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# MaDrone: Using Drones to Facilitate Connectedness Across Geographic Boundaries

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## Abstract

The emergence of affordable consumer drones promises new perspectives for interacting with the physical world around us. Affordable, accessible, and easy to operate drones have the potential to overcome geographic boundaries between users living in different locations and subsequently foster connectedness. Yet, the design space of using drones to facilitate social interactions beyond geographic boundaries is still underexplored. In this position paper, we envision principles derived from the concept of lucid engagement and the psychological need for connectedness to explore how drones can mediate social interactions. We introduce our design concept and discuss it based on a specific application scenario. We discuss the opportunities and challenges related to our interaction concept. Finally, we outline next steps for future research.

## Author Keywords

Human-drone interaction; social connectedness; ludic engagement; drone

## Introduction and Background

In recent years drones have become affordable for the average consumer. Simultaneously, the field of Human-Computer Interaction (HCI) started to explore the design space of Human-Drone Interaction.

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*Interdisciplinary Workshop on Human-Drone Interaction (IHDI 2020)*  
*CHI '20 Extended Abstracts, 26 April 2020, Honolulu, HI, US*  
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Broader selections of different drone models and sizes and the availability of automation frameworks [8] foster the creation of new concepts and prototyping of novel drone based user interfaces.

Studies have shown that ‘flying user interfaces’ [6] can be used, among other things, to interact with the world around us, such as to provide assistance [2, 3] and as a means to interact with other people [19, 18]. Consequently, drones have the potential to significantly shape our communication landscape [5]. However, drones have mainly been used to foster utilitarian activities. There has been little exploration of their potential for more ephemeral interaction qualities going beyond facilitating communication, such as fostering connectedness between humans. A sense of social connectedness includes feeling connected to the world around you, being part of the society, and feeling close to other people [15].

Drones also have inherent characteristics which make them particularly suitable for supporting playful, ludic interactions. They are transportable, easy to operate, and they also address human fascination with flying objects. Ludic activities describe playful activities driven by curiosity, such as geographic exploration [7]. However, even though drones have been used as toys (e.g. [10]), as hovering touchable objects [12] (e.g. for VR [9, 1]), and to support communication [19], the design space of drones to facilitate social interaction, exploration, and ludic engagement is still underexplored. Hence, one of the aims of this position paper is to envision the potential of drones to support social connectedness through geographic exploration of spatially separated users.

In contrast to previous work that explored drones as digital companions (e.g. to accompany the user on their way home) [11, 13, 14], we envision integrating the digital companion qualities of the drone with the human companion

qualities to facilitate connectedness through shared geographic exploration.

### **MaDrone: Facilitating Connectedness**

With MaDrone, we have identified opportunities for connectedness that go beyond face-to-face video communication, as detailed below.

**Connecting people** MaDrone allows people, e.g. friends and family, to connect remotely, i.e. across geographic borders. The possibility to share visual content over long distances supports social connectedness among users, especially when they live in different geographic regions.

**Providing a Bird’s Eye View** Contrary to prevalent video communication, drones can provide a feeling of exploring through the bird’s eye view, allowing for ludic engagement [7]. Through directly influencing the visual content that is created, we create a feeling of agency for the user [16]. Increased immersion can also be obtained through interactive arrangement simulating the natural way of conduct. Enabling the remote participant to perceive both the presence of the other person and their surroundings may enhance the social benefits of telepresence experience.

**Negotiation of Control** MaDrone allows users to negotiate and share control (cf. Fig. 1) over the video content. Previous work has already showed that shared interactive systems (e.g. tabletops) that facilitate interaction between co-located users can potentially lead to new communication mechanisms [17]. Here, we aim to explore how novel interactive systems (i.e. drones) can be used for geographically distributed users.

**Connectedness beyond Social Bonds** By building an understanding of the living environment of another and

sharing the experience of exploring an area, MaDrone creates a feeling of social connectedness. In addition, actively exploring remote geographic areas supports building an understanding of other living contexts and subsequently fosters connectedness that goes beyond social bonds. It allows connectedness to nature and society, and creates a feeling of 'being there'.

### **Scenario**

Figure 1 illustrates the concept of MaDrone in the form of a storyboard. The storyboard describes communication and negotiation between Lisa and Max, as well as the interaction with a drone located with Max.

Initially, Max invites Lisa to explore the city with him. Lisa is excited about this opportunity. When she accepts the invitation, Max decides to guide Lisa through a nearby park. He instructs the drone to follow him.

Lisa enjoys exploring the park with Max. She follows his tour on her computer screen. Later, she requests to take control over the drone. Max receives her request and accepts it.

Lisa can now steer the drone herself and even focus the camera on scenery that she wants to explore. She could control the drone with her keyboard and mouse, but decides to connect a joystick that she owns. Finally, when Max decides to return home, he instructs MaDrone to return.

### **Discussion and Next Steps**

Adding more users to a shared drone experience produces challenges and opportunities. Future interfaces where multiple users control a drone will need to include the means to negotiate navigation. While past work explored different navigation modes, such as gestural interaction with flying drones and cultural influences on human-drone interaction

techniques [4], these traditionally assume that the drone has a single pilot. In contrast, one of the main challenges that arise from our vision is facilitating a positive experience of the navigation negotiation in a dyad or a group of more than two people.

Another interaction design challenge stemming from our vision is designing for the domestication of drones so that they can become everyday objects, possibly fostering ludic engagement. As users are often overwhelmed with the initial perceived complexity of operating a drone or simply scared of being hit, future designs should enable simplified control so that a variety of audiences can have access to the drone's social features.

### **Conclusion**

In this position paper, we shared our vision of how drones can be used to facilitate social interaction through enabling exploring geographical location together. We showed how shared drone interaction can foster social connectedness between remote users and thus cater to their social needs. We illustrated our vision with a scenario and a storyboard. The concept presented here illustrates a key challenge to Human-Computer Interaction: designing interfaces that enable multiple users to collaboratively use drones for social exploration. Further, our work suggests that drones can become a medium for ludic interaction.

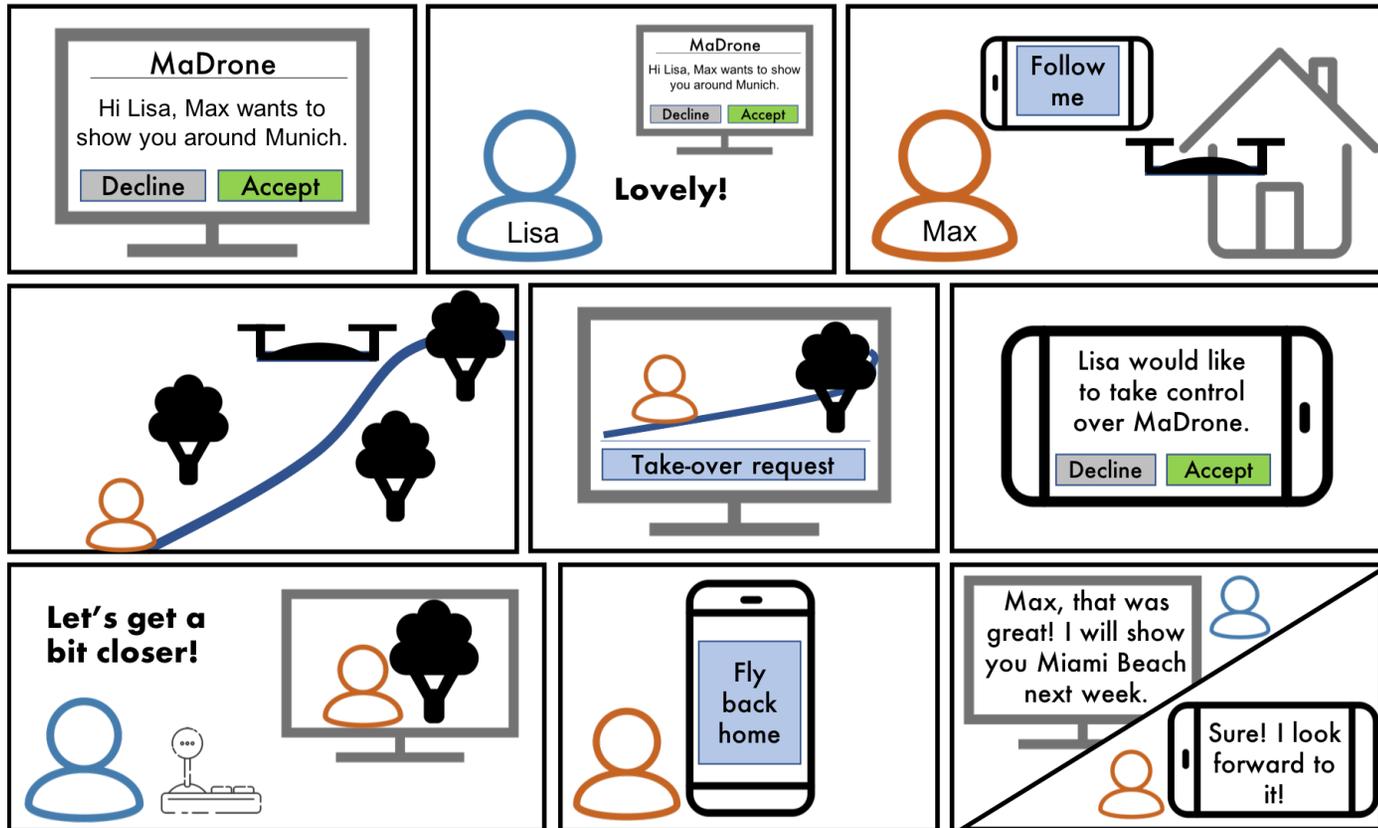


Figure 1: The storyboard illustrates a scenario of how MaDrone can facilitate connectedness across geographic boundaries.

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