Mapping Unsafe Places and Emotions: Study of Ames, Iowa

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This research concentrates on mapping places and emotions. The case study is focused on a small college town in Ames, Iowa. The research questions concentrate on the locations of unsafe places in the city, their characteristics, and the emotions felt at these places. The unsafe places were collected in a map-based experiment conducted at the 'Play Ames: Imagine your City' community engagement festival. While taking the survey, residents were asked to plot a point where their unsafe place was on the paper map and describe emotions they felt at this place. In this initial study 46 locations were mapped and visualized in a geographic information system. The results of the survey revealed common themes between their 'unsafe' places across the city such as high volume of traffic, being isolated, and not having enough lights. The most often mentioned emotions were: anxious, nervous, risky, concerned, agitated, stressed, insecure, and worried. In the future we will add a layer on favourite places and combine the data with data on evocative places.

Keywords: paper-map experiments; unsafe places; characteristics of unsafe places; mapping emotions

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1 Introduction and Research Focus

Places and emotions and mapping them in a geographic information system (GIS) represent intriguing challenges for geoinformation science. These challenges are related to the definition and formalization of places for the needs of information and geoinformation science (Goodchild, 2011; Purves et al., 2019; Winter and Freksa, 2012), questions related to the concept of a place and the difficulties associated with mapping places in a GIS due to their fuzzy borders (Burrough and Frank, 1996; Poplin, 2020). Similarly to places, emotions do not represent a typical geographic object and are therefore difficult to map in a GIS (Poplin, 2018). Nold (2009) has contributed greatly to the field of emotional cartography. Using technology similar to a lie detector, Nold invented a bio-mapping device that records a user's level of sweat which has been associated with intensity of emotions. The device also records the geolocation of the user, creating a novel method of exploring associations between physical space and emotion.

This research was also done in response to Poplin's article titled 'Exploring evocative places and their characteristics' (Poplin, 2020). In her research, she studies evocative places, places that evoke images, emotions, and memories and concentrates on places that evoke positive emotions. We are interested in exploring the opposite side by choosing places that evoke negative emotions, more specifically, unsafe places. Another aspect of this research that intrigued us was the concept of mapping emotions. According to researchers on places, emotions do not have set boundaries, nor do 'places'. Their boundaries are 'fuzzy' and cannot be identified at first glance. Where does a place end and another begin? Emotions have always been a concept that dealt with the human brain and internalizing those

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emotions in order to make sense of life (Damasio, 2006). People express emotions in many different ways. That could be through agitation, anxiety, happiness, recklessness, etc. By having the participants physically pinpoint locations they do not like to visit, it can help them process those feelings and determine what exactly they feel when going to these places and why. We additionally wish to study problems related to the visualization of emotions on maps.

Our research aims to contribute to this fundamental research in geoinformation science by focusing on unsafe places. It is organized around the following research questions:

- Locations of unsafe places. Where are unsafe places located in the city?
- Characteristics of unsafe places. How do the residents describe the main characteristics of self-selected unsafe places?
- Emotions related to unsafe places. How do the residents feel at these places?
- Can a mapping experiment be used to engage residents in a discussion about safety in the city?

In order to study unsafe places, we concentrated on the small college town of Ames, located in Iowa, USA. Ames has 66,427 residents out of which 29,478 are students studying at Iowa State University according to US Census Data (United States Census Bureau, 2019, 2020). An increased knowledge about how residents perceive places can help urban planners and designers design better places in which they will feel appreciated and safer.

2 Research Methodology

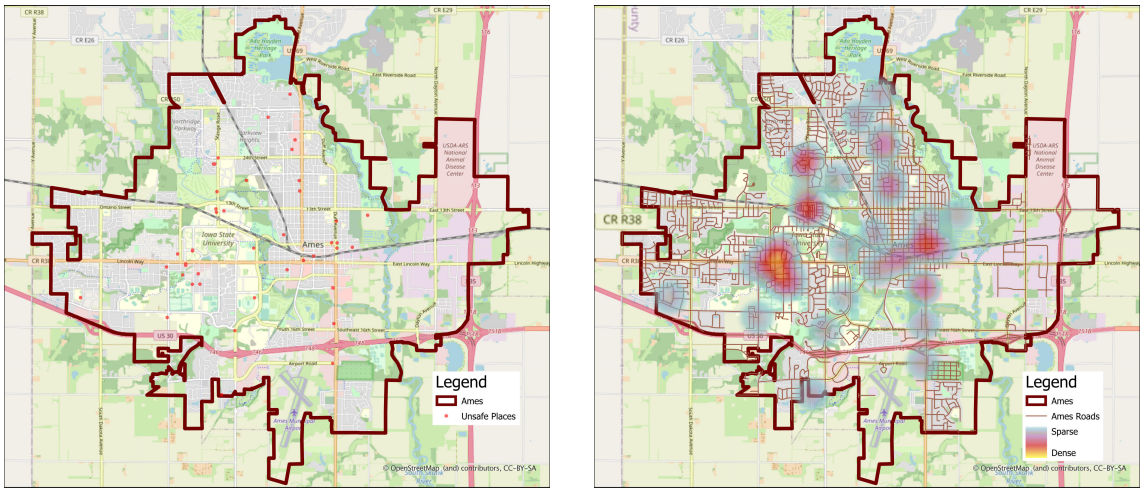
The research methodology was based on a paper-map experiment conducted at the 'Play Ames: Imagine your City' community engagement festival. The festival was organized on 25 September 2021 in a collaboration of the City of Ames and the Community and Regional Planning Department, Iowa State University. A group of students from Iowa State University lead the paper-map experiment at the festival and engaged residents in a discussion about safety and unsafe places.

The materials for the paper-map experiment consisted of a paper-map of the city of Ames and a questionnaire. The map was a two-foot by three-foot map printed on paper. It was designed in a GIS application particularly for the purpose of data collection and included layers of roads, buildings, and labels of the most important points of interest in the city. The questionnaire consisted of the following main categories: location of the unsafe place self-selected by the participant; information about how unsafe this place is indicated on a Likert scale from 1 to 5; information about emotions felt at this place; accessibility of the indicated unsafe place; how frequently it is visited by the participant; and how important it is to the participant. We also included a question related to what problems they experienced there, e.g., high traffic, lack of lighting, abandoned buildings, and other phenomena that could contribute to a place lacking safety. Questions about gender, employment status, and age were added at the end of the questionnaire, as well as the question about the location of the residence of the survey participant.

In order to better guide the participants in selecting emotions they felt at their location, a feelings inventory was created based on the list of negative emotions found on the Center for Non-Violent Communication's website (Center for Nonviolent Communication, 2005) and originally compiled by Rosenberg (1999). Once the surveys and mapping were completed, the data was compiled in an ArcGIS 123 survey as well as in an Excel sheet to be able to view the distribution of the responses. Once that data was analysed, we then transferred it into ArcGIS Pro to create a final layout of all mapped unsafe places in Ames.

3 Research Results

Altogether, 46 participants responded to the survey contributing 46 locations of unsafe places. Most participants were either employed full-time (33%) or students (24%). About 51% identified as female, 38% as male, 9% as NA, and 2% preferred not to answer. Many participants were between the age range of 25–34 (24%) and 35–44 (20%).



(a) Individual locations **(b)** Heat map

Figure 1: Unsafe places in Ames, Iowa. (a) Individual locations of unsafe places; (b) Their concentrations represented in a heat-map with roads

3.1 Locations and Characteristics of Unsafe Places

The survey and mapping activity helped to identify a few areas in Ames where the city residents felt unsafe[1]. Some common answers were the Dunkin Donuts on Lincoln Way, Stange Road, crosswalks across the Iowa State University campus, Knapp Street, Bandshell Park, and areas close to Northridge. Figure 1 shows the locations of the unsafe places indicated with a red point (left) and a heat map on the right visualizes high concentrations of unsafe places (indicated with yellow and red). The three areas where the highest concentrations of points were Stange Road, Duff Avenue, and the area around Dunkin Donuts on Lincoln Way. All these locations had one thing in common: heavy traffic. They were all worried that they could either be in a car accident or a pedestrian could get hurt for lack of signage because drivers were not paying attention. Figure 2 shows the main reasons for a place to be perceived as unsafe. The main reasons are heavy traffic, not enough lighting, isolated, and crime. Most of the participants expressed that the unplace safe inconveniences them as well as is important in their life, which suggests that this is a bigger problem than it may seem. The set boundary these emotions created were those of the roads themselves.

Once we collected a sizeable amount of data points, some trends started to emerge with mapping emotions and the meaning of a place. Mapping emotions on a single point may not be the best practice.

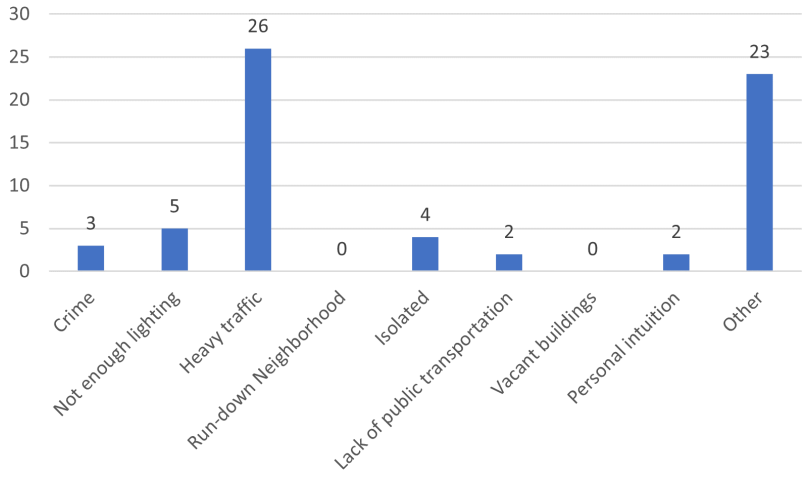


Figure 2: What makes the usafe places in Ames, Iowa, unsafe?

Table 1: The most often mentioned emotions felt at unsafe places in Ames, Iowa

Emotion	Count
Anxious	8
Nervous	7
Risky	5
Concerned	4
Agitated	4
Stressed	4
Insecure	4
Worried	4

As we only had the residents place a single point, the area in which they felt the emotion is reduced and potentially incomplete. However, as seen in Figure 1, hot spots were identified in which we were able to see areas in which groups were experiencing negative emotions. There was a high volume of *Other* responses in the study. They can be divided into the following three categories: *Bad Road Design* with 6 responses, *Bad Walkway / Trail Design* with 7 responses, *Other People* with 6 responses, and then the remaining *Other* with 4 responses. For example, the majority of the points presented were drawn because people felt as though there was a high volume of traffic. The points along the same road where they experienced an unsafe situation helped define the road itself as an unsafe place. These results made us think of questions we could ask future participants, e.g., does your attitude, or emotions, change once you turn onto this busy road, or get into a certain vicinity of the unsafe areas?

3.2 Emotions Felt at Unsafe Places

The most often mentioned emotions are compiled in Table 1. Beside these emotions, also feeling tense (3x), uneasy (3x), fearsome (2x), and uncertain (2x) was mentioned by the participants. Only once mentioned were the following emotions: fidgety, hazardous, precarious, shaky, uncomfortable, and vulnerable. How to visualize these emotions in a map represents a real challenge. Geoinformation science does not yet have an answer to that. The only idea that comes to mind is to visualize the emotions as an attribute to a place and analyse places based on the expressed emotions.

4 Conclusions and Further Research

Overall, we believe the festival was a huge success. The participants were very engaged in the activity and looked like they had fun plotting their points on the map. They were interested in seeing the final results to see if there are any big problem areas in the community. We learned that it takes multiple revisions to create a survey, and even then, there is not a guarantee that it will be flawless. We also learned that we need to have as many multiple-choice questions as possible, so we get the answers that we are expecting instead of answers that have nothing to do with the questions themselves.

The majority of the participants also said that their unsafe place was located close to them – less than two miles – and that they did not access it through public transportation. This could suggest that the public transportation in Ames possibly should be re-networked to provide better public transportation for those having to go through these unsafe places by car or bike. During the festival, some participants seemed confused about the idea of the activity. Some said they never felt unsafe in Ames; some simply said they could not think of any areas that needed work. The city officials also expressed interest in seeing the final results compared with the data they have collected.

This mapping experiment clearly demonstrated the issues of mapping places in a GIS. Currently selected representation in the form of a point is very limited. A place is more than just a point. When reducing it to a point it loses the concept of a place. Some of the places may have other forms and shapes, such as, e.g., lines or polygons. In our further research we aim to study the concept of a place from the perspective of the residents. The approach in mapping emotions as attribute to the location enabled by a GIS seems a rather simple solution. It allows to visualize places at which similar emotions are felt. However, a GIS does not offer solutions for the visualization of intangible objects such as

emotions. Emotions also change over time and do not stay fixed and attached to one particular place. They represent an intriguing challenge for mapping and geoinformation science. Some researchers represented emotions with the help of emoticons. Camara et al. (2021) used emoticons, or emojis, to map out emotions that participants felt during urban mobility. This approach is limited as one can only distinguish among a few emoticons, and clear linkage between the emotion and the emoticon is necessary for mapping. Emoticons also take quite a substantial space in the map and can only be located on a point basis. Pánek (2018) developed this idea further, collected emotions as pinned points, and used a hexagonal grid formed from aggregation of points and a heat map. This is a possible concept we may consider for the visualization of emotions. It shows a grid with different colours and intensity of emotions displayed in the grid.

Nummenmaa et al. (2014) created their own unique computer program titled *EmBody*. In this study, participants were shown stimuli such as words, images, or movies. They were then asked to colour in an empty silhouette of a body, using warm colours to signify movement or activity and cool colours to signify stillness or lack of activity. The results suggest that emotions are culturally universal and could be associated with specific parts of the body. In the future, we would be interested in adopting this bodily silhouette method to further explore the relationship between the body, emotions, and physical spaces. Tyrväinen et al. (2007) utilized a postal survey method to map the social values of urban woodlands in Helsinki, Finland. Results were compiled and visualized using colours to represent positive and negative values, as well as specific feelings such as 'the feeling of forest' and 'tranquility and peacefulness'. This research is specific to pre-defined areas, whereas ours is more open ended based upon the respondents' locations. In the future, it could be possible to work with more defined areas and to visualize our results accordingly.

Within the next two months, we will be conducting more research on mapping unsafe places in Ames as well as mapping favourite places. We will be utilizing a similar methodology in approaching both of these topics. A survey will be created for unsafe places and a separate one will be created for favourite places. After the data is collected, the results will be entered into a spreadsheet and then entered into ArcGIS Pro for further analysis of common clusters. The limitation of the current research is that we were only able to collect forty-six unsafe places. Since our last submission, we were able to collect fifty more points on unsafe places as well as fifty points for favourite places. Over the next few months, we will be analysing the new data in order to formulate more concrete results.

Notes

1. The collected data can be viewed following the link: https://arcg.is/1T1ajz0.

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Author Contributions

T Kosacz and M Gula provided the main idea of the experiment as well as the methodology, results, and conclusion. A Poplin served as an advisor and contributed to the writing of all sections of this paper. T Tobin contributed to Section 4. F Nourin led the data collection group in the phase of the preparation and on the day of the festival.

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