Performing the Digital Self: Understanding Location-Based Social Networking, Territory, Space, and Identity in the City

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Expressions of territoriality have been positioned as one of the main reasons users alter their behaviors and perceptions of spatiality and sociality while engaging with location-based social networks (LBSN). Despite the potential for this interplay to further our understanding of LBSN usage in the context of identity, very little work has actually been done toward this. Addressing this gap in the literature is one of the chief aims of the article. Drawing on an original 6-week study with 42 participants utilizing a bespoke LBSN entitled "GeoMoments," our research explores the following: (1) the way that territoriality is linked to self-identity; and (2) how this interplay affects the interactions between users as well as the environments they inhabit. Our findings suggest that participants affirmed their self-identity by selectively posting and claiming ownership of their neighborhood through the LBSN. Here, the locative decisions are made related to risk, hierarchies, and the users' relationship to the area. This practice then led participants to discover and interact with the digital information overlaying their physical environments in a playful manner. These interactions demonstrate the perceived power structures that are facilitated by identity claims over a virtual area. In the main, our results reaffirm that territoriality is a central concept in understanding LBSN use, while also drawing attention to the temporality involved in user-to-user and user-to-place interactions pertaining to physical place mediated by LBSN.

CCS Concepts: • **Human-centered computing** → **User studies**; **Field studies**;

Additional Key Words and Phrases: Location-based social networks, self-identity, self-presentation, impression management, territoriality

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1 INTRODUCTION

Smartphones encompass a number of significant technologies. Two noteworthy integrations include the mobile web and the global position system (GPS). This assimilation has enabled mobile technologies to take advantage of location-based services [82], and engage with what de Souza e Silva refers to as "hybrid space." This "hybrid space" occurs when physical environments are overlaid with digital and location information that can be accessed with suitable mobile devices. Following these developments, social networking sites (SNS) have expanded to encompass locative features, just as location-based social networks (LBSN) have developed into a unique form of SNS in their own right. LBSN allow users to share their physical location with a select group of friends, as well as geo-tagged media content, such as photos, audio, and texts. Key examples of LBSN include Foursquare, Swarm, and Glympse.

The field of locative media has attracted considerable commercial interest, just as it has become the focus of a growing body of scholarly work [21]. As Saker and Evans [75] have previously mapped out, research in the field of LBSN has chiefly focused on the ability of locative applications to coordinate social interactions in space and place [7, 48, 65], leading to a sense of co-presence [12, 62], altering how people approach physical space [63, 66, 82], turning everyday life into a game [23, 39, 46, 67], and reshaping how mobile media is understood [8, 10, 76]. Extant research in this field has therefore tended to focus on the impact of locative media on spatiality.

More recently, however, studies of locative media have extended to other areas. Related studies have examined the more performative aspects of LBSN usage, which can affect understandings of self-identity. In the context of LBSN, self-identity has been helpfully defined as the way individuals choose to present themselves through their locational movements as mediated by LBSNs such as Foursquare [74, 77]. As a corollary to this, and moving beyond LBSN usage to include embedded human traits [48], a similar line of research has emerged that examines notions of human territoriality, and the tendency people have to control a geographic area in order to exert their influence, and to underline and affirm their place in the world [66, 68].

Practices involving human territoriality have been discussed in the context of spatiality and sociality [64], and have been theorized as encompassing performative aspects of LBSN use that are linked with thoughts, behaviors, and perceptions regarding space, mobility, and social interactions [40, 43]. In addition, this interplay has been implicated in the relevant literature as important not only for LBSN but for other types of location-based systems and services. For example, in hybrid reality games (HRGs), such as Pokémon Go, territoriality is an important motivator for game-play (e.g., [65]), while in location-based recommendation systems, such as Foursquare, the importance of territoriality equally relates to practices of consumption [83]. The exploration of the way that territoriality is linked to expressions of self-identity in the context of LBSN in China is done through an original LBSN entitled "GeoMoments" that has been specifically developed to address these concerns.

The main contributions of this article include:

(1) A reaffirmation that territoriality is not only a central concept in understanding LBSN use, but also the following: (1) it is intertwined with the performative nature of user-to-user

and user-to-place interactions, (2) it can prompt the activation of the user contribution to the LBSN and instigate interaction across users, (3) and it can motivate individuals to critically think about space and place.

(2) An understanding that users comprehend expressions of territoriality as being an explicit part of their "self" and as such go to great lengths to defend their territory in LBSN in order to maintain and safeguard their constructed self-identity.

(3) Evidence that the interplay of territoriality and self-identity can cause virtual and physical space to be under constant negotiation and to "spill over" into one another, and that this constant flux not only acts as a nexus for the social structure of LBSN but also affects the users' behaviors and perceptions of spatiality, sociality, and mobility.

In the next section, we provide an overview of literature surrounding LBSN, detailing the works on self-identity and territoriality, and highlighting the first scholarly insights on the potential coupling of these two areas. We then describe our methodology. This begins with a brief introduction to the GeoMoments, and the way it differs from other LBSNs, before continuing with a description of how GeoMoments was used to accommodate the research objectives driving this study. Following this, we illustrate our findings, elaborating on the different ways that self-identity and expressions of territoriality were manifest in participants' use of GeoMoments. Finally, we conclude with a discussion of these findings. This includes a consideration of design implications, limitations of this study, and a brief overview of future research trajectories.

2 RELATED WORK

Similar to the effect of SNSs, extant research has demonstrated that LBSN can assist the development of new forms of identity formation, narration, and identity maintenance [64, 77]. As Saker and Evans [75] have previously noted, studies exploring self-identity and LBSN have emerged in various fields (e.g., human-computer interaction, media studies, urban sociology, and human geography), and have focused on the performative side of marking one's location in the context of impression management [18, 34, 44], self-representation and identity [2, 31], friendship performance [7], and reflection and memory [34, 72, 74]. For the most part, these studies have either drawn on Goffman's division of "front stage" and "back stage" [41] or Butler's concept of performativity [5], as an interpretive methodological lens. Consequently, these studies have tended to focus on the activity and actions of the individual, and only cursorily engaged with issues of spatiality. Nonetheless, they provide the following evidence:

(1) Individuals carefully stage the way they will present their "LBSN self." The self-representation narratives are seen as on-going projects that need to be constantly modified, updated, and safeguarded [18, 44, 75].

(2) LBSN foster the creation of a shared identity in a location. They can also result in homophily, bonding, and trust among those who frequent this location [22, 48].

(3) There is a clear interplay between self-identity, and activity/actions of individuals, and this has the potential to affect behavior, perceptions, and interaction in both virtual and ordinary life [77].

(4) Self-identity narratives and performances through LBSN can affect the polysemic meaning of physical places and have the potential to disrupt hierarchical or hegemonic manners of understanding physical space and place [29].

(5) Individuals use LBSN as "mediated technological objects" to record and recall events and places [42]. The content created through LBSN is also viewed as a series of spatiotemporal images that depict a recent moment in time, which becomes part of the past as soon as it is shared. LBSN can, in this way, shape the present by bringing forth past events (temporal

> and spatial) and project the future through the interactions afforded to the user [74]. This results in LBSN facilitating reflection upon past experiences that have thus been digitally archived [27, 34].

To address the role of spatiality in the context of identity and locative media, Schwatrz and Halegoua introduce the "spatial self" [77] as a theoretical framework that conceptually bridges the presentation of the "self" with geographic traces—both physical and digital—of activity, by enabling the interpretation of "a variety of instances (both online and offline) where individuals document, archive, and display their experience and/or mobility within space and place in order to represent or perform aspects of their identity to others." Related literature also illustrates that in most cases, users articulate their identity through LBSN in places that hold personal meaning to them beyond their physical location [35], eliciting playful antagonistic behavior that manifests in territorial claims [19, 66, 68]. At the same time, this equally demonstrates the importance of questions relating to territoriality in the context of self-identity and locative media. Broadly speaking, human territoriality can be understood as a universal human behavior [24] that attempts to influence something or someone by controlling a geographic area [45]. Territoriality involves securing an area to perform various activities [70], as well as influencing or controlling the access and interactions with this space [51]. In this vein, territoriality co-constitutes social space, while equally implicating the creation of status, self-image, privacy, and intimacy [81]. In other words, the creation and transformation of meanings pertaining to territory establish boundaries for social life, in the form of rules and relationships [4, 80]. In order for territories to remain effective, they need to be constantly produced and reproduced through control, socialized behaviors, norms, and projections of identity [51]. Broadly speaking, human territoriality can be understood as a universal human behavior [24] that attempts to influence something or someone by controlling a geographic area [28, 45, 71]. Territoriality involves securing an area to perform various activities [70], as well as influencing or controlling the access and interactions with this space [51]. In this vein, territoriality co-constitutes social space, while equally implicating the creation of status, self-image, privacy, and intimacy [81]. In other words, the creation and transformation of meanings pertaining to territory establish boundaries for social life, in the form of rules and relationships [4, 80]. In order for territories to remain effective, they need to be constantly produced and reproduced through control, socialized behaviors, norms, and projections of identity [51]. In the context of LBSN and territoriality, locative media can readily shape how an environment is approached and experienced. Drawing on Lofland's understanding of urban public space [57, 58], Humphrey's [48] study of the mobile social application, Dodgeball, for instance, readily demonstrates the parochializing effect LBSN usage can have on how users' experience their surrounding. Here, parochialization is defined as being:

> the process by which people share socio–locational information with one another through communication technologies such as check–ins on mobile social networks, such that the public realm, where people had previously encountered strangers, starts to feel more familiar due to the social exchanges through the network. Places that would have felt public could be experienced as parochial because mobile social network users were socially connected to others in the space [47].

Developing this position in the context of more recent LBSN, Fazel et al. [36] argued that mobile social networks can serve as a platform where one's territorial relationship with places can be negotiated through both physical and social interactions with others. This is symptomatic of LBSN offering more social reach and authority in making territoriality legible than a single person could through everyday physical practice within a space. Of particular interest to this research are the

findings relating to person-to-place parochialization. Fazel et al. [36] reasoned that the ability for users to make virtual claims on physical spaces by "checking in" and the way the interface of Foursquare communicates that there is a competition over territories can produce territorial practices and defense of these places as "home territories." In accordance with this, Saker and Evans [75] have similarly suggested Foursquare can facilitate a form of playful parochialization, where the locative play of this LBSN can serve as a motivator for users to spend more time engaging with their physical environment, just as the playful mechanisms of badges and points can push users, or "players," as they refer to them, to visit areas they otherwise would not, while the mayorhship mechanic can remind users of the environments and spaces they frequently visit. In other words, and specifically regarding this latter point, this playful parochialization underlines the interplay between territoriality and self-identity in the context of LBSN, which is the overarching concern of this research. These playful parochializing relationships that are facilitated by the interplay of territoriality with the performative aspects of LBSN not only influence the mobility of users and the way users perceive space and place through LBSN, but also produce various behaviors. These behaviors include, individuals increasing the patronage in establishments within the area they perceive themselves as controlling in LBSN [83], or individuals claiming physical areas in HRGs like Pokémon Go, for instance, and actively trying to prohibit others from visiting them and playing the game there [66]. This illustrates that territorial relationships are constantly negotiated through social and physical interactions and are made "legible" to others through everyday practice, action, and negotiation [3, 38]. Montgomery [61] defines legibility as

> "the degree to which the different elements of the city (defined as paths, edges, districts, nodes and landmarks) are organized into a coherent and recognizable pattern". "This recognizable pattern is important for all places within a city, and one of the uses of location-aware mobile technologies is to make those patterns more visible and easier to navigate."

As such, the "relevance of legibility lies primarily in the way that digital technologies can render the everyday world legible in new ways" by "making the invisible visible" [18]. Brewer and Dourish [3] note that the legibility of "ordinary" spaces are perceived as "conveying particular sorts of messages," and they argue that the hybrid space as facilitated by the LBSN can increase the legibility of spaces because they can reveal new messages, patterns, and types of knowledge about an environment. As LBSN facilitate these negotiations, it becomes clear that Slater's [54] conceptualization of "you are what you type," which he used to signify the sense of a person's online performance and identity in SNS, in an LBSN context can be re-interpreted as "you are where you check-in." As Humphreys concurringly asserts, this practice normalizes territorial claims:

> While they (LBSN) are limited in the population they reach [...] in some ways they offer more reach and authority in making territoriality legible than a single person could through everyday physical practice in a space. By making claims over a particular geographic area one does not have to actually exert control over others, but by socially demarcating one's connection to a place, one ostensibly normalizes the activities, resources, etc., which represent the potentialities for power within that area [48].

In the context of more recent locative media, individuals not only use these technologies to assert meaning on spaces through practice (that is their actual movement and activities within space), but also by making territorial claims on space they "do not own" and are owned by "others" in order to perform an identity to their perceived audience [66]. Additionally, the manner in which certain locations or activities are annotated and communicated are performative and are part of

an ongoing negotiation and presentation of identity that is both directed at their friends but is also part of a conscious effort to control and curate a narrative of identity that is stable, affirms the users' self-identity, and presents this "self" on the users' terms with regard to location [68, 75]. This often creates playfully antagonistic behavior when one's territorial claim is seen as illegitimate and has significant interactions with the identity an individual is trying to guard via the antagonistic behavior expressed through territorial claims [48, 66, 68]. In sum, then, this literature overview presented above illustrates that territoriality is closely related to the performative aspects of LBSN use relating to identity and can be considered one of the main incendiaries for affecting the users' behaviors and perceptions concerning spatiality, sociality, and mobility. That being said, the underlying structures of the interplay of territoriality, user behaviors and perceptions, and the performative aspects of LBSN use (such as the notion of self-identity) are quite nebulous. This is due to only a handful of studies explicitly exploring this issue and the majority of studies that touch upon it either (1) focus on the topic implicitly and theorize about the interplay based on broad observations/understandings, while only superficially touching upon the performative aspects of territoriality and the relations it has with sociality, spatiality, mobility, and so on (e.g., [51]), or (2) reduce the complex nature of the performative aspects associated with territoriality and self-identity to a handful of measures and behavior descriptors while overlooking the rich tapestry of interactions that relate to these (e.g., [63]). Given the centrality of territoriality and self-identity in LBSN, further analysis is required, as exploring this facet of LBSN might advance our understanding of LBSN use and how locative media can affect users' perceptions and behaviors in physical space. To address this gap in the literature, this study is driven by the following interests: (1) the way that territoriality is linked to expressions of self-identity in the context of LBSN, and (2) how this affects the interactions between users as well as space and place.

3 METHODOLOGY

3.1 Design Process

To achieve the various goals set forth in this study, we chose to design, develop, and implement an LBSN entitled GeoMoments. The reasoning behind developing a bespoke LBSN from scratch (rather than using existing ones) is threefold. (1) Our study takes place in a large urban center of China. Mainstream LBSN (e.g., FourSquare and Swarm) and the mapping services associated with these (e.g., Google maps) are mostly unavailable or limited in this region. (2) Using a custom-made application means it is possible to have full control over all the design and LBSN variables that need to be gathered. Not only does this set our study apart from extant research on LBSN, but it also means we can adapt and modify this LBSN in accordance with the findings of our study for future projects. (3) Working with an LBSN other than Foursquare enables the pluralization of the LBSN literature and helps minimize potential bias stemming from the use of a single application.

To make GeoMoments as user-friendly as possible, we drew from design trends and concepts already popular in other SNSs in China, such as Weixin (WeChat[1]) and Shina Weibo.[2] The resulting interface is therefore familiar in terms of look and feel, and interaction is intuitive for those familiar with the aforementioned social networking platforms. See Figure 1 for screenshots of GeoMoments.

The following list outlines the core functionality of GeoMoments:

(1) Creation of "moments" through geo-tagging of text and images—with the ability to delete or edit them.
(2) Creation of a user profile with a picture and other personal information.

[1] https://weixin.qq.com.
[2] https://www.weibo.com.

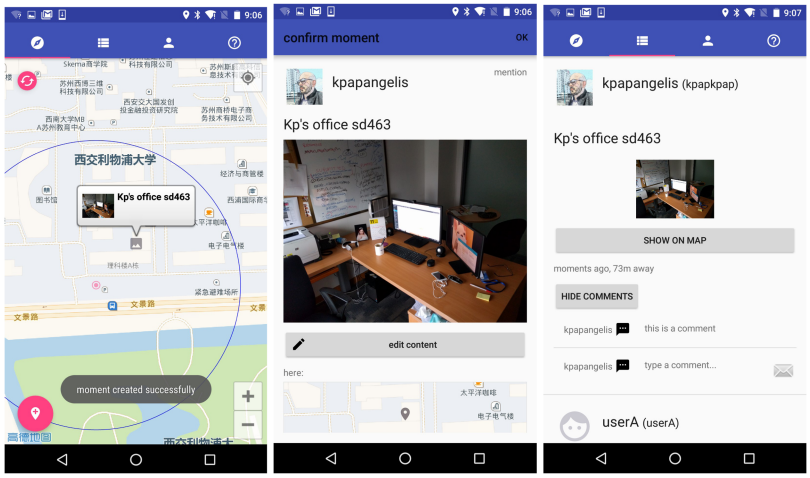

Fig. 1. The GeoMoments app interface allows users to add "moments" and interact with other users. The design of the app draws from popular social networks to lower the app's learning curve.

(3) Friend list with the ability to add or remove friends.
(4) Comment system that enables threaded interactions with other users.
(5) "Mention" system that enables users to "tag" other users in moments and comments.
(6) Notification mechanism that informs the users for comments, mentions, tags, and updates to moments from friends.

The design affordances of GeoMoments are analogous to those of Foursquare. GeoMoments enables interactions both in the wild and in specific locations and is predicated on hybrid space. Put differently, the user experience depends not only on the events on the screen but also on the players' position in the physical world. This enables a space of actions that encompasses not only what the participants can be involved in but also what they act on as they "do the city" in their everyday lives.

Throughout the development of GeoMoments, we carried out a series of extensive tests in a controlled laboratory environment. Each component of GeoMoments was tested individually and with respect to other components. After testing GeoMoments in the laboratory, we recruited 20 individuals to test the performance, and stability of our LBSN in a multi-user scenario, using different devices over a period of 4 weeks. Throughout this phase, participants were in close contact with us and reported issues that we were able to address as and when they emerged. It should be mentioned that since GeoMoments was developed as a technological probe and not as a commercial product, we did not take into consideration usage scenarios that are not in the scope of the main functionality of GeoMoments. For example, we did not test or optimize GeoMoments for high data loads, high movement speeds of users, or GPS tracking complications caused by buildings or other environmental disturbances. These in the wild tests helped us improve the stability and performance of GeoMoments by uncovering several problems. Similarly, these tests enabled us to elicit some initial information about how users engage with GeoMoments, make territorial claims, and interact with others, as well as space and place.

Following the testing phase, we conducted extensive discussions with the participants in an informal setting and critically evaluated the performance of GeoMoments. Following these discussions, we reworked GeoMoments, and shortly thereafter we released an updated version. The new version included a series of design changes and bug fixes. The bug fixes aimed on

improving usability, stability, and to the functionality of the front-end and back-end services. The design changes primarily aimed to encourage territoriality through playful-antagonistic behavior so as to facilitate the present study. This was because during our 4-week testing period we only saw a handful of strong expressions of territoriality. It is our belief that this was due to (1) GeoMoments focusing more on the interactions between individuals in space, and not on interaction of individuals and space, (2) and because it lacked mechanics that promote antagonistic people-place interactions such as the mayorship function of FourSquare, where users who check-in to a location more than other users over a 60-day period become the "mayor" of that space. Based on (1) discussions with the 20 participants of the testing phase, (2) discussions with three experts in LBSN, (3) and drawing insights from the related literature and our previous work exploring territoriality as a driver for gameplay in HRGs, we did a series of changes to GeoMoments with the intent to promote territoriality. The following list outlines the design changes in the core functionality of GeoMoments to facilitate the present study:

(1) *Removal of friend list* as during the testing phase the discussions with the participants echoed the results of previous studies [9, 15, 16, 66, 68], which illustrated that the interactions of individuals that are "friends" are less antagonistic than the ones that were not friends. This is also been observed to varying degrees in the literature as friendships in social media result in bonding and less antagonism [50].
(2) *Limiting the users' ability to see and interact with moments and other users only to 500 m from their physical locations* as our previous studies [48, 55] showcased that individuals that were physically present in a particular when posting moments or interacting with others were more "bonded" and involved with that particular area rather than posting from far away. It should be mentioned that is also evident in the literature as a large number of studies report that individuals bond and form attachments with areas in LBSN and this oftentimes elicits strong territorial behaviors [36, 48].
(3) *Adding the ability for users to "claim" an area with moments.* This mechanic is very similar to mayorships in Foursquare but instead of check-in into an area often in GeoMoments users "claim" areas by (1) the number of interactions (comments, likes, clicks, etc.) that other users have with their moments in an area; or by (2) the number of moments a user has in an area. Moments in the "claimed" area of the user appear as a thumbnail and hence are more prevalent in the map while all the other moments appear as pictograms. This design change was done primarily because it was discussed by the participants in the testing phase, secondarily because individuals in both our previous studies [66, 68, 69] expressed high territoriality behavior if another user had moments with high number of interactions from other users or high number of moments in their "claimed area," and tertiary because it is documented in the literature that similar mechanics elicit territorial behavior in LBSN (e.g., [48]).

Once we implemented these changes in GeoMoments we conducted a 2-week testing study with 15 new participants in order to ensure that the changes undertaken promoted territoriality. It should be noted that aside from the aforementioned changes this time we made sure that the participants we chose all lived and worked within 5 km of each other. This was done to facilitate more interactions between the users.

After the end of the 2-week testing period, we conducted two focus groups with the participants to discuss how they interacted with space, place, and other individuals through GeoMoments. During the focus groups, we show to the participants their posts spatially arranged and discussed with them how they went about and interacted with space and other users. In brief, this second test study revealed a completely different usage behavior than the previous one with territorial

behavior being more prominent. The observations of this testing phase were in line with other studies that have explored territoriality in LBSN—e.g., users were engaging in playful spatial antagonism (e.g., [48]), were more aware of the dynamics of space both in the virtual and in the real world [37], and created "home territories" and "defended them" [66].

Before concluding this subsection, it is worth mentioning that although in many respects the final design of GeoMoments is analogous to other LBSN, such as FourSquare. This is due, in part to the materiality of the designed affordances of LBSN such as GeoMoments being created through social processes and interpreted and used in social contexts. The social nature of this materiality is influenced and shaped by the designed affordances of LBSN. The behavior of the users of LBSN is believed to be shaped by the mechanics and design of the LBSN in question and the social affordances it provides. That is to not to say that different mechanics and designs in different LBSN will result in completely different behaviors, but rather that the mechanics and designs play an active role in "heightening" or "quietening" certain behaviors. In order to achieve the goals set forth in this study, as previously discussed, we designed the mechanics and affordances of GeoMoments to "amplify" the playful antagonism and territoriality expressed by the participants. This may have caused some findings to be more prominent than others. For example, the design changes which were aimed at encouraging "playful antagonistic behavior" and "territoriality" may have elicited stronger expressions of territoriality than we would have otherwise observed if we had implemented different design affordances. Similarly, these changes may have "quietened" the expression of other behaviors—e.g., collaboration. Modifying the design to elicit a specific behavior in order to study aligns with the relevant literature on the topic, and is a common practice when one explores multidimensional phenomena, such as performativity and self-identity [1, 6, 85]. In line with other literature in the area and to explore the topic at hand, our analysis focuses on the "lived experiences" of the participants rather than the cause–effect relationships of the designed affordances of GeoMoments on the behavior of the participants. With respect to this, and our study sharing a lot of characteristics with other similar studies on the topic (e.g., methodological framework, interpretative lens, and so on—see Section 3.3 on page 11 for more information) and directly building on top of a substantial body of work (e.g., [48, 75]), this work should be viewed as part of a much bigger discourse on performativity and LBSN, and as such, should not be interpreted in a vacuum in relation to the design of GeoMoments, but rather in parallel with existing discourses, literature, and understandings.

3.2 Deployment

Following the development and testing of the new version of GeoMoments, a study involving a total of 42 students (20 males and 22 females, with an average age of 27 years) was conducted over the course of 6 weeks. The study took place in the Suzhou Industrial Park[3] (SIP) area in the city of Suzhou in the province of Jiangsu, China. The participants were recruited through flyers we handed out at the campus of the Xi'an Jiaotong-Liverpool University (XJTLU). The participants were offered 150 CNY (approximately 22 USD) in Taobao vouchers to participate in the study. As soon as individuals expressed interest we conducted a short pre-screening discussion with them to ensure that their phone met the technical requirements of GeoMoments (e.g., correct version of Android, over 2 GB phone memory, were enrolled into a mobile plan with adequate data), and that they understood what was required from them and the terms of the study. Also, to ensure that

[3]Even though the area we conducted the study is called "Suzhou Industrial Park" it is not an Industrial Park. It is a high density residential/office zoning district with population of 2,000,000 that includes a mix of multifamily residential buildings, office space, educational establishments, several small shopping districts, and seven malls. You can find more information about SIP here: http://www.sipac.gov.cn/english/.

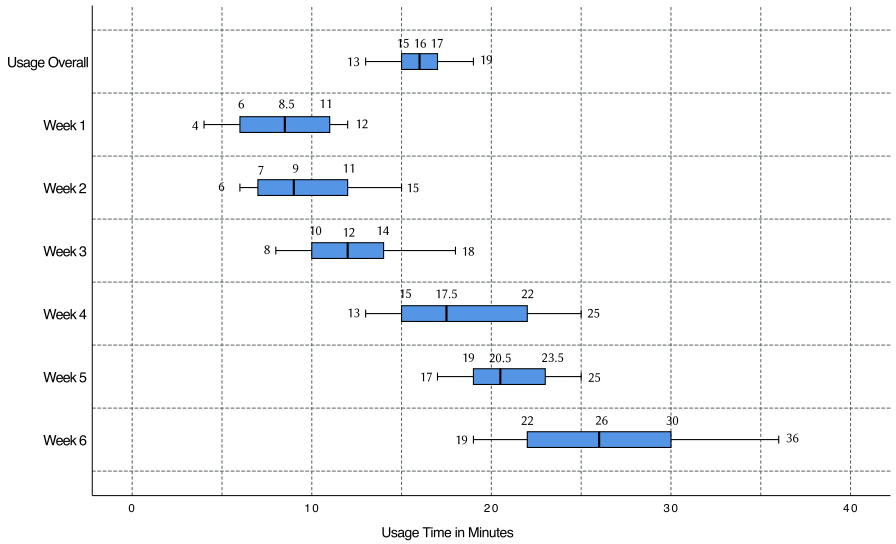

Fig. 2. Participants' usage of GeoMoments.

participants did not know each other or the researchers during the pre-screen discussion we asked them "if they know anyone else that was participating in the study" and "if they know anyone from the research team." Once we had 60 expressions of interests, we formed a candidate cohort that included participants that answered "no" to both questions. After cross-referencing the collected pre-screen information we formed the final cohort, which included 42 students. All participants were students of XJTLU, living relatively close to each other, and spent a substantial amount of their day at the SIP area near the campus.

The participants interacted with GeoMoments 15 to 20 times a day. We had no inactive participants or dropouts in our study. On average throughout the study the participants spent 16 minutes every day on GeoMoments—22 out of 42 participants used GeoMoments more than 16 minutes per day (group A), and 20 out of 42 participants used GeoMoments less than 16 minutes a day (group B). Overall, group A used the GeoMoments on average 13% more than group B. See Figure 2 for an illustration summarizing the total usage of GeoMoments of GeoMoments on a week by week basis.

In total, the participants created 380 pictorial posts, 202 textual posts and interacted 1,876 times with other users via 656 comments, 309 likes, 310 mentions, and 601 profile visits. In 178/2458 (7.2%) of the total number of interactions occurred in week 1, 369/2458 (15%) in week 2, 371/2458 in week 3 (15%), 498/2458 in week 4 (20.2%), 491/2458 (19.9%) in week 5, and 578/2458 (23.5%) in week 6. Such a distribution of interactions is normal and on par with similar studies that involve deployment of technologies in the wild (e.g., [14, 16, 49]). See Table 1 for the engagement of the two groups' with the functions of GeoMoments on a weekly basis.

The participants from group A accounted for 66% of all interactions. In particular group A posted more pictorial (62%) and textual moments (67%) than group B, commented more (60%), as well as mentioned more others (67%), liked more posts (65%), and did more profile visits (70%) than group B. On the other hand, the participants in group B accounted for 38% of all the interactions. They posted less pictorial (38%), and textual moments (33%), commented and liked posts less (40%; 35%), and neither mentioned others in their posts as often as group A (33%) nor visited the profiles of others that much (30%). On average, the participants from group A did 39.5 pictorial posts, 22.5

Table 1. Participants' Interactions with the Functions of GeoMoments on a Week-by-Week Basis

	Pictorial Moments	Textual Moments	Comments	Likes	Mentions	Profile Visits
Week 1	27 (17A/10B)	28 (19A/9B)	80 (48A/32B)	16 (10A/6B)	2 (1A/1B)	25 (18A/8B)
Week 2	56 (35A/21B)	33 (22A/11B)	94 (56A/38B)	53 (34A/19B)	8 (5A/3B)	98 (69A/29B)
Week 3	63 (39A/24B)	29 (19A/10B)	112 (67A/45B)	30 (20A/11B)	35 (23A/12B)	102 (71A/31B)
Week 4	69 (43A/26B)	39 (26A/13B)	125 (75A/50B)	63 (41A/22B)	80 (54A/26B)	122 (85A/37B)
Week 5	72 (45A/27B)	33 (22A/11B)	115 (69A/46B)	63 (41A/22B)	95 (64A/31B)	113 (79A/34B)
Week 6	93 (58A/35B)	40 (27A/13B)	130 (78A/52B)	84 (55A/29B)	90 (60A/30B)	141 (99A/42B)
Total	380 (236A/144B)	202 (135A/67B)	656 (394A/262B)	309 (201A/108B)	310 (208A/102B)	601 (421A/180B)

Please note that A and B in the table refer to the group A and group B respectively.

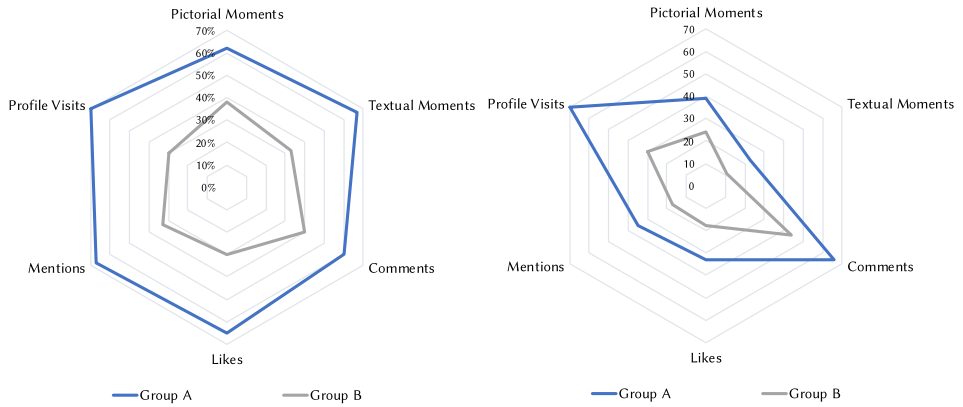

Fig. 3. Left—The two group's percentage of usage of the different functions of GeoMoments. Right—average use of each function of GeoMoments of the participants of the two groups.

textual posts, 66.5 comments, 34.5 likes, 33.5 mentions, and 70.6 profile visits. Each participant from group B did on average 23.8 pictorial posts, 11.1 textual posts, 43.8 comments, 17.1 likes, 18.1 mentions, and 30.1 profile visits. See Figure 3 left for the group A's and group B's percentage of usage of the different functions of GeoMoments, and Figure 3 right for the average usage of the functions of GeoMoments of the two groups.

3.3 Data Analysis

As is evident from Figure 3, there are differences in the use of the functions between the two groups. With an independent sample *t*-test analysis, we found that the functions of the two groups used differently are as follows: pictorial moments (t10 = 2.673, $p = 0.025$, Cohen's d = 1.40), textual moments (t10 = 7.119, $p < 0.000$, Cohen's d = 4.58), comments (t10 = 3.931, $p = 0.003$, Cohen's d = 2.24), and profile visits (t10 = 3.172, $p = 0.011$, Cohen's d = 1.44). The functions that the two groups used in the same manner are as follows: likes (t10 = 1.524, $p = 0.169$, Cohen's d = 1.19), and mentions (t10 = 1.350, $p = 0.053$, Cohen's d = 0.77). In light of this, and similar to other studies in the field that utilize a comparable approach (e.g., [49]), we did not consider the participants as one homogeneous group but as two distinct groups based on average usage in our analysis.

With this in mind, we then proceeded to interview the participants of the two groups using a semi-structured approach. The interviews lasted roughly 45 minutes. Questions guiding these interviews included (1) how participants used GeoMoments; (2) the persona they projected to other users; (3) impression management; (4) issues around the interplay of self-presentation, identity

and territoriality; (5) serendipitous, ad-hoc and playful antagonistic interactions; (6) reflection and memory; (7) territorial strategies; (8) expressions of self and social norms; (9) legibility of spatial claims and public places; (10) implicit and explicit expressions of territoriality; (11) and people-place attitudes/relationships. During interviews we used both "objective data" (data that are generated by the participants and are objective in nature and easy quantified; e.g., usage statistics, frequency of interactions), and "digital data" (user-generated data that have more than one meaning and are not easily quantified, e.g., pictorial and textual moments, interactions with others through likes and comments) as probes in an ad-hoc fashion. Our approach was similar to what MacCracken calls "auto-driving" and, for the most part, aimed to evoke important moments, people, places, things, and events and clarify vague or ambiguous answers or when we wanted more specific or in-depth information about a particular situation [59]. In particular we had at hand the following to show to participants if required during the interviews: (1) the participants' posting history and GPS traces against the posting history and GPS traces of other participants, (2) their pictorial and textual moments, (3) usage statistics (including how long they used GeoMoments, how many moments they posted, and how often they interacted with others through comments, likes, etc.), (4) the moments they commented, liked, and so on, and (5) the participants they mentioned or visited their profiles. All interviews were thematically analyzed. Our analysis was grounded on Goffman's theatrical metaphor of "front stage" and "back stage" and as such we considered all externalized interactions through GeoMoments (e.g., history of activity, narrative through pictorial, and textual posts) dramaturgical actions that are designed to be seen by others and to improve one's public self-image. Also, to make a parallel between the users' dramaturgical actions in both the spatial and temporal dimension and relate our results to the relevant literature we do the following:

(1) Utilized the "spatial self" and as such defined "moments" as a device of self-presentation and account activity [77].
(2) Conceptualized the locations marked by user moments in a chronologically recursive fashion, in order to reinforce the spatial and temporal dimensions that contribute to the reflective narrative and performances of a person's self-identity [34].
(3) Acknowledged GeoMoments as durational objects of "mediated memory" and treated user-generated moments as interconnected points of reference that can shape the present by bringing forward past events and project to the future [27, 33].
(4) Considered solely owned territories in the hybrid space, and per the literature we considered this manifestation of territoriality as an attempt "to influence something or someone by controlling a geographic area through the production of social space" [28, 45, 71], and acknowledged territorial strategies.
(5) Took into account that the designed affordances of GeoMoments may have affected the contextual and relational factors that shape, change, and organize the behavior of the participants in our study. As such and in line with the literature [6], our analysis focused on the "lived experiences" of the participants rather than the cause–effect relationships of the designed affordances of GeoMoments on the behavior of the participants.

The analysis of the data involved the following key stages: (1) familiarization of the data; (2) developing a thematic framework; and (3) coding of the data. In the familiarization phase, we transcribed all interview data. This was followed by the creation of an initial thematic framework based on *a priori* issues as described in the related literature, and from topics that surfaced during the familiarization phase. After this, the data were independently coded by four researchers. During the coding stage, we used exact quotes from the participants to inductively identify potential themes and patterns within the data and collated all the relevant coded data extracts within the identified themes.

To examine the inter-coder agreement of the four coders we used Cohen's κ index. Cohen's κ index was first calculated and then the κ coefficient across the coder pairs using average P(e) values were calculated as well (Cohen, 1990). The agreement between the independent coders was good. Cohen's $\kappa(m) = 0.788$ (with 95% confidence intervals 0.104 to 0.232) and $p < 0.0005$. According to Landis and Koch [52], $0.7<\kappa<0.8$ represents a good strength of agreement, and the confidence interval indicates that the coding is reliable, non-random, and in line with previously published inter-coder reliability estimates obtained from coding similar constructs. Furthermore, the marginal distributions of coding did not indicate prevalence or bias problems, suggesting that Cohen's κ was an appropriate index of inter-coder analysis [32].

Once the coding phase was concluded, we further refined our initial thematic framework by (1) using the varying agreement rates in individual constructs to identify and resolve issues (e.g., low agreement rates, for instance, indicated that respective codes were defined too broadly and would need clarification), and by (2) collectively reviewing the coded data extracts, and revisiting the whole dataset. This process was undertaken to not only iron-out disagreements, but also to ascertain whether the themes "worked" in relation to the dataset, and whether any additional data within themes had been missed in earlier coding stages. Once we were confident that our thematic framework fitted our dataset, and we are able to tell a coherent story, we concluded the analysis process.

Finally, rather than taking a purely theoretical position, our research adopts a more experience-centered design to highlight the lived experience of the individuals using GeoMoments; we took the location-based technologies at our disposal out of the lab and into the wild to fully comprehend the trends and reasoning behind the use of such a system in a natural setting and understand more about the fabric of self-identity, sociality, and spatiality in relation to GeoMoments [11, 17].

4 FINDINGS

4.1 Participants Affirmed Their Self-Identity Through Selective Content Posting

During the first few days of the study, only 15 moments were posted. However, this not lasted long as soon enough participants from both groups (24/42; 13/22 group A and 11/20 from group B) soon began posting more moments. Initially, the majority of moments were clustered near each other (e.g., their neighborhood) and were very similar in content. This began to change after approximately 2 weeks of usage, when participants started posting moments outside these initial clusters. Gina and Jim said the following after being shown their early posts and GPS traces against the aggregated posting activity and GPS traces of other participants:

> When I saw that others were posting moments near the University, Linkcity mall, the lake [...] I did the same. But after I saw other liking my posts I didn't want to post there anymore [...] as these are places I go to out of necessity and to be honest I don't want to be seen there [laughs] so I decided to post elsewhere [...] in places where I go often and are cool, so if others happen to see my posts they will say 'oh wow she hangouts here' (Gina).

> I was unsure about what to post [...] Once I saw that others liked my photos – and noticing that others was using GeoMoments. I wanted to post things in places that make me appear cool (Jim).

As this opening extract attests, after Jim and Gina noticed that a conceivable audience was using GeoMoments, and would therefore potentially witness their posts, an ongoing negotiation and presentation of identity was initiated. This was both directed toward other users and was also part of an effort to control and curate a narrative of identity that potentially affirmed their

self-identity, as well as their relationship to locations. Saker [73] has previously described this process as "the affirmation of identity through the potential of surveillance," which is supported by our research.

4.2 Locals Claimed Ownership of Their Virtual Neighborhood

During the course of this study, we also observed that the majority of individuals (32/42; 15/22 from group A and 17/20 from group B) posted moments in certain areas and avoided others. When we inquired about these posting patterns it emerged that participants were posting moments mainly in areas they had parochial ties with (especially around their homes), or areas that they perceived as being of high value (e.g., malls) to others and avoided posting moments in or "claiming" areas that would make them "seem uncool." When we probed them as to why they were doing so, participants from both groups (23/42; 13/22 from group A and 10/21 from group B) mentioned that they were claiming areas to make sure "everyone knew that they were locals in this area" and "obviously you would not claim an area that it would make you look like you were a local to a bad, crappy, or (swearing redacted) area." Jess and Rick said the following after being shown their pictorial and textual moments spatially arranged, and asked to comment on their posting activity:

> I chose to post a lot of moments around the area near my house and Linkcity mall. I posted a lot of interesting things around the area my house is as I want to show to others that I am here. [...] To be honest I don't want others coming in posting their food or pets. [...] but I posted a lot around the Linkcity mall [...] to look cool to others. I mean if you post a lot in an area others see you as local. Being local at the mall is big deal. [...] you show to others that you are regular at a cool place (Jess).

> I will post in near my house, and near the Linkcity mall but I would avoid posting from Mudu (an area in the city) as it is simply not cool to be there. I don't want to advertise to everyone that I go there by leaving a moment there (Rick).

These extracts illustrate that (1) some participants understood their connection to certain places as observed by other users in GeoMoments as being representative of a certain lifestyle and; (2) that the moments they post are seen as part of an ongoing narrative of the self. It should be noted that almost all participants (38/42; 20/22 from group A and 18/20 from group B) used the terms "local" and "claim" extensively when discussing an area. This conceptualization is quite interesting as it insinuates relationship with and ownership of an area through the moments posted. This created friction, and often participants were competing over who would post the most moments to claim an area. The content of these moments varied and included informative posts (e.g., the bus stop has moved), and selfies. When someone threatened a "claimed" area, one of the principles that prompted a defense of that area was whether the claimer was perceived as having a legitimate claim on the place in question. As Jesse explains after she is being shown her moments arranged in a spatial timeline:

> I used to have the most moments around the Linkcity mall [...] in restaurants, Starbucks etc. Everyone knew I was local. Now Kate came here and started posting moments. She didn't have a single post before. Now she has 12 and I have 21. She thinks that she is better than me. [...] to be honest I got so pissed off that I tried to find her on WeChat to tell her to stop doing so [...] I think she knew that we were in a war – a war for the mall [laughs] (Jesse).

Such behavior was evident among the majority of participants (35/42) from both groups (18/22 from group A and 17/20 from group B) when someone challenged their ownership by posting moments in their claimed area. This finding supports Lofland's [57] suggestion that defending a territory is one of the principles of stranger interaction, and aligns with his understanding that "people become familiar with one another because they share a similar routine where they occupy the same place at the same time. The difference in this instance is that Foursquare allows for these types of relationships to develop around public places, but the interactions are not predicated on temporal co-location" [47]. It should be mentioned that throughout our study, different participants expressed these territorial claims differently. For example, some were posting pictorial and textual moments and passively claiming space while others were more aggressively confronting "invaders" by messaging them. That being said all individuals (42/42) did express some form of territoriality in relationship to their self-identity through the praxis of GeoMoments. Significantly, highly contested places were often where (1) individuals had parochial ties with (these were usually the places near their work or home); (2) claims made by others were seen as illegitimate; (3) the majority of users perceived this area as being of high value to "own" to other users; and (4) considered home "territories" by more than one user. That said, it should be underlined here that while such interactions were often antagonistic, this antagonism was implicitly playful.

4.3 Status and Post Usefulness Matter When Claiming an Area

When someone threatened a "claimed" area, one of the principles that prompted a defence of that area is whether the claimer was perceived as having a legitimate claim on the place. Jesse states the following after being shown who "attacked" her and who she "attacked" throughout our study:

> I used to have the most moments around the Linkcity mall [...] in restaurants, Starbucks etc. Everyone knew I was local. Now Korra came here and started posting moments. She didn't have a single post before. Now she has 12 and I have 21. She thinks that she is better than me (Jesse).

Such a behavior was evident among most participants (35/42; 17/22 from group A, and 18/20 from group B) when someone challenged their "ownership" by posting moments in their "claimed" area, with the degree of concern seemingly increasing the longer users had engaged with the LBSN. In some cases, it led to individuals taking extreme measures, for example, a participant posted a selfie holding a piece of paper and claiming an area and declaring it a "no moments zone" for anyone else except himself. Places that were highly contested were often places where the others' claims were seen as illegitimate or were perceived by the majority of users as being of high value to "own" in the eyes of other users. For example, a participant described how another participant "came and stole my post and my area. [...] I wrote about the bus stop not working. Why has he stared posting his selfies here? Obviously, I post important things and he does not." Several participants mentioned similar things especially with regard to moments containing locational information that was deemed useful. This illustrates that a subset of the participants perceived hierarchy over an area not only based on the parochial ties with that area, or the perceived value of the area to others, but also on the usefulness of the information one provided through their claims on an area. It should be noted that 33 out of 42 participants (18 from group A and 15 from group B) used the word "steal" when talking about other users "taking" their area from them. This speaks to the perceived legitimacy of someone's claim to a particular place, that it confers value, worthy of theft, and suggests the stealing of a hierarchical position from which one can make a claim over a place. This resonates with Guha and Birnhotlz's [1] proposal that the visibility of check-ins in Foursquare can lead to tension.

4.4 Decisions Regarding Expressions of Territoriality Were Made in Relation to Perceived Risk and Hierarchy

When making decisions about which territories were going to be claimed, our study found that all participants (42/42) judged the risk of being "attacked" based on the anticipated frequency of other users visiting these places. Participants applied this strategy over all places they were claiming and only breached it for one purpose: the defense and demonstration of power in the user's "home territory." Interestingly, the idea of a "home territory" is not a fixed concept in GeoMoments. There is no difference between territories, and there is no particular role for a territory as "home territory" or "home base." Nonetheless, almost all participants from both groups (38/42; 20/22 from group A and 18/20 from group B) used these spatial expressions to describe the territories they claimed in the places where they live. Importantly, then, the idea of a "home territory" was created by participants using GeoMoments during our study. This makes it all the more noteworthy to find that all participants expressed a desire to claim their "home territory" and to keep control of it, even in the knowledge that this would not grant them any specific gamic advantage over other participants. In these instances, then, while participants were not necessarily rewarded in the gamic space of GeoMoments, the act of digitally inscribing the physical spaces they commonly frequented served to affirm their "local" status, and thus underline the authenticity of their spatial self. Almost all participants from both groups (40/42; 21/22 from group A and 19/20 from group B) reported they had claimed the area around the place where they lived (dormitory or apartment) or tried to claim other users' territory in the same place (if lived nearby) to claim the territory for themselves. Moving forward, the content of moments was also deemed to be important in the context of which participants had the right to post moments in this or that area. For example, one participant described how another participant "came and stole my post and area. [...] I wrote about the bus stop not working. Why he had start posting his selfies here? Obviously, I post important things and he is not." This illustrates that a substantial subset of participants (34/42; 19/22 from group A and 15/20 from group B) perceived hierarchy over an area not only based on parochial ties with an area or the perceived value of the area to others, or whether an area was a "home territory," but also on the usefulness of the information being providing. In this vein, for some participants, users providing high quality spatially contextual information were seen as having more legitimacy over an area than other individuals who simply chose to post selfies. Interestingly, some participants (29/42; 14/22 from group A and 15/20 from group B) used the word "steal" when talking about other users "taking" their area from them. This suggests that it speaks to the perceived legitimacy of someone's claim to a particular place, that it confers value, worthy of theft, and that it suggests the stealing of a hierarchical position from which one can make a claim over a place.

4.5 Areas Lacking Posts Became Undesirable Irrespective of Physical Location

Our study also found that some participants' (25/42; 13/22 from group A and 12/20 from group B) desire to "claim" certain areas extended beyond perceptions of their identity and the relationship of these identities to a specific environment, to include the popularity of an area as represented through the volume of archived moments. Unclaimed areas were accordingly perceived as being conceptually empty, and after a certain time, participants became less interested in claiming these sites. As Boris explains after being shown his posting history:

> At the beginning I posted a lot near Jinji avenue as I thought that it would be a place that everyone will want to post so I thought better start early during the testing phase of GeoMoments to have a headstart. However, I quickly gave up as no one was posting there. I even deleted my moments. [...] If no one is posting moments, why should I? I only did it because I thought other would do so! (Boris).

Territoriality in LBSN not only helps create parochial relationships with space and place [48] but also negatively communicates which environments lack sociability, and should, therefore, be avoided. In much the same way as a busy restaurant appears more desirable to passing patrons than an empty diner, for the majority of our participants, the volume of accrued moments was seemingly understood as being representative of the validity of a particular place. However, it would be wrong to assume that this practice simply implicates a communal desire by participants to align themselves with sought after sites because these environments were, on the surface at least, more esteemed. In these instances, the majority of participants (35/42; 17/22 from group A and 18/20 from group B) were chiefly interested in claiming areas that were digitally active, because this meant there was a higher likelihood their posts would be witnessed by other users, and thus a higher likelihood that their sense of self might be affirmed. For these participants, there was little value in engaging with areas that notably lacked other users. Our findings consequently echo the previous studies of LBSN. Identity projects do not occur in a vacuum. Performances of the self are, to varying degrees, acts of sociability that occur through both passive and active interactions. Participants might choose to territorialize areas that extend beyond their "home territory," if their "home territory" was not a site of territorial activity. In other words, and in the context of locative media and identity projects, the need for location authenticity is not necessarily the primary motivator behind performances of the self. For some participants, it was more important that their performances were witnessed by others.

4.6 Participants Discovered the Presence of Power Structures in a Playful Manner

While some participants (23/42; 11/22 from group A and 12/20 from group B) expressed this perpetuation of identity through territorial claims quite seriously, others expressed it through playful interactions (19/42; 11/22 from group A and 8/20 from group B). As Max and John discuss after being shown their posting history and asked to discuss how they engaged with others:

> I am living in (redacted) it is quite a big compound and has one more GeoMoment user [...] I was posting moments here first and then when the other started doing the same we had a big fight [laughs]. I took over building 1-6 with my moments and (redacted) took over the buildings in the south side [...] but to be honest I was posting content there to piss him of a little bit [laugh] (John).

> I was going over areas and was posting a lot of random trash moments and was waiting for the backlash [...] it was so funny [laughs] [...] I was doing it again and again but no one took it to the heart as everyone knows that I post a lot of funny/teasing moments (Max).

The extracts above illustrate that expressions of territoriality can also be viewed as a ludic layer overlaid on the physical space that can turn the capacity of one to perpetuate identity narratives through LBSN into a playful experience. This echoes findings of other researchers [48, 56, 66, 82], as well as Esjin–Duuns theorization that LBSN can reveal the spatial power structures of our cities [30].

4.7 "Strangers" Were Welcomed to an Area If Their Posts Conformed to a Shared Identity

This playful antagonistic behavior that the participants expressed during our study not only has significant ramifications with regard to the identity of individuals, but also to their capacity to perpetuate one's self-identity narratives through related performances. In essence, GeoMoments was perceived by the participants as a new "front-stage" way to present themselves to others. It is

thought of as "an on-going project that is constantly being modified, updated and safeguarded," one that is "constructed through certain techniques or practices" to demonstrate the "multiplicity of ways in which individuals constitute their identities in a creative and constructive fashion" [79]. Mary explains the following after being shown her posting history and being queried about the places she frequents:

> As I said earlier, I am a shopaholic and all my moments are near the malls. [...] and actually I used to get really pissed off when others would come and post moments in the mall [laughs] I mean I am here often I know people and I can recognize people I see in the mall from their moments [...] when people I don't know post it frustrates me [...] I feel like they try to take over the mall [laughs] (Mary).

For Mary, her moments, and as a result of her territorial claims, fit within a predefined narrative that conforms with her own sense of identity. This not only illustrates that her identity was perpetuated through territorial claims but also that the perceived legitimacy of a claim over an area extends and includes the "familiar strangers" (i.e., an individual who is recognized by another from regularly sharing a common physical space such as a street or bus stop, but with whom one does not interact) [19]. In this vein, then, the legitimacy of spatial claims made familiar strangers correlates with the temporality of their actions. This finding, therefore, supports what Lofland [57] refers to as "intimate-secondary relationships," which are long lasting "relationships" with strangers and these parochial or familiar relationships tend to manifest along routes and patterns of our everyday lives. Previous research on LBSN has illustrated that these relationships facilitate the parochialization of public space. These understandings in relation to our aforementioned findings fold into comparable narratives that illustrate that GeoMoments provided new social opportunities, which fed back into their ongoing personal narratives.

4.8 Participants Created and Maintained a Consistent Self-Brand, and Continuously Curated Their LBSN Activity

A significant number of participants in our study (39/42; 20/22 from group A and 19/20 from group B) also used territorial claims to safeguard their identity by maintaining a consistent self-brand. For Mary, the perception of herself as being a "shopaholic|" was affirmed precisely because the majority of her posts occurred in close proximity to shopping malls. In a similar vein, it was Max's propensity to post jovial and mocking comments, which meant that others knew it was him, because "(he) posts a lot of funny/teasing moments" and "that is who he is through GeoMoments." This resonates with related studies of SNS and locative media that suggest individuals tend to see their own sense of self as being akin to a brand that they maintain and guard through LBSN [20, 78], as well as with Saker's [74] conceptualization of the "affirmation of identity through the potential of surveillance." Accordingly, it becomes clear, that as per Senft's understandings that identity depicted through SNSs can be perceived as a brand [78], individuals in GeoMoments see claimed territories as extensions of their "self" akin to a brand that they have to safeguard from others in order to control and curate a narrative of identity that potentially affirms with their self-identity and represents their "spatial self." This implies a process of privatization of territories they claimed by personalizing and appropriating the "public" space [53].

Further, our data clearly shows that the sharing of location through "moments" not only has significant ramifications with regard to the identity practices of individuals but also to the construction of meanings associated with a space. GeoMoments allows identity to be "an on-going project that is constantly being modified, updated and safeguarded" and "constructed through certain techniques or practices" through "the multiplicity of ways in which individuals constitute their identities in a creative and constructive fashion" [79]. As such, by sharing location-based

moments, GeoMoments contributes to the creation of identity, influencing the way that it is revised, perpetuated, and safeguarded. Identity becomes something that is curated. As Saker posits, "the mode of construction (of identities) is significant here, as in this instance concomitant identities are in part shaped through location, and an awareness of what location might mean. This is established by the fact some participants subsequently felt compelled to share their location at a particular place" [72]. This was echoed throughout our study by almost all of the participants (35/42; 19/22 from group A and 16/20 from group B). Jonathan discusses the following after being shown the places where he posted the most moments:

> I would only leave moments in cool places. I would never leave a moment at university, work or in the shabby and rundown parts of the city. If I do that than other may think that I hang around and I'm local there [...] [laughs] I try to maintain a cool persona [laughs] I have even asked people to remove my mentions from moments in uncool places [...] my image my image [in a squiggly voice, laughs] [...] the only time that I had ever left a moment at the place I would not normally leave moments is when I passed my exams. I wanted everyone to know that I was a senior now (Jonathan).

In the passage Jonathan wants his moments to fit within a predefined narrative that conforms with the "cool" identity he wants to project through GeoMoments. He only broke from that narrative to use GeoMoments in order to make explicit his new identity of "senior student." This demonstrates that Jonathan wants his "performance" through GeoMoments to be seen by others in order for their performed identities to be realized. This is supported by Saker's observations that "by becoming more aware of the importance of location to certain friends, [a user] consequently becomes aware of what these locations might mean in terms of [his/her] identity" [33], as well as other studies that have examined Foursquare and impression management (e.g., [18]).

4.9 Perceptions of Shared Posting Identities Led to Actual Social Interactions in the Physical Space

Lofland [57] asserts that historically we have only thought of people in the public realm in categorical terms, with observable characteristics and traits, such as race, gender, age, and social role. However, in our study, individuals gave meaning to the public realm through projections of their identity, which in combination with the affordances that GeoMoment enables (e.g., the archive of moments) provides personal biographical and idiosyncratic information about the user. Thus, when individuals in our study saw "claimed" areas, some of them (30/42; 20/22 from group A and 10/20 from group B) visited other participant's profiles and history of posted moments. Jonathan explains the following after being shown the usage statistics of his various functions in relation to his moments:

> I am an avid RC plane pilot [...] I was posting a lot of moments of my planes close to the park [...] the park is mine I have over 25 moments there and I'm there daily! [laughs] [...] I noticed that there was another user of GeoMoments here. I was very surprised! [...] he posted quite a bit of moments [...] I was pissed off and essentially, I started a battle about the park with him [laughs] but I went and spied his moments and thought that he must have recently taken flying RC plane as a hobby. I took the liberty and contacted him to show him the ropes [...] now we are good friends [laughs] who would have thought that I would make a friend through GeoMoments someone I called a (swearing redacted) (Jonathan).

This suggests that parochial relationships with strangers can contribute to the emergence of new experiences in the parochial realm. Likewise, it suggests that territoriality can encourage quasi-primary relationships, which are "relatively brief encounters (a few minutes to several hours) between strangers or between those who are categorically known to one another" [57], and facilitate them to evolve. As such it becomes apparent that territoriality in LBSN can be an enabler and make participants aware of commonalities of identity, as well as deepen social relationships. This sense of connection may relate to that of a shared identity and comes from the expectation of a shared experience having lived in the same area within the city or potentially knowing some of the same people. As Saker [72] suggests, "in this instance concomitant identities are in part shaped through location, and an awareness of what location might mean. This is established by the fact some participants subsequently felt compelled to share their location at a particular place."

5 DISCUSSION AND CONCLUSION

In our study, the participants used GeoMoments in an effort to control and curate a narrative of identity in a manner directed toward other users, one that potentially affirmed their self-identity through the "self" represented through this LBSN. Our findings support extant literature that has focused on exploring territoriality in LBSN [66, 83], and the performative side of marking one's location through LBSN in the context of impression management [18, 44] and self-representation and identity [2, 26, 78].

Before we discuss our results, two points are worth mentioning. First, unless otherwise specified, in this section, we do not differentiate between group A and group B. This is because our analytical interpretations were found to be (1) present in both groups and (2) uniformly distributed across groups, thus illustrating that in our study the differences in usage do not affect expressions of self-identity and territoriality. This echoes prior literature that shows that differences in expressions of self-identity can only be seen when there are large disparities in usage [64], which was not the case in our study. Second, we discuss our findings in the context of the broader LBSN literature (e.g., [75, 77]), and we do not limit it to studies that only utilize similar theoretical frameworks to ours [1, 60, 78]). This enables us to take a more critical stance, and relate our findings against the broader canon of locative media without being limited and encumbered by the singular perspective of the interpretative lens we used.

Chiefly, the digital expressions of the "self" we observed in our study highlights the fact that the moments participants created through GeoMoments are part of larger narratives and performances related to the experience of place. This practice commonly occurred in areas where users chose to leave moments or interact with others to hold valuable meaning beyond their physical location. This brought about playful antagonistic conduct where individuals "claimed" these areas with textual and pictorial moments. When their "claimed" areas were challenged, these participants exhibited further antagonistic behavior—again, albeit playful in nature—that included posting more moments in their area to legitimate and communicate their claim, or making posts directly communicating that they have claimed this area. Here, it could be argued that claiming an area in the space where a player lived was simply out of the comfort of using GeoMoments at home or work and does not give evidence of territorial behavior. Yet all of the participants in our study claimed, or at some point tried to claim and "protect" the space where they lived—their "home territory" —even though "home territory" is not a concept featured in GeoMoments. This wording and protective behavior indicates territoriality and suggests that territorial claims can be communicated through LBSN [36]. This communication, while limited in the population of participants (i.e., the other participants in the LBSN as opposed to those in the physical space), in some ways offers more reach and authority in making territoriality legible than a single person could through everyday physical practice in space. By making virtual claims over a particular

geographic area one does not have to actually exert control over others, but by virtually taking over one's connection to a place, one can normalize the activities, resources, which represent the potentialities for power within that area, within the context of the digital currency of LBSN. This can aid in the curation of a particular self-identity, make one more aware of their actions, and therefore provide opportunities for reflection and integration of them into self-narratives. We suggest that this is facilitated primarily through "nudges" that occur during the use of LBSN as a "mediated memory object" and the perceived connotations that these actions have in the potential audience of these [25]. As a corollary, we believe that LSBN usage may support awareness building and has normative influence on the users as the locational past permeates into the present and potentially affects the future. This comes in line with the relevant (and rather limited) literature and seems that it has strong potential to shape the present and future expressions of self and as such potentially affect the user behavior both in the real and the virtual space [38].

Our study also indicates that the interplay of self-identity and territoriality in LBSN not only helps create parochial relationships with space and place [48] but also creates the idea of socially empty places, by claiming and re-claiming conceptually empty spaces, individuals continuously fill and empty a territorial mold, and on a conceptual level, repeatedly separate and recombine meanings of space in time. In this respect, our participants separated space from meaning and combined them, assigning new meaning to places and new places to meanings over and over again through their playful antagonistic behavior and territorial claims. Repeatedly, these configurations were reshaped under the auspices of sociability, and desire for performances of the self to be witnessed by others above and beyond preconceived notions of locative authenticity. This illustrates that "claimed" territories act as a container or mold for the spatial properties of an identity. The perceived influence and authority over a "claimed" area becomes the object to which spatial identity attributes are perpetuated and safeguarded. As such, expressions of territoriality appear as an essential device by which the meaning of a place is made in LBSN and suggests that the potential "things" (such as socially valuable artifacts that perpetuate identity narratives through LBSN) need a place to exist, and that their control sparks territorial competition. In essence, "change" and the future of space are seen by the participants through the lens of GeoMoments as sets of spatial configurations different than those that exist now or that existed in the past. This suggests that territoriality in LBSN contributes not only to the interplay of self-identity of parochial relationships with space and place [48], but also to the safeguarding of one's LBSN identity from others by making it visible and thus legible.

As illuminated above, for the majority of the participants the locative functionality of LBSN allowed them to perpetuate and affirm their territorial ties, and in so doing reflectively solidify their perceived sense of self. In the context of identity and performances of the self, then, LBSN usage does not simply affirm the self through the presentation of place and the abstracted symbolism different places exhibit. For some participants, at least, what is equally important is the spatial positioning of place in the context of its surrounding environment. The decision to physical and digitally interact with a specific location suggests something about the self that is congruent with this site, just as it serves to territorialize the spatial self within a certain terrain. Consequently, the digital inscription of place does more than represent the self thus digitally inscribed; this performance correspondingly asserts the self through the implicit suggestion the self and surrounding environment are intimately intertwined. While previous studies have examined LBSN in the context of identity, the connection between performances of the self, locative media, and territoriality have not been as explicitly explored as they have been here. Within the canon of locative media, this proposed connection adds much needed contours to understanding surrounding the spatial implications of LBSN.

The limitations of this work predominantly relate to the nature of our study and the design of GeoMoments. For example, one could argue that the relatively low number of participants and the rather limited geographic area of our study may have affected the participants and therefore the shared ventricular, etiquette, culture, and expressions of "self" in relation to territoriality can be partially attributed to "small network dynamics," "the group norming effect" or to strong "weak ties" [84]. In a similar tone, it could be said that the designed affordances of GeoMoments or even the cohort of individuals we studied may have affected the behavior of the participants and might have caused some findings to be more prominent than others. For example, the design changes that aimed to encourage "playful antagonistic behavior" and "territoriality" in order to facilitate the present study may have elicited stronger expressions of territoriality than we would have otherwise observed if we have had different designed affordances and participants.

As such, the findings that emerged from exploring the interplay of LBSN and self-identity should be treated as exploratory insights, which create a platform for our understanding of the interplay of self-identity and territoriality within the context of LBSN.

Therefore, further future work is needed to explore the interplay of performativity in LBSN, territoriality, and the interactions with person-to-person and person-to-place parochial relationships in a broader context, utilizing alternative methodologies, and study designs. For example, quantitative approaches such us trait classification questionnaires (e.g., the Big-5 personality trait test) could be used in conjunction with qualitative methods to help understand the participants. Similarly, other secondary sources of data, such as mobile phone logs from the smartphones of the participants and observations could also be used to corroborate claims, explore the perceived versus the real, explore behavior in-situ, and so on. In addition, as we previously stated, the designed affordances of GeoMoments may have affected the behavior of the participants in our study. Therefore, it is suggested that future studies on the topic utilize different mechanics, interactions, and designs. In order to facilitate this we have released an open-source version of GeoMoments under the GNU General Licence V3.0. The open-source version of GeoMoments includes both the back-end and front-end elements, is well documented, modularized, has a lot of locative and social functions implemented, and works in pretty much all versions of Android right out of the box. It can be requested from the authors or found in the following link: https://bitbucket.org/Geomoments/. We also suggest that future work focuses on disentangling and unfolding the cause–effect relationship of the design to the performative behaviors of the participants. This could include, for example, an iterative process where features are added gradually after behaviors pertaining to self-identity have been identified with each iteration. However, it is worth bearing in mind that self-identity is not stationary and is always "influx," and as such these types of exploration should be explored acknowledging the temporality of behaviors as they emerge and are made manifest. Further, we suggest that future studies, aside from exploring different designed affordances, should be setup in a way where different scenarios under different contexts are investigated. These could, for example, include the interplay of different types of territoriality and performative usage (e.g., perceptions of self-identity and shared/community facilitated and supported territoriality), temporality, and the evolution of territoriality in LBSN, and so on. Importantly, it is suggested that these should be explored in a relevant context and examined in relation to relevant theories (e.g., pluralism [13]).

Overall, it is our contention that by utilizing such methods and study designs, such as the ones outlined above would provide us with better understandings of the performative aspects of LBNS in relation to space and place.

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