



Delft University of Technology

Peoples' values and feelings matter

Participatory heritage management using social media

Foroughi, M.; Andrade, Bruno; Pereira Roders, A.

Publication date

2022

Document Version

Final published version

Published in

Artificial Intelligence and Architectural Design

Citation (APA)

Foroughi, M., Andrade, B., & Pereira Roders, A. (2022). Peoples' values and feelings matter: Participatory heritage management using social media. In J. Muntañola (Ed.), *Artificial Intelligence and Architectural Design: An Introduction* (Vol. 33, pp. 107-120).

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

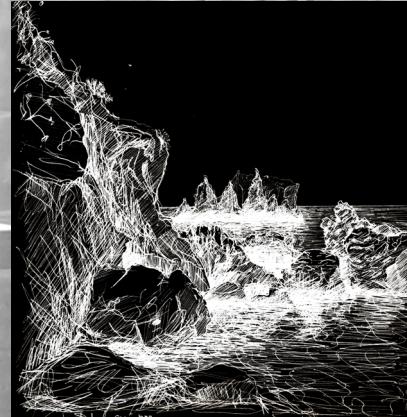
Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

ARQUITECTONICS

MIND, LAND & SOCIETY

ARTIFICIAL INTELLIGENCE AND ARCHITECTURAL DESIGN: AN INTRODUCTION



JOSEP MUNTAÑOLA



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

**Institutions that support the review
(Co-editors):**

Universitat Politècnica de Catalunya
Grup de Recerca GIRAS. UPC
Universidad de los Andes
Mérida, Venezuela
Universidad Nacional del
Litoral. Santa Fe. Argentina
Universidad de Santo Tomás
Bucaramanga. Colombia
Universidad Politécnica de
Puerto Rico. Puerto Rico
Corporación HEKA. Ecuador
Colegio Nacional de Arquitectos
del Ecuador. Quito. Ecuador
Pontificia Universidad Católica de Valparaíso
Valparaíso. Chile

Assistants to the Editor:

Júlia Beltran Borràs
Josue Nathan Martínez

Mail and subscriptions

ARQUITECTONICS

Mind, Land & Society

Depart. de Projectes d'Arquitectura
Universitat Politècnica de Catalunya
Av. Diagonal, 649, 5a planta
08028 Barcelona / Spain
Tel.: (0034) 934 016 406
Fax.: 934 016 396
newsletter.pa@upc.edu
www.arquitectonics.com
www.agapea.com

Cover Photography and Drawing:
Photography Design by Barozzi-Veiga,
Draw by Josep Muntañola Thornberg

Edición:

Universitat Politècnica de Catalunya
Jordi Girona 1-3, Edifici K2M-S103-104
08034 Barcelona
Tel.: 934 015 885
eBooks UPC: <http://ebooks.upc.edu>
E-mail: info.idp@upc.edu
ISSN: 1579-4431
ISBN: 978-84-19184-49-8
Depósito legal: B 13419-2022
Impresión: Service Point

© 2022, **ARQUITECTONICS** y Josep Muntañola
© 2022, Iniciativa Digital Politécnica.
Oficina de Publicacions Acadèmiques Digitals de la UPC

Primera edición: Septiembre de 2022

Head of the Series:

Josep Muntañola. *Barcelona*

Author for this Issue:

Josep Muntañola

Associate Editors of the Series:

Magda Saura. *Barcelona*

Adjoined Co-Editors:

Beatriz Ramírez. *Universidad de los Andes.*

Mérida. Venezuela

Marcelo Zárate. *Universidad Nacional
del Litoral. Santa Fe. Argentina*

Ruth Marcela Díaz, Samuel Jaimes Botía.
Universidad Santo Tomás,

Bucaramanga. Colombia

María I. Oliver de la Cruz. *Universidad
Politécnica de Puerto Rico. Puerto Rico*

Rodrigo Saavedra. *Pontificia Universidad
Católica de Valparaíso. Valparaíso. Chile*

Board of Advisory Editors

(Scientific Committee):

Botta, Mario; *Architect, Switzerland*

Boudon, Pierre; *Architect, Canada*

Bilbeny, Norbert; *Philosopher, Spain*

Carbonell, Eudald; *Archaeologist, Spain*

Fernández Alba, Antonio; *Architect, Spain*

Ferrater, Carlos; *Architect, Spain*

Gómez Pin, Víctor; *Philosopher, Spain*

Heikkinen, Mikko; *Architect, Finland*

Kalogirou, Nikolaos; *Architect, Greece*

Langer, Jonas; *Psychologist, USA*

Levy, Albert; *Architect, France*

Lagopoulos, Alexandros; *Urban Planner, Greece*

Mack, Mark; *Architect, USA*

Magnaghi, Alberto; *City Planner, Italy*

Messori, Rita; *Philosopher, Italy*

Mateo, Josep Lluís, *Architect, Spain*

Moore, Gary T; *Architect, Australia*

Mul, Jos de; *Philosopher, The Netherlands*

Pallasmaa, Juhani; *Architect, Finland*

Pardo, José Luis; *Philosopher, Spain*

Ponzio, Augusto; *Philosopher, Italy*

Preziosi, Donald; *Anthropologist and Linguist,
USA/UK*

Provansal, Danielle; *Anthropologist, Spain*

Rapoport, Amos; *Architect, USA*

Rewers, Eva; *Philosopher, Poland*

Ricoeur, Paul, *Philosopher, France* †

Romañà, Teresa; *Pedagogue, Spain*

Salmona, Rogelio; *Architect, Colombia* †

Sanoff, Henry; *Architect, USA*

Scandurra, Enzo; *Urban Planner, Italy*

Solaguren, Félix; *Architect, Spain*

Tagliabue & Miralles, *Architects, Spain*

Valsiner, Jaan; *Psychologist, USA*

Werner, Frank; *Historian, Germany*

ARCHITECTONICS 33
MIND, LAND & SOCIETY

Artificial Intelligence and Architectural Design: an Introduction

9	Josep MUNTAÑOLA and Magda SAURA.....	Foreword
13	First Part	Practices and Ideas Emerging from the Impact of Artificial Intelligence on the Architectural and Urban Design Practices and Theories of Today
15	Ana COCHO	Chapter I.1: Cognition and sub-symbolic AI Paradigms: Distributed AI as the ubiquitous future blanket for collective cognitive performance.
29	Diego NAVARRO	Chapter I.2: Genetic Algorithms and the Hyperdimensional Design Space
41	Julia BELTRÁN	Chapter I.3: Using Space Syntax Analysis in Detecting Pathologies in Historical Open Spaces
55	Maria VOGIATZAKI and Constantin SPYRIDONIDIS	Chapter I.4: Xenomateriality: Designing with Hekate
81	Maria VOGIATZAKI and Constantin SPYRIDONIDIS	Chapter I.5: The spirit of design distilled
107	Mahda FOROUGHI, Bruno de ANDRADE and Ana PEREIRA RODERS	Chapter I.6: Peoples' values and feelings matter: Participatory heritage management using social media
121	Second Part	
	Josep MUNTAÑOLA	Some Theoretical Considerations in Order to Start a Dialogy between the Three Branches of the Langer's Tree
144	References	

Chapter I.6:

Peoples' values and feelings matter: Participatory heritage management using social media

MAHDA FOROUGHI¹, BRUNO DE ANDRADE²,
AND ANA PEREIRA RODERS³

Abstract

Social media has been increasingly used by various communities to express their opinions, values, and feelings about cities and, in particular, built heritage. Social media platforms, interactive technologies used by virtual communities and networks became an important source for recent innovative studies on participatory heritage management. Amongst them, the application of artificial intelligence (AI) methods to analyze social media data for heritage management, in particular peoples' feelings and their relation to cultural significance (values and attributes), is seldom explored. This chapter explores the potential of social media content as a data source and artificial intelligence methods to analyze people's feelings and opinions about the cultural significance of built heritage. The city of Yazd, Iran, was taken as a case study, with a specific focus on windcatchers (architectural element used for natural ventilation), a key

1, 2, 3. Department of Architectural engineering and technology, Faculty of Architecture and Built Environment, Technical University of Delft, the Netherlands
E-mail address: m.foroughi@tudelft.nl, work address: Julianalaan 134, 2628 BL Delft

urban attribute also conveying outstanding universal value, ever since inscribed on the UNESCO World Heritage List in 2017. This chapter details: 1) the state of the art on participatory heritage management using social media; 2) the methodology to extract values and sentiments assigned to windcatchers on Instagram and Twitter posts over the last ten years; 3) and last, the preliminary findings on the values of windcatchers, sentiment and emotion analysis, and the association analysis between the values of windcatchers and emotions. Results indicate the most and least addressed categories of values and emotions. Moreover, some potential relations between values and emotions (e.g., economic, ecological, and scientific values with trust) are revealed. Besides, it became proven that negative sentiments over windcatchers of Yazd are scarcely expressed (e.g., critiques) in social media. This study confirms the potential of social media for heritage management in terms of (de)coding and measuring the values of heritage attributes and related feelings. This research is useful to the windcatchers in Yazd, but also replicable to other case studies and scales.

Keywords:

Social media, artificial intelligence, public participation, cultural significance, sentiment analysis, emotions

1. Introduction

People observe, experience, and interact with their environment, expressing their values and feelings (Pitsilides et al., 2012; Gorz, 1984). There has been a growing interest in including people's opinions in planning fields, and particularly in the heritage field, through a participatory approach (Landorf, 2009). A participatory approach is often positively associated with socially inclusive innovation processes, cultural value creation (Nakagawa, 2010; Sasaki, 2010), and a shared sense of identity (Biondi et al., 2020).

This fundamental change in the relation between heritage and the public is promoting collaboration, sharing interests, views, feelings, and sensitivities (Dodd, 1994), which reinforces their place attachment for being a member of a community, and growing ownership on heritage. Linked to a sense of living, heritage is dynamically recreated by communities in response to their interactions with nature and history, generating a sense of identity and continuity (Silberman et al., 2012).

Online communities have increasingly used social media platforms to share their opinions and create discussions over buildings and cities, particularly built heritage. The activity of diverse groups of people in social media leads to an interactive practice of 'remembering together'. It is more than simply individually sharing information because it encompasses discussing (e.g., (re)posting, responding) diverse experiences, understandings, feelings, and values about events with particular significance (Simon, R., 2012). Accordingly, van Dijck (2007) claims social media facilitates the culture of connectivity. Consequently, forming a collective memory in social media platforms offers new ways of public participation in heritage management (Simon, 2012).

In fact, social media posts shared through online conversations provide opportunities for smart technologies (e.g., Artificial Intelligence - AI) and techniques (e.g., Natural Language Processing - NLP) to capture and decode public voices at an unprecedented pace, which can potentially dynamize the dominant planning power structure (Tayebi, 2013). Besides, social media can reduce costs and upscale the involvement of stakeholders in urban planning (Ye et al., 2021; Kleinhans et al., 2015).

Social media platforms have been recently applied for participatory heritage management (Silberman et al., 2012; Giaccardi, 2012). Decoding cultural significance by distinguishing attributes (resources to be conserved) and values (the reasons to conserve the resources) is growing in attention both by research and practice, as endorsed by UNESCO Recommendation on the Historic Urban Landscape (UNESCO, 2011). Diverse scholars have been using social media to conduct innovative research to engage people and interpret their opinions and sentiments. They already analyzed people's feelings (Liang et al., 2021; Joseph, 2021; Abdul-Rahman, 2021; Alizadeh et al., 2019) and their values (Ginzarly et al. 2019) related to spatial areas and heritage properties using AI models. However, no paper was found exploring the potential relations between sentiments and values.

Social media and artificial intelligence (AI) is, therefore, yet to be further explored in this topic. Even if widely addressed, there is a lack of research and heritage-specific tools to decode the cultural significance of built heritage, distinguishing and relating values (Bai et al., 2021). In addition, literature often focuses on the scale of country, city, and neighborhood (Monachesi, 2020; Ginzarly et al., 2019; Alizadeh et al., 2019), rather than specific attributes of cities, architectural elements such as the windcatchers. Hence, this chapter aims to

investigate the potentials of social media as a data source and artificial intelligence methods for revealing the cultural significance (values and attributes) of built heritage: in particular, windcatchers of the city of Yazd, Iran was taken as a case study.

2. Method

This research is conducted in four steps: data acquisition, data pre-processing, data analysis, and results (see Figure 1).

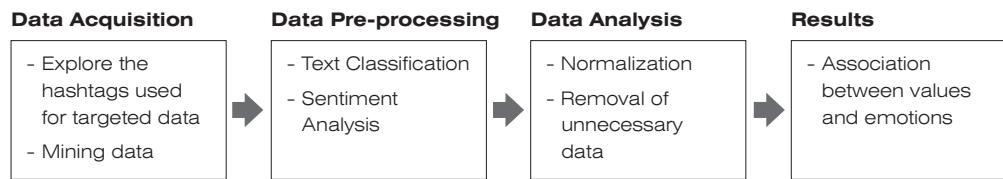


Figure 1. Overview of the research process.

2.1. Data acquisition

Related posts to the windcatchers of Yazd were mined from Instagram and Twitter. Various Persian and English hashtags are used referring to windcatchers including “badgir”, “wind-catcher”, “windcatcher”, “wind-tower”, “windtower”, «یاریگداداب», «امریگداداب», «ریگداداب», «ریگداداب», «زی_یاریگداداب», «زی_ریگداداب». This research retrieved all posts using these hashtags by WebHarvey software (23,899 posts). No time limit was applied to scoping the dataset.

The content of the data includes user name, post, time (time posted), number of likes, number of users' posts, number of users' followers, number of users' followings, and users' bio. The data do not cover the demographic characteristic of users, including age, gender,

education, and professional status, because mostly these are not provided by the users. Moreover, this research considers ethical issues by only processing the comments expressing heritage cultural significance and not using or storing any sensitive personal data. Personal data will not be disclosed at any research stages, and the users' identities will remain anonymous.

2.2. Data cleaning and pre-processing

The gathered posts not mentioning windcatchers and Yazd were excluded. To find these posts, the different forms of the word "Yazd" (both in Persian and English) were normalized to "yazd" with lowercase, and all posts that did not include "yazd" were excluded from the dataset. In the end, a total number of 3,346 sentences were analyzed. In addition to text normalization, unnecessary data (e.g., mentions, emojis, punctuation marks, website links) were removed to facilitate the data analysis.

2.3. Data analysis

After the data cleaning and pre-processing, the dataset was ready for automatic content analysis. The content of each post was analyzed and assessed through automated quantitative content analysis and qualitative categorical analysis. The quantitative analysis revealed the most and least frequent words. The qualitative analysis showed how users refer to windcatchers and associate them with values and sentiments. Values are the reasons that people want to protect heritage resources. Sentiments are people's feelings attached to heritage resources.



Figure 2. Cultural Values Framework (Pereira Roders, 2007)

2.3.1 Values analysis

The addressed values were analyzed on eight scales (see figure 2) - social, economic, political, historic, aesthetical, scientific, age, and ecological - using the cultural values framework (Pereira Roders, 2007). The multi-class text classification analysis of values was undertaken using Python libraries, including Numpy (for calculation analysis), Pandas (for research on the data frame), and Bert model (word embedding). This research used the cosine similarity method for the multi-class text classification, because the distribution of labels in the available train dataset differed drastically, and there were not enough available trained datasets.

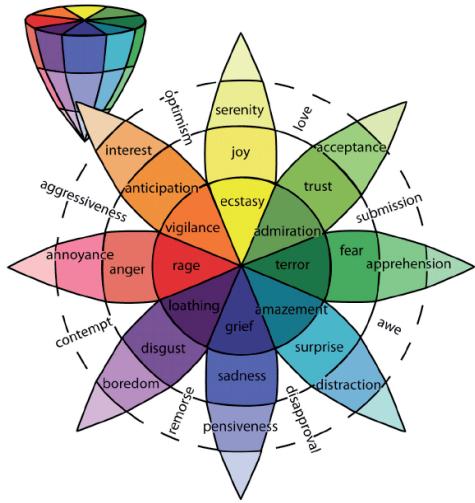


Figure 3. Plutchik wheel of emotions (Donaldson, M., 2017)

2.3.2 Sentiment analysis

The overall sentiment of posts was analyzed on five scales, from very positive to very negative, using the transformers library to load a pre-trained transformer model and the Bert model, developed by Devlin et al. (2018), to create the Word embedding. Word embedding encodes the words' meanings into vectors, and the terms that are closer in the vector space are expected to be similar in meaning. The embedding fed into the Gated Recurrent Unit (GRU) model to predict sentiment. Despite the algorithmic limitations, the results' reliability was confirmed (accuracy: 94%, precision_value: 72%, and F-measure: 77%). To reveal more details on sentiment analysis, emotions within each group of sentiments were conducted on the data set, using Plutchik's wheel of emotions (Robert, 1980). This theoretical framework clusters emotions in eight basic emotions, which are four pairs of opposite emotions: joy and sadness; anger and fear; trust and disgust; and surprise and anticipation (see figure 3).

3. Results

3.1 Values of windcatchers in Yazd

Most of the posts (66%) conveyed at least one of the eight values to the windcatchers of Yazd. The most frequent values are respectively age (26%), historic (18%), social (16%), aesthetical (14%), economic (10%),

2. **Accuracy** :
$$\frac{(\text{TruePositives}_1 + \text{TruePositives}_2) + (\text{TrueNegative}_1 + \text{TrueNegative}_2)}{(\text{TruePositives}_1 + \text{TruePositives}_2) + (\text{TrueNegative}_1 + \text{TrueNegative}_2) + (\text{FalsePositives}_1 + \text{FalsePositives}_2) + (\text{FalseNegative}_1 + \text{FalseNegative}_2)}$$

Precision_value :
$$\frac{(\text{TruePositives}_1 + \text{TruePositives}_2)}{(\text{TruePositives}_1 + \text{TruePositives}_2) + (\text{FalsePositives}_1 + \text{FalsePositives}_2)}$$

F-measure :
$$\frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

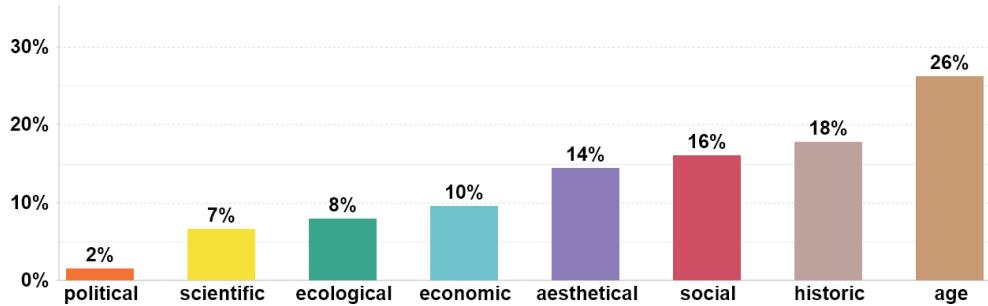


Figure 4. The frequency of values in all the collected posts.

3.2 Sentiment analysis and relation with values

Sentiment analysis revealed the dominancy of posts with very positive and positive feelings (86%) followed by posts with neutral feelings (14%), and only 14 posts were found expressing negative feelings. These findings contradict the scholars concluding that people often use social media to complain and generally be pessimistic about urban issues (Resch, Summa, Zeile, & Strube, 2016).

To disclose more details on sentiment analysis, emotions within each group of sentiments were analyzed. The dominant emotions expressed by posts, as expected, are positive (joy, trust, surprise, and anticipation). While among these positive emotions, dominant ones are respectively joy (45%), trust (30%), and surprise (21%), anticipation is rarely addressed.

The association analysis between values and only the dominant emotions (namely joy, trust, surprise) was explored because other emotions are rarely mentioned. This analysis shows some relations, for example, While 73% (the maximum percentage in diagram 5) of posts conveying aesthetical value express joy, only 12% (the minimum percentage in diagram 5) express surprise. This can show a strong relation between aesthetical

value and emotion of joy and a weak relation between aesthetical value and emotion of surprise among people posting about windcatchers of Yazd.

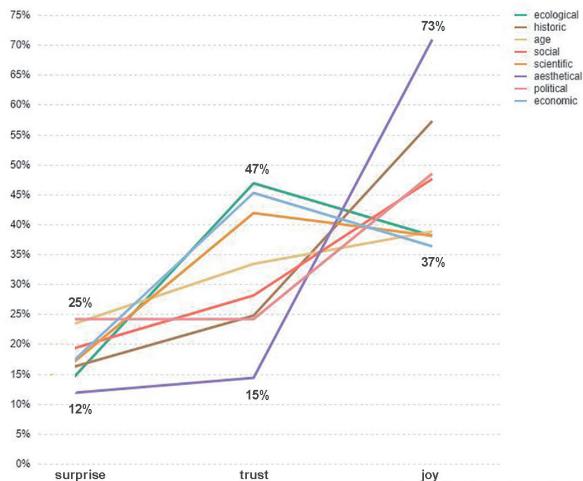


Figure 5. the association between the dominant emotions and the values.

Surprise has the minimum association with all the values among the most common emotions (e.g., *"It is well known as the city of windcatcher an amazing piece of ancient tech!"*) as the minimum percentage of posts refer to surprise (from 25% to 12%). Interestingly, aesthetical, historic, political, social, and age values are more linked with joy than trust (see figure 5). For example, the word "beautiful" associated with aesthetic value conveys joy as emotion (e.g., *"We loved exploring Yazd from its secret rooftops... From there, you get a view of its beautiful windcatchers..."*). On the other hand, economic, ecological, and scientific values relate more to trust than joy (e.g., *"windcatchers are engineering elements used to create natural air conditioning"*) (see table 1). To better understand the association between values and emotions in the analysis, more exemplary quotes are shown in table 1.

Exemplary quotes	Values	AI logics	Emotion
We're visiting one of the most <i>beautiful viewpoint</i> in the world! From #arthouseyazzd you can see a panoramic view of #yazd and it's magic #windcatcher and #dome! #tourguide#privatetour #traveltoiran #privat-guidedtours. (guidepersia, 2019)	aesthetical	beautiful (aesthetical),	joy
Beautiful <i>historic</i> city of Yazd, the Zoroastrian temple, the city of windcatchers, very <i>beautiful</i> and <i>historic</i> , with hospitable people. (m.akbari2000, 2019)	historic, aesthetical	historic (historic), beautiful (aesthetical)	joy
<i>Beautiful</i> architecture of #dowlatabad garden and the world tallest wind tower (#badgir) in the UNESCO registered city of #yazd. (seeyouinyazd, 2019)	aesthetical	beautiful (aesthetical)	joy
We loved exploring Yazd from its secret rooftops... From there, you get a view of its <i>beautiful</i> windcatchers (badgir) designed to cool homes, poking out of the baked-brown labyrinth of lanes. (maryzeuk, 2016)	aesthetical	beautiful (aesthetical)	joy
This house is noteworthy in terms of using the <i>traditional</i> Iranian architecture ... its two-floor windtower(BADGIR) is unique and awesome. The <i>antiquity</i> of this house dating back to <i>Qajar period</i> . (dreamtrip2iran, 2016)	Political, historic, age	Zandieh and Qajar period (Political), history of 270 years (historic, age)	joy
<i>Beautiful</i> rooftop view of the old part of Yazd, with all its badgirs (windcatchers) and blue domes. (svenpunkt, 2020)	social, age	traditional (social, age)	joy
windcatchers are <i>engineering elements</i> used to create <i>natural air conditioning</i> (ifilmenglish, 2018)	aesthetical, age	beautiful (aesthetical), old (age)	joy
Badgirs are in shape of high structures designed to <i>cool</i> the inner environment of the houses by receiving the wind; <i>cooling</i> it; and directing the stream of cool wind into the inner spaces. ... (khavartravel.en, 2019)	Scientific, ecological, economic	engineering elements (scientific), natural (ecological), air conditioning (economic)	trust
A windcatcher (windcatcher) is a <i>traditional</i> Persian <i>architectural element</i> to create <i>natural ventilation</i> in buildings. (smm870508, 2015)	economic	cool (economic), cooling (economic)	trust
The famous Yazdi wind-catchers/badgirs, <i>ancient</i> system of <i>natural air-conditioning</i> designed to <i>catch even the lightest breeze</i> and <i>direct it to the rooms below</i> (batakoja, 2016)	economic	traditional (social, age), architectural element (scientific), natural (ecological), ventilation (economic)	trust
... #BADGIR is a #traditional #handmade <i>engineering</i> architectural #masterpiece to deal with the unbearable heat of the central #Iranian desert. ... (who_loves_iran, 2017)	age, ecological, economic	ancient (age), natural (ecological), air-conditioning (economic)	trust

Exemplary quotes	Values	AI logics	Emotion
It is well known as the city of windcatcher an amazing piece of <i>ancient tech!</i> (emmeandeffe, 2020)	social, age, scientific	traditional (social, age), engineering (scientific)	trust
<i>Qajar and Zand governments</i> built the world's tallest brick tower (wind catcher) the interior view of dowlat abad mansion's clay windcatcher , yazd , iran. ... (handycraft, 2020)	age	ancient (age)	surprise
A windtower is one of the most famous elements in the <i>traditional</i> Iranian architecture. ... (beautifulworldoftravel, 2020)	political	Qajar and Zand governments (political)	surprise
... The program that can be considered as "the most treacherous acting against Iran's <i>national identity</i> " is a brazen attempt of the UAE sheikhs to inscribe "Iranian windcatcher " as " windcatcher and Arabic heritage" in the United Nations and this obvious theft is soon to be recognized. ... (amlakbank, 2019)	social, age	traditional (social, age)	surprise
... Probably windcatchers cannot function properly as a <i>traditional</i> architectural element. (moudi.forouhi.photo, 2020)	social	national identity (social)	anger
We're visiting one of the most <i>beautiful viewpoint</i> in the world! From #arthouseyazd you can see a panoramic view of #yazd and it's magic #windcatcher and #dome! #tourguide#privatetour #traveltoiran #private-guidedtours. (guidepersia, 2019)	social, age	traditional (social, age)	sadness

Table 1. Exemplary quotes and addressed values

Overall, the result item shows that both Instagram and Twitter users have been actively sharing their opinions over why windcatchers are significant (or not), assigning positive or negative feelings. This was made possible by decoding their views into classes of values and sentiments. The analysis of emotions and their associations with values is seldom investigated in the literature. This gap has started to be filled up in this research, which indicates that sentiments could be at the core of the value formation. For instance, if people attach a negative feeling to an attribute (e.g., windcatcher), they probably associate a negative value to it. Besides, some classes of values are keener to be more firmly attached

to certain emotions (e.g., aesthetical value with joy, and scientific value with trust).

4. Discussion and conclusion

Social media contributes to the act of remembering together, strengthening the sense of belonging and place attachment to the built heritage. Reaching and considering collective values and feelings about built heritage in an inclusive way contribute to the sense of identity and continuity, increasing the chances of a heritage attribute being conserved. Overall, the main contribution of this paper was to reveal the potential of applying social media analysis for participatory heritage management processes through the identification and interpretation of values and their association with sentiments and emotions.

Artificial intelligence methods were used to extract people's feelings and values assigned to windcatchers of Yazd from Instagram and Twitter over the last ten years. In contrast to some scholars' findings that people often use social media to be pessimistic about urban issues, posts rarely addressed negative sentiments over windcatchers in this research. Also, the association between values and the dominant emotions (namely joy, trust, and surprise) was analyzed, revealing some initial relations such as the relation between aesthetical values and joy, as well as, the scientific values and trust. Emotions might be related to the reasons why people convey value and how they interact with heritage and its attributes. Accordingly, this might affect how the public engages with heritage management. Still, this is just the start. Further research is needed to analyze the importance of emotions and how the relationship between emotions and value formation can be an asset for more inclusive heritage management.

The results of the data analysis provided a better understanding of the public's feelings and values assigned to windcatchers in Yazd, Iran. An innovative aspect of this research is the methodological process developed, which can be applied to other case studies with different scales.

Future studies are needed to advance social media data analytics, particularly concerning heritage management. First, social media's potential for crowdsourcing and real-time data analysis could drastically affect heritage management decision-making. The second issue is how to utilize the collective values and emotions expressed by online communities in heritage management to align with the sense of continuity and strengthen the collective memory and conservation of built heritage. Through these actions, social media and AI methods have the potential to contribute to more inclusive heritage management, bringing together a diversity of public voices in all its spectrum of positive and negative emotions and values. When better aware of the relation between values and sentiments, policymakers can better define their strategies, triggering them to rather invest in trust when motivating residents to keep their houses' windcatchers and use them as natural ventilation systems (conveying ecological and economic values), or in joy, when motivating residents to keep windcatchers based on beauty and scenery (aesthetical values). A small but crucial difference that can ensure the success of strategic planning in heritage management.