, to illustrate how these factors might potentially affect the unique sense of ownership in the context of drone technology.

Sense of Ownership in the Drone Design

Understanding of Ownership in HCI

Despite the fact that our understanding of psychological ownership over different technologies is still rather fractured and predominantly descriptive [5, 20, 13, 19, 14, 18, 17], there are some preliminary efforts to develop the HCI-

focused adaptation of the theoretical conceptualization of ownership from other areas of knowledge.

For instance, in the recent work [16], we have analyzed several examples of HCI papers on the technology possession in context of multidisciplinary research on ownership (e.g. [22, 1, 21, 23]), and illustrated how the mechanisms and rationalizations of the perceptions of ownership over physical and digital objects can be mapped to the previously developed multi-dimensional structure of ownership. Specifically, we suggested the following five *dimensions* of ownership for a particular consideration in HCI research:

- (a) **Self-identity** reflecting the object of possession becoming an aspect of a “representation” of an owner;
- (b) **Self-efficacy** reflecting the owner’s judgement of their capability and competence to perform a task and to control the object;
- (c) **Accountability and Responsibility** reflecting the voluntary or enforced authority and obligation to take care of the object and related performances, consequences, and issues;
- (d) **Autonomy** reflecting the owner’s judgement of their capability to independently initiate decisions and actions with the object;
- (e) **Territoriality** reflecting the owner’s identification of their possession through external references and causing an owner to defend the object if ownership is endangered.

Specifics of Ownership in HDI

In this paper, we raise the question of how the sense of ownership over social drones might differ from the ownership over other technologies, and what aspects would, in contrary, yield similarities with sense of ownership over

other technological possessions. One of the motivations for such question is that the identified key specifics of drones – the possibility of autonomous operation mode [7], ability to act as user’s proxy [25, 15], and users’ tendency for anthropomorphization [6, 8] – are, arguably, affecting each of the five dimensions of psychological ownership.

For example, the dimension of self-identity, when the possession becomes an extension of the owner’s self [1, 9, 4], could be expected to be significantly affected by the perception of a drone as a separate autonomous identity.

Furthermore, the dimension of self-efficacy – users’ beliefs in their ability to accomplish tasks [12, 1, 21, 22] – could depend on the expected level of user’s participation in the actual task performance, which is currently unclear for the drone technology.

Similarly, accountability and responsibility factors in psychological ownership are potentially much more flexible in human-drone interaction, if the level of expected user’s participation in the task performance is reduced and the focus is shifted to the drone’s decision making.

While the autonomy dimension of ownership seem to be the most similar to the ownership over other technology, in the context of drone design it opens an exciting avenue for the investigation of legal and ethical challenges associated with the restrictions on drones’ task performances.

Finally, the ownership dimension of territoriality in drone design is, arguably, one of the most novel directions in design research, since the drone’s unique autonomous and long-distance nature of task performance make it to be a proxy of its user/owner. However, the understanding of the mechanisms of territoriality in such task performance is yet drastically underdeveloped.

The Role of Ownership in Drone Design

In the recent work on the design of social drones, Baytas et al [2] have analyzed the results and implications from an extensive set of research papers on social drones, human drone interaction, and drone design. Based on this analysis, the authors developed a framework to enable end-to-end, post-hoc characterizations of drone design studies. The framework includes six drone design concerns, reflecting the specific design elements, and six human-centered concerns, which refer to the human responses evoked by these elements. The six human-centered concerns identified by Baytas et al [2] include:

- ergonomics – whether people are physically comfortable in interacting with the drone;
- appeal – whether people are willing to accept, acquire, and/or use drones as designed;
- tactility – the degree to which people perceive the drone as something they can touch, hold, and manually manipulate;
- intuitive control – the degree to which people are able to intuitively control the drone via the proposed design;
- intuitive comprehension of a drone – the degree to which people are able to interpret intentions or messages that the drone is trying to convey; and
- perceived social role of a drone – the existing conventions around social roles which people perceive as relevant for drone behavior.

Building on the five dimensions of ownership suggested for HCI [16], we argue that the question of ownership over

social drones spans across at least five of the six human-centered drone design concerns [2]. For instance, the appeal concern reflects the affective component of psychological ownership [23, 24], and, arguably, its territoriality and self-identity dimensions. The tactility concern seem to be likely to be related to territoriality and accountability dimensions, the intuitive control and comprehension of drones is directly associated with the self-efficacy dimension and, potentially, with the autonomy dimension. Finally, the concern of a perceived social role of a drone is, arguably, related to the questions of specifics of self-identity, autonomy, and accountability dimensions in the sense of ownership over drones. Correspondingly, due to the breadth of the representation of ownership aspects in the human-centered drone design concerns, we suggest that the understanding of the specifics of ownership over social drones is one of the fundamental considerations for the drone design.

Conclusion and Discussion Points

In this position paper, we suggest that understanding of the sense of ownership over drones is one of the fundamental questions in human-drone interaction, which affects the majority of user-centered concerns in drone design. We illustrate how the specifics of drones, such as their autonomous operation, ability to act as user's proxy, and users' tendency for anthropomorphization of drones, might bring unique aspects to different dimensions of psychological ownership.

Furthermore, the investigation of the sense of ownership over drones opens a research window into a broader set of fundamental design questions. For instance, it leads to a question of who is the user of a drone, in particular, when a drone performs social actions in a distance (e.g. assisting in rescue missions), and what differences should be reflected in the interaction design for multiple users of a drone.

Thus, we would like to advocate the iHDI community to consider the exploration of the mechanisms of drone ownership, as we believe that it would bring an important angle to the understanding of the drone design and would allow to further advance the efforts put into structuring the design space for social drones.

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