Place in the GIScience Community – an Indicative and Preliminary Systematic Literature Review

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The concept of place has recently gained importance in geographical information science (GIScience). One reason for this is the emergence of user-generated geographic information, which partially represents subjective everyday geographical encounters. No consensus, however, on how to deal with place in GIScience has yet been reached. This paper presents a systematic literature review providing an overview of how parts of the GIScience community currently use the concept of place as it is understood in human geography. The results suggest that most place related GIScience scholars refer to the humanistic tradition of geography focusing on the essence of experiences of place. Further, it is found that geotagged data published online are a major driver of place-based research, whereas scientific data (e.g., surveys) are less commonly found in respective papers. Many researchers make use of exploratory approaches, which may reflect the early stage at which place-based GIScience research still sits. We also identify a difference between the approach core members of GIScience take and those working on the edge of the field. Thereby, the former often work more conceptually than the latter. The results of this preliminary review inform the current GIScience discourse on place by important evidence about the intellectual standpoints of GIScience scholars, thus fostering future research into place.

1 Introduction

The use of user-generated information, partially depicting the world from the everyday perspective of normal people, has become commonplace in geographical information science (GIScience). Notions of place that are geared towards experienced and perceived space (opposed to the geometric notion that is usually used) are therefore currently gaining popularity (Purves et al., 2019; Westerholt et al., 2018a). The concept of place, however, is fuzzy and hard to grasp. Further, various academic disciplines developed their own subject-related definitions and vocabulary concerning place, oftentimes through the lenses of time and philosophical currents. A consistent GIScience understanding of place does not yet exist (Merschdorf and Blaschke, 2018). The vision of a place-based GIS (Goodchild, 2011), however, requires an unambiguous definition of place, its formalization, and ways to extract meaningful information from subjective user-generated data (Merschdorf and Blaschke, 2018).

Several publications appeared using various concepts of place or place-based data (e.g., Chen et al., 2018; Gao et al., 2017; Scheider and Purves, 2013; Winter and Freksa, 2012). Many place-related publications in GIScience thereby make use of conceptual frameworks borrowed from human geography and apply these in different contexts. This conceptual variety, indicating a lack of consensus, motivates

the main research question of the present contribution: *In which ways do GIScience and cognate scholars make use of the concept of place?*

We address this research question through a systematic literature review. In order to answer the research question on the basis of the identified corpus, all the collected articles are disassembled with regard to a range of aspects. That is, we extract the ways in which the authors make intellectual use of the concept of place in their contributions. This allows us to draw conclusions about the GIScience scholars' understanding of the concept of place and how they use it. One way we investigate this is to look at the referenced geographical literature. Another path taken is to investigate the methodological approaches applied, as these may hint on the understanding of place authors make use of. Another indication we consider is the identification of research objectives found in the records. The results obtained show clear indications of how the community handles place-based data. They also suggest potential future directions towards developing an unambiguous GIScience definition and understanding of the concept of place.

The remainder starts out by briefly introducing the concept of place in Section 2. Section 3 then outlines the approach taken for conducting the systematic literature review. The results of this review are presented in Section 4, before they are discussed and concluded in Section 5.

2   Place

Place has been of central interest to philosophers and geographers alike. The terms *place* and *platial*[1] have been used in different ways and contexts – from Aristotle (Drum, 2011) over Yi-Fu Tuan (Tuan, 1977) to Mike Goodchild (Goodchild, 2011). The ancient Greek philosophers Plato and Aristotle were probably the first to formulate a systematic philosophy of place. They coined the terms *topos* and *chôra* resembling the contemporary geographic concepts of *space* and *place* (Agnew, 2011; Casey, 1997). They thus distinguished two meanings of geographical space with space (topos) referring to a void location without qualities and place (chôra) being considered space imbued with meaning and identity: 'Place [...] is a part of the terrestrial surface that is not equivalent to any other, that cannot be exchanged with any other without everything changing. Instead, with space, each part can be substituted for another without anything being altered' (Farinelli, 2003, p. 11). This dualism thus has a long tradition and is still found in the contemporary literature.

Contemporary debates about place (including those in GIScience) are strongly influenced by the human-geographic discourse that began in the 1970s. Three general branches are typically distinguished: regional-geographic accounts of place, ideas from humanistic geography, and the process-oriented viewpoints of radical geographers (Cresswell, 2014). One understanding that has emerged since then is that the crisp dualism between space and place cannot hold true. Yi-Fu Tuan, one of the most influential scholars writing on place, noted in 1977 that '[w]hat begins as undifferentiated space becomes place as we get to know it better and endow it with value' (Tuan, 1977, p. 6). This makes clear that there is an inherent link between the abstract notion of space and place in the sense of lived space (Soja, 2008). GIScience scholars are facing the challenge to synthesize this complex concept into a notion that is available to formalization in a more technical context.

Any mathematical and computer-based approach to place requires formalized input, standardized and defined rules, and well-defined concepts and terminology (Goodchild, 2011). Another component of place is its dependence on context. People from different backgrounds have different ways to experience their everyday geographies. This is, for instance, reflected in the various ways in which the concept of place is expressed (and expressible) in different languages (Blaschke et al., 2018). Still, despite place being a heterogeneous and fuzzy concept, there also exists a core to it, a shared understanding that all languages treat space more as a container while place is usually interwoven with notions of human experience and perception. In order to work effectively and to ensure the comparability of research approaches, scholars should thus focus on this common core, which may serve as the basis for a thorough future understanding of place in GIScience.

3   Methodological Approach

The approach taken to answer the research question is a systematic literature review. We thereby borrow elements from Borrego's guidelines for systematic reviews in developing interdisciplinary fields (Borrego et al., 2014). In addition, we have classified the authors into two groups: core members of the GIScience community (evidenced by clear indications from their articles) and contributors from the fringes of the field. The way we have classified authors is as follows: Authors stating explicitly to be GIScientists in their papers are considered core members. As this may be too strict, we have relaxed the condition by also considering those core who explicitly mention the GIScience community and work on a topic from the core research agenda as proposed by Mike Goodchild and revisited by Thomas Blaschke and Helena Merschdorf (Blaschke and Merschdorf, 2014; Goodchild, 1992, 2010). The fringe of GIScience as utilized here then comprises authors who address at least two topics from that agenda alongside place. We anticipate that this is just one possible way to break down the community into finer parts. Still, it allows to gain a clearer picture of how the community approaches the topic of place. Our framework consists of four main steps (see Figure 1), which are outlined in the following subsections.

3.1 Inclusion and Exclusion Criteria

The protocol presented is the outcome of an iterative refinement procedure, which has improved and supplemented the initial version to improve the quality of the study. The main selection criteria are as follows: We only consider records written in English, as most publications within the GIScience community are published in this language. Most records are extracted from two main databases: *Thompson Reuters Web of Science* (multidisciplinary) and *ACM Digital Library* (focus on computer science). These cover a broad range of the relevant literature. In addition, we have manually added the proceedings of the PLATIAL'18 workshop published on ZENODO (Westerholt et al., 2018b), as well as the proceedings of the tenth International Conference on Geographic Information Science (GIScience 2018), since these contain relevant recent records. The temporal interval is set to $[1991, 2019]$, given that the GIScience community started operating under its name in 1991 with Mike Goodchild coining the term at a specialist meeting in that year (Goodchild, 1992, 2010). Clearly, this is a limitation as relevant literature from before 1990 might be available, too. Yet, setting 1990 as our start date reduces the variance and noise by constraining the considered community. Given the technical restrictions of our approach in terms of abstract screening (see below), only records with an abstract can be taken into consideration. It would otherwise not be possible to stick to the framework developed. This strategy has certainly led to the exclusion of relevant book chapters and other types of manuscripts. Subsequent work should take this into account. Finally, all records eligible need to discuss the concept of place itself (at a conceptual level), methodological approaches towards place, or the application of the concept within the GIScience community. Table 1 provides an overview of all queried databases and the search strings used.

3.2 Record Identification

The inclusion criteria led to the retrieval of 2,140 academic records from the Web of Science database (referred to as WOS hereafter) and 149 records from the ACM Digital Library (referred to as ACM hereafter). Removing duplicates ($n = 137$), records written in languages other than English ($n = 2$), records published before 1990 ($n = 1$), and those lacking an abstract ($n = 688$) has lead to a final inclusion of 1,461 academic records fulfilling all inclusion criteria. The corpus considered is structured as follows: 63% journal articles, 3% conference contributions, 18% book reviews, 7% editorials, 5% specialist meeting abstracts, 3% reviews, and 1% letter. This composition explains the high number of records lacking abstracts, as some of these categories do not normally come with abstracts (e.g., specialist meeting abstracts). The 1,461 records identified this way have entered the screening phase of the study.

3.3 Screening

The first screening step is the semi-automated abstract screening of the remaining 1,461 academic records. This is performed to remove unsuitable records lacking connection to the concept of place, to the GIScience community, or to the research question. To achieve this, we have compiled three
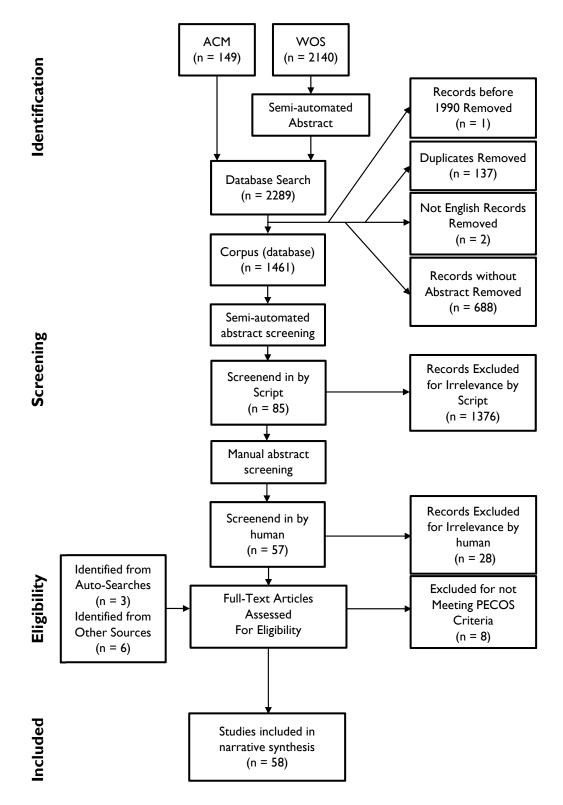
Figure 1: Systematic literature review approach. Overview of all stages of the systematic review.

Table 1: Database search strategy. The databases and search query strings used to carry out the review.

Database	Search Query String
Web of Science	(TI=("place" OR "places" OR "platial" OR "place based") AND TI=(GIScience OR Geoinformatics OR GIS OR "Geographic Information Science" OR "Geographic Information" OR ppgis OR "public participation gis" OR "spatial cognition" OR "cognitive reference" OR representation OR define OR defines OR defining OR defined OR definition OR definitions OR concept OR concepts OR formalization OR formalize OR formalized OR formalizing OR space OR spaces OR spatial OR methodology OR method OR technique OR application OR utilization)) AND LANGUAGE: (English), SSCI Timespan=1991-2019
ACM Digital Library	+acmdlTitle:(place platial) +acmdlTitle:(GIScience Geoinformatics GIS "Geographic Information Science" "Geographic Information" ppgis "public participation gis" "spatial cognition" "cognitive reference" representation define defines defining defined definition definitions concept concepts formalization formalize formalized formalizing space spaces spatial methodology method technique application utilization)

bags of keywords: one related to the concept of place, another one representing GIScience, and a third one reflecting the research question. Only records containing keywords from all three bags are taken into account further. In addition, a position-based syntactical context analysis was applied to exclude records that do not contain place and space-related terms in mutual vicinity of 10 positions. The choice of a maximum distance of 10 positions is to a certain extent arbitrary and should be replaced in further research by an improved syntactic procedure. Still, our results indicate that even the straight-forward approach taken here allows to get rid of general discussions about geography, where these terms would appear naturally. Performing this step leaves 85 papers for further manual abstract screening. During the manual screening step, another 28 records were excluded, as these did not discuss the concept of place (e.g., 8 publications were discussing hippocampal place cells), or used the term place in unintended ways (e.g., as a synonym for space, which was the case with more than 10 publications from computer science). It also turned out that some publications were not related to the GIScience community though they were discussing place as intended (more than 10 publications). After this step, 57 records were left for the final eligibility and quality assessment.

3.4 Quality Assessment

The final step is based on assessing the full text of the 57 records left from the screening step, 8 of which failed to match the criteria of this study as identified by manual screening. In all, 58 records fulfilled all criteria and were thus considered eligible. The quality assessment tasks (QA) defined in regard to the research question help to evaluate certain individual aspects:

- QA 1: *Is the concept of place utilized articulated clear enough to allow any assessment?* This criterion determines whether the explanation is adequate to fully identify the concept used.

- QA 2: *Do the authors modify a concept of place or do they develop a novel conceptual contribution?* This criterion focuses on the originality of an author's contribution and engagement with place.

- QA 3: *Do the authors develop new methods regarding the concept of place?* This criterion shows the depth of the authors' engagement with the concept of place at a methodological level.

- QA 4: *Is the application of the concept of place original and creative in an empirical sense?* If so, this shows that the authors are seriously engaging in empirical investigations of particular places.

- QA 5: *Are the limitations of the concept of place used clearly outlined?* This demonstrates a strong awareness for, and a critical reflection of, potential weak points of the approach applied.

Points were awarded to rank the individual records. Thereby, 1 point was awarded if a criterion was fully met, 0.5 points indicate partial fulfilment, and 0 points were given when a record failed to meet a criterion. Based on this, the records were classified into the categories 'good' (5–3.5 points), 'fair' (3.0–2.5), and 'poor' (< 2.5 points), which has identified 30 studies to be of good quality, 26 were found to be fair, whereas only 2 studies were considered poor.

3.5 Limitations

The approach taken has several limitations. The number of databases searched is two and therefore small. This is justified by the broad scope of the databases and because the scope of this study is relatively narrow. However, there is a chance that some relevant records might have been missed out. In addition, only English-language publications are considered, which leads to an absence of publications in other languages. However, we regard this as only a minor limitation, as the majority of the scholarly literature on the topic in question is written in English. Further, the search terms should be extended in future research to better match some areas that may be underrepresented in this study. For instance, keywords like 'spatial cognition' are contained, but other terms representing psychological aspects more comprehensively may be required in order to better reflect the importance of that field (see Davies, 2018). Further research related to identifying relevant place-related keywords could optimize the results further. The manual screening has been conducted using a detailed protocol but was not verified using a peer-review including a larger number of scholars. A last point worth mentioning is that our decision for a proximity-based context analysis might have given preference to records referring to the works of humanistic geographers. Nevertheless, the results discussed in the next section are still meaningful in the light of our research question.

4   Results

Among the retrieved records are 48 journal articles, 4 short papers, 4 conference proceeding papers, and 2 literature reviews. All those records were published between 1994 and 2019, with 39 of them being published after 2009 and at increasing annual publication rates. This finding supports the observation that the concept of place is becoming more popular recently within the GIScience community (Purves et al., 2019; Westerholt et al., 2018a). Institution-wise, the authors mainly come from the fields of geography (ca. 50%) and GIScience/geoinformation (ca. 30%), as well as other fields like architecture, cartography, remote sensing and, history (ca. 20% all together). A closer look at the authors reveals that Thomas Blaschke participated in three publications. Tim Cole, Song Gao, Alberto Giordano, Helena Merschdorf, and Emmanuel Papadakis have all participated in two publications. These are the most active authors identified in our corpus. Nevertheless, some key authors like Ross Purves are absent in the results. This indicates that some important keywords may be missing in our approach presented. The results presented in this short paper can thus be considered an impetus to the conception of a full assessment of GIScience's involvement with place.

4.1 Geographic Place Concepts Applied

We found that within the 58 retrieved academic records 20 different concepts of place were applied. Still, 13 records did not refer to any particular concept of place from the literature. Out of the 20 different concepts, 13 are used less than 3 times and 9 of them were only used once. The core members of the GIScience community appear to use a greater variation of concepts. Among them, more than 57% of the concepts used appeared once while for the records assigned to the contributors this holds true for 47%. The concepts of place that were applied most often are those from the phenomenological understanding of place proposed by Yi-Fu Tuan and related scholars. Tuan's concept (Tuan, 1977) was applied 14 times (members: $n = 6$; contributors: $n = 8$), closely followed by the work of Agnew (1987), which was used 6 times (members: $n = 3$; contributors: $n = 3$). Cresswell's concept (Cresswell, 1996) was applied 4 times (members: $n = 1$; contributors: $n = 3$), and Curry's concept (Curry, 1999) also was

applied 4 times (members: $n = 2$; contributors: $n = 0$). Finally, Lefebvre's related concept of social space (Lefebvre and Nicholson-Smith, 1992) was applied twice (members: $n = 0$; contributors: $n = 2$).

4.2 Types of Place-Based Data Used

We have also briefly looked into the types of place-based data used across the corpus identified. The most frequently used type of data is online geotagged data (like those extracted from social media; contributors: 22%; members: 21%), followed by interview data acquired for the purpose of investigating specific places (contributors: 24%; members: none), secondary data identified from the academic literature (contributors: 11%; members: 43%), and traditional GIS data (e.g., administrative data sets; contributors: 9%; members: 29%).

4.3 Methodologies Applied

We identified 11 different methodological approaches within the retrieved records. The most prevalent type of methodology was case studies being found in roughly more than 36% of all records (contributors: 36%; members: 38%). Another frequently found approach is data exploration with a coverage of 19% (contributors: 21%; members: 8%), followed by literature review and analysis with an approximate share of 12% (contributors: 7%; members: 31%). Further popular approaches found are methodological frameworks to investigate place-related data (contributors: 7%; members: 23%), and social-scientific and human-geographic study designs (in the sense of workflows; contributors: 9%; members: none).

4.4 Research Objectives

The objectives for which the concept of place is being employed can be sorted into 19 categories overall. Investigating place–human relations are the most frequently articulated goals ($n = 15$), followed by the closely related categories of sense-of-place analyses ($n = 9$) and investigations into the meanings of places ($n = 8$). A more technical goal articulated often is to visualize places ($n = 8$). Overall, core members of the GIScience community showed a more technical and conceptual focus. In contrast, GIScience contributors seem to be more interested in applying place-based information and concepts to work on related applied tasks.

5   Discussion and Conclusions

The results outlined disclose interesting patterns and trends. Most GIScience authors covered in our corpus do not lay out in much detail their theoretical stance on place. Oftentimes, a range of human-geographic and philosophical authors are cited, but the actual ontological standpoint taken, especially with respect to place-based information, is not elaborated in much depth. This, on the one hand, shows that GIScience authors are aware of a range of concepts available from geography. This finding is further underpinned by our observation that core GIScience community members refer to a greater variety of place concepts than contributors coming more from the fringes of the field. On the other hand, this observation also shows that in many cases place is used in an ambiguous manner. Clearly, a more thorough understanding of place (in a geographic sense) and the nature of place-based information (in a GIScience sense) will be necessary to foster an efficient and fruitful future development of this field within GIScience.

The most frequently applied place concepts are those borrowed from humanistic geography. Accordingly, we found Yi-Fu Tuan and John Agnew to be the two most frequently cited authors, both coming from a phenomenological background rooted in experience. At the same time, humanistic geography is also concerned with the 'essence of place', i.e., the intersubjective core elements that render place important for humanity and human existence (Cresswell, 2014). This focus on the underlying structure is probably preferred by GIScience authors, because the more formal approach taken in information science is easier aligned with this viewpoint. Nevertheless, a stronger engagement with other approaches like those found in descriptive regional geography, process-oriented radical geography, or more recent relational approaches like those from non-representational geography would benefit the development of a holistic GIScience notion of place-based information.

We further found that exploratory empirical works are prevalent among the study designs applied. Being in line with our finding that there is no consensus on place in GISscience, the prevalence of exploratory approaches seems very reasonable. The given context thus favours and requires preliminary research to provide a clearer picture of what can, in principle, be done academically with the types of place-based information available. Exploratory frameworks in this sense enable the uncomplicated study of problems that lack a clear epistemological agreement caused by the ambiguity around the concept of place and what the community aims to do with it (Shields and Rangarajan, 2013). This is also well aligned with the other important type of study design, which is case studies. Looking at particular, specific places in depth, however, can still be helpful to develop a better general understanding of place.

Data-wise, GIScience research on place seems to be driven to some extent by the increasing availability of geotagged online information. In our results we found that 22% of all considered manuscripts deal primarily with one particular kind of data set in an empirical manner. These data sets includes social media but also geotagged blogs and other items from the Geoweb (Scharl and Tochtermann, 2007). Acknowledging the technical nature of the field, this can be considered a pragmatic approach. Now that new kinds of data are available, the community seems to be looking for ways to make sense of the novel kinds of information these provide. The results obtained thus indicate that the GIScience community is to some extent responding to the availability of new data sources in a pragmatic manner. Still, the GIScience community is not only driven by data but also partly by their overlap with geography. Many GIScience scholars are working in geographical institutions and thus in close contact with human geographic colleagues. This may hence explain the relatively strong interest in human-place relations including sense-of-place (in opposition to physical and other aspects of place), particularly among the core members of the community. This finding confirms a certain intellectual like-mindedness shared between GIScience and human-geographic scholars.

The results obtained are to be considered preliminary. This is due to the initial character of this review but also to the relatively small number of manuscripts ultimately considered. Still, though being non-exhaustive, the small number of manuscripts may hint on a reasonably rigorous approach. Therefore, to conclude the article, we offer the following main conclusions drawn from the evidence gained from the systematic literature review:

1. The GIScience community seems to currently focus on humanistic geographical approaches but may benefit from a more inclusive and broader consideration of geographical approaches to place.

2. The results indicate that the community is looking very much towards available data sets, thereby taking a very pragmatic viewpoint. More conceptual work independent of specific forms of data could be beneficial to the future development of the field. Some promising works into this direction are already available (e.g., Scheider and Janowicz, 2014; Winter and Freksa, 2012).

3. The review results indicate deviating behaviour in response to place between core members of GIScience and others contributing more from the fringes of the field. The work contributed by the core members thereby seems to be more conceptual in nature. This is promising as it shows that the core members of the community seem to focus on developing novel concepts of handling place-based information, while related yet more empirical scholars add another valuable viewpoint to the discourse by applying these.

Notes

1.   To the best of our knowledge, the adjective *platial* has first been used by Casey (1993).

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References

Agnew, John A: *Place and politics*. Winchester, MA, USA: Allen and Unwin, 1987

—— *Space and place*. In: Agnew, John and Livingstone, David N (eds.), *The SAGE Handbook of Geographical Knowledge*, London, UK: SAGE, 2011, vol. 2011. 316–331

Blaschke, Thomas and Merschdorf, Helena: *Geographic information science as a multidisciplinary and multiparadigmatic field*. Cartography and Geographic Information Science, 41(3), 2014, 196–213. doi: 10.1080/15230406.2014.905755

Blaschke, Thomas; Merschdorf, Helena; Cabrera-Barona, Pablo; et al.: *Place versus space: from points, lines and polygons in GIS to place-based representations reflecting language and culture*. ISPRS International Journal of Geo-Information, 7(11), 2018, 452. doi: 10.3390/ijgi7110452

Borrego, Maura; Foster, Margaret J; and Froyd, Jeffrey E: *Systematic literature reviews in engineering education and other developing interdisciplinary fields*. Journal of Engineering Education, 103(1), 2014, 45–76. doi: 10.1002/jee.20038

Casey, Edward: *The fate of place: a philosophical history*, 1997

Casey, Edward S: *Getting back into place: toward a renewed understanding of the place-world*. Bloomington, IN, USA: Indiana University Press, 1993

Chen, Hao; Winter, Stephan; and Vasardani, Maria: *Georeferencing places from collective human descriptions using place graphs*. Journal of Spatial Information Science, 2018(17), 2018, 31–62. doi: 10.5311/JOSIS.2018.17.417

Cresswell, Tim: *In place/out of place: geography, ideology, and transgression*. Minneapolis, MN, USA: University of Minnesota Press, 1996

—— *Place. An introduction*. Hoboken, NJ, USA: Wiley and Sons, 2014

Curry, Michael R: *"Hereness" and the normativity of place*. In: Proctor, James D and Smith, David M (eds.), *Geography and Ethics*, London, UK: Routledge, 1999. 95–105

Davies, Clare: *Place and placing locations: a cognitive perspective*. In: Westerholt, Rene; Mocnik, Franz-Benjamin; and Zipf, Alexander (eds.), *Proceedings of the 1st Workshop on Platial Analysis (PLATIAL'18)*. 2018, 15–20. doi: 10.5281/zenodo.1472737

Drum, Peter: *Aristotle's definition of place and of matter*. Open Journal of Philosophy, 1(1), 2011, 35–36. doi: 10.4236/ojpp.2011.11006

Farinelli, Franco: *Geografia: un'introduzione ai modelli del mondo*. Turin: Einaudi, 2003

Gao, Song; Janowicz, Krzysztof; Montello, Daniel R; et al.: *A data-synthesis-driven method for detecting and extracting vague cognitive regions*. International Journal of Geographical Information Science, 31(6), 2017, 1245–1271. doi: 10.1080/13658816.2016.1273357

Goodchild, Michael F: *Geographical information science*. International Journal of Geographical Information Systems, 6(1), 1992, 31–45. doi: 10.1080/02693799208901893

—— *Twenty years of progress: Giscience in 2010*. Journal of Spatial Information Science, 2010(1), 2010, 3–20. doi: 10.5311/JOSIS.2010.1.2

—— *Formalizing place in geographic information systems*. In: Burton, Linda M; Matthews, Stephen A; Leung, ManChui; Kemp, Susan P; and Takeuchi, David T (eds.), *Communities, neighborhoods, and health*, New York, NY, USA: Springer, 2011. 21–33. doi: 10.1007/978-1-4419-7482-2_2

Lefebvre, Henri and Nicholson-Smith, Donald: *The production of space*. Chichester, UK: Wiley, 1992

Merschdorf, Helena and Blaschke, Thomas: *Revisiting the role of place in geographic information science*. ISPRS International Journal of Geo-Information, 7(9), 2018, 364. doi: 10.3390/ijgi7090364

Purves, Ross S; Winter, Stephan; and Kuhn, Werner: *Places in information science*. Journal of the Association for Information Science and Technology, 70(11), 2019. doi: 10.1002/asi.24194

Scharl, Arno and Tochtermann, Klaus: *The geospatial Web*. London, UK: Springer, 2007

Scheider, Simon and Janowicz, Krisztof: *Place reference systems. A constructive activity model of reference to places*. Applied Ontology, 9(2), 2014, 97–127. doi: 10.3233/AO-140134

Scheider, Simon and Purves, Ross: *Semantic place localization from narratives*. Proceedings of the 1st ACM SIGSPATIAL International Workshop on Computational Models of Place (COMP), 2013. doi: 10.1145/2534848.2534858

Shields, Patricia M and Rangarajan, Nandhini: *A playbook for research methods: integrating conceptual frameworks and project management*. Stillwater, OK, USA: New Forums Press, 2013

Soja, Edward W: *Thirdspace: toward a new consciousness of space and spatiality*. In: Ikas, Karin and Wagner, Gerhard (eds.), *Communicating in the Third Space*, New York, NY, USA: Routledge, 2008. 63–75

Tuan, Yi-Fu: *Space and place. The perspective of experience*. Minneapolis, MN, USA: University of Minnesota Press, 1977

Westerholt, Rene; Gröbe, Mathias; Zipf, Alexander; and Burghardt, Dirk: *Towards the statistical analysis and visualization of places*. Proceedings of the 10th International Conference on Geographic Information Science (GIScience), 2018a. doi: 10.4230/LIPIcs.GISCIENCE.2018.63

Westerholt, Rene; Mocnik, Franz-Benjamin; and Zipf, Alexander: *Introduction to the PLATIAL'18 workshop on platial analysis*. In: Westerholt, Rene; Mocnik, Franz-Benjamin; and Zipf, Alexander (eds.), *Proceedings of the 1st Workshop on Platial Analysis (PLATIAL'18)*. 2018b, 1–5. doi: 10.5281/zenodo.1475267

Winter, Stephan and Freksa, Christian: *Approaching the notion of place by contrast*. Journal of Spatial Information Science, 5, 2012, 31–50. doi: 10.5311/JOSIS.2012.5.90