Poster: Future Work Statements at SOUPS

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1 Introduction

Extending knowledge by identifying and investigating valuable research questions and problems is a core function of research. Research publications often suggest avenues for future work to extend their results, and usable privacy and security (UPS) researchers commonly add future work statements (FWS) to their publications. We define FWS as a passage in a research article that suggests future work ideas that the research community could address. Considering these suggestions can help with developing research ideas that efficiently utilize prior research resources and produce results that tie into existing knowledge. However, our community lacks an in-depth understanding of FWS' prevalence, quality, and impact on future research in the UPS field.

Our work aims to address this gap by reviewing all 27 papers from the 2019 Symposium on Usable Privacy and Security (SOUPS) proceedings and analyzing their FWS. Additionally, we analyzed 978 publications that cite any paper from SOUPS 2019 proceedings to assess their FWS' impact. We answer the following research questions:

RQ1 *How do SOUPS research articles include future work statements?*

RQ2 *To what extent do researchers address future work statements from SOUPS research articles?*

We find that most papers include FWS, which are often unspecific or ambiguous. Therefore, the citing publications often matched the future work statements' content thematically, but rarely explicitly acknowledged them, indicating a limited

impact. We conclude with recommendations for the usable privacy and security community to improve the utility of FWS by making them more tangible and actionable, and avenues for future work.

2 Related Work

Research on context-based citation analysis and use of information retrieval and natural language processing (NLP) techniques in bibliometrics investigates future work statements [10, 23, 28, 19, 22, 47, 48]. Barata and da Cunha introduced a research debt life cycle based on manual FWS analysis, showcasing points in the research process where future work statements can and do have an impact [4]. Meta-research to investigate research and publication practices is an upcoming topic in the UPS community [11, 20]. We add our insights on the prevalence and impact of future work statements to this growing body of knowledge about meta-research in USP and adjacent fields.

3 Methodology

Our systematic literature analysis of FWS consists of two parts, as depicted in the methods overview on the poster. (i) First, we investigate all 27 publications from the SOUPS 2019 proceedings to identify FWS and analyze them in depth. (ii) Second, based on these publications, we analyzed whether and how 978 publications that cite one of the SOUPS 2019 publications implement or address the originally proposed future work. We decided to focus on SOUPS publications, as SOUPS is the premier venue with a focus on publishing UPS research. Moreover, we analyze the 2019 SOUPS proceedings, as they discuss recent research, but are mature enough that other researchers had almost five years to address suggestions from the 2019 future work statements. Our analysis of published materials has no human subjects and contains no sensitive data, thus we do not see ethical concerns, do not further discuss ethics, and did not request IRB approval.

3.1 Dataset

For our systematic literature analysis, we compiled a dataset with relevant literature. This corpus consists of two parts:

SOUPS 2019 Proceedings (n = 27). For the analysis of future work statements, we considered all 27 publications from the SOUPS 2019 proceedings. We collected the set of publications based on bibliographic data from *DBLP* [8], and validated completeness with a comparison to the SOUPS full proceedings and technical sessions [41].

Citing Publications (n = 978). To investigate the implementation of future work statements, we included all citations of the aforementioned SOUPS 2019 papers. We consider publications that cite a (SOUPS 2019) paper potential future work of the original paper. To identify citations, we used *Google Scholar*, which yields 1,484 citations of the SOUPS 2019 publications (as of December 2023).

3.2 Data Analysis

Analyzing FWS. In the 27 SOUPS 2019 papers, we identified and analyzed all FWS. The first author read all publications [24] (only skipping related work sections) and marked all FWS.

Analyzing Citing Publications. For the 978 citing publications, we analyzed if and how any of the initially identified FWS were implemented. To assess whether citing publications implement future work of the initial SOUPS papers, the first author reviewed all citations for each SOUPS 2019 paper. For each citing paper, the researcher read its title and abstract and examined the context to identify whether the paper implements any of its future work, similar to the three pass approach for reading papers [24]. For each paper that implemented future work, we performed an in-depth analysis and focused on how exactly the FWS of the initial SOUPS 2019 paper was implemented, if the FWS was acknowledged, or if it was just general follow-up work (e.g., reusing methods, replications).

4 Results

Summary RQ1. We find that 26 of 27 papers in the 2019 SOUPS proceedings contain 129 FWS in total (cf. Table 2), with a median of 4 FWS per paper (SD=2.67). FWS had an average length of 39.25 words (MD=35, SD=20.47). Most future work statements were located in the discussion section followed by sections containing "future work" in the title (cf. Figure 1). However, some were also placed in less obvious places such as next to specific results, where they are at a higher risk of being overlooked by readers. FWS commonly pointed out new research areas, topics, and goals. They also called for the investigation of the impact of potential factors of influence, methodological extensions, consideration of insights in future research design, examination of additional populations, and reuse of methodological contributions (cf. Table 1). We identified four different levels of FWS specificity: broad/ambiguous, clearly stating a research objective, clearly stating a research method, and clearly stating a research objective and method (cf. Figure 2).

Summary RQ2. We find that eight of 129 future work statements have been implemented and acknowledged by seven citing publications, starting the year after the original SOUPS publication (Figure 3). While the sample is too small for a statistical evaluation, we see a tendency of FWS from more often cited publications, to be more likely to be implemented in the future (see Table 2). Overall, the SOUPS 2019 publications inspired future research without necessarily acknowledging FWS. For example, thematic similarity or reuse of similar methods can inspire future work, or replications were conducted as an obvious future work direction—not needing to be outlined by a FWS. Authors rarely implemented their own FWS, in six cases it was a distinct set of authors for the citing publication and the SOUPS 2019 publication containing the corresponding FWS. Interstingly, no paper that implements a FWS was published at SOUPS. Implemented and acknowledged statements often called for an extension of their methodology.

5 Recommendations & Future Work

Based on our findings, we recommend that if authors decide to include FWS, they should derive specific research objectives from their detailed insights into the used methods and studied problem. The FWS should be easily findable in a designated subsection. To encourage well thought-out, actionable FWS, we recommend that researchers who implement them explicitly acknowledge FWS that they base their work on.

In writing a paper on future work, we aim to give future work statements that follow the aforementioned recommendations. While this paper comprehensively investigates the future work statements in SOUPS 2019 papers and how they are implemented, we lack insights for other years and venues. Therefore, we suggest to conduct similar studies for other years and venues, e.g., to validate our results. To this end, our methodology and coding could be directly replicated by other researchers. As outlined in Section 2, several NLP-based approaches for future work analyses exist. We propose applying those to facilitate a literature review of future work statements on a larger corpus of UPS publications. Our provided dataset of future work statements can be used as ground truth to fine-tune models for UPS research or evaluate the existing NLP approaches' performance.

arXiv Publication

We published a full paper with more detailed results on arXiv: https://arxiv.org/abs/2405.20785 [42].

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Availability

To support transparency, verifiability, and repeatability of our work, we provide the following artifacts: (1) annotated dataset of future work statements from SOUPS 2019 proceedings, (2) dataset of 978 publications that cite one or more SOUPS 2019 papers. The artifacts are available for review at: https://doi.org/10.17605/OSF.IO/QKFNB
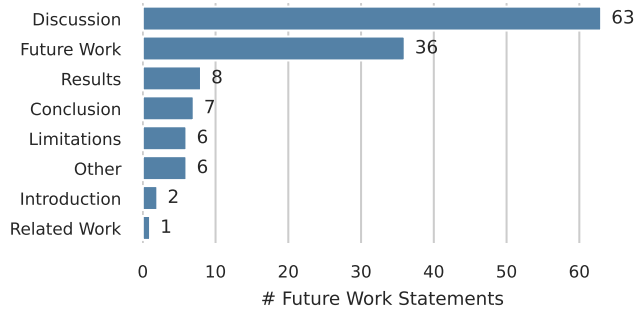
Figure 1: Distribution of future work statements in different sections in the SOUPS 2019 proceedings.
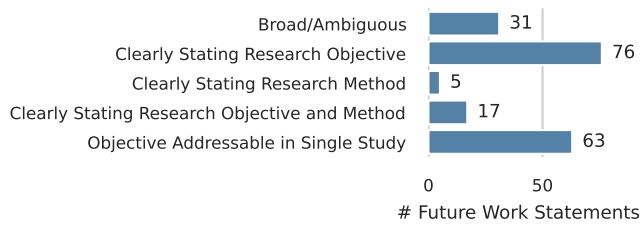

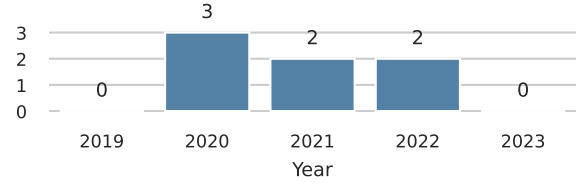Figure 2: Summary of future work statement specificity.

Figure 3: Publication years of citing publications that implement a future work statement from SOUPS 2019 papers.

Table 1: Summary of the six FWS categories we identified and their distribution in the SOUPS 2019 proceedings. Multiple categories are possible for one future work statement.

Category	Definition	#FWS[1]
Future Research Target*	The future work statement points out a specific area, a topic, or a goal for future research.	49
Potential Factors of Influence*	The future work statement asks the researcher to further investigate the effect of potentially influential factors uncovered in the study.	34
Extension of Methodology	The future work statement asks future research to address limitations inherent to the study's methodology or to verify or expand the results with an extended or different methodology.	24
Supportive*	The future work statement describes how the contributions of the study can support future research design decisions.	12
Different Populations	The future work statement calls for an examination of (a) different population(s).	11
Utilize Contributed Methodology*	The future work statement calls for future research to utilize a methodology or study instrument that the study contributes.	5

* Adapted from Zhu et al. [48].   [1] Number of future work statements.

Table 2: Overview of all 27 SOUPS 2019 publications, their future work statements, and citing publications which implemented the future work statements.

SOUPS 2019 Proceedings	#Cites[1]	Has FWS[2]	#FWS[2]	Implementation and Acknowledgment of Future Work Statements		
[1] Abdi et al.	2	●	4	○	0	—
[2] Alqhatani and Lipford	44	●	2	○	0	—
[3] Ayalon and Toch	13	●	7	○	0	—
[5] Busse et al.	54	●	4	○	0	—
[6] Ciolino et al.	51	○	0	○	0	—
[7] Das et al.	51	●	4	●	1	Murthy et al. [33] (2021)
[9] Di Martino et al.	62	●	6	○	0	—
[12] Drury and Meyer	41	●	4	○	0	—
[13] Faklaris et al.	66	●	7	○	0	—
[14] Frik et al.	135	●	7	●	1	Ray et al. [37] (2020)
[15] Fulton et al.	37	●	4	○	0	—
[17] Habib et al.	81	●	2	○	0	—
[21] Hayes et al.	50	●	8	○	0	—
[26] Kum et al.	16	●	10	○	0	—
[27] Li et al.	60	●	7	●	1	Martius and Tiefenau [29] (2020)
[30] Mecke et al.	12	●	11	○	0	—
[31] Mecke et al.	4	●	5	○	0	—
[32] Mhaidli et al.	64	●	7	○	0	—
[34] Patnaik et al.	50	●	3	○	0	—
[35] Pearman et al.	141	●	5	○	0	—
[36] Qin et al.	27	●	2	○	0	—
[38] Reese et al.	160	●	2	●	2	Kruzikova et al. [25] (2022), Golla et al. [16] (2021)
[40] Simoiu et al.	41	●	7	○	0	—
[43] Tabassum et al.	136	●	5	●	2	Sereda [39] (2022), Haney et al. [18] (2020)
[44] Vance et al.	36	●	3	○	0	—
[45] Voronkov et al.	21	●	1	○	0	—
[46] Wu et al.	29	●	2	○	0	—
Total	1,484	26	129	5	7	

[1] Number of citations of the SOUPS 2019 paper (as of December 2023).   [2] Number of future work statements in the SOUPS 2019 paper.