"What's going on in Accessibility Research?" Frequencies and Trends of Disability Categories and Research Domains in Publications at ASSETS

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ABSTRACT

ACM SIGACCESS Conference on Computers and Accessibility (ASSETS) is considered one of the premium forums for research on accessibility. Recently, Mack *et al.* shed light on the demographics, goals, research methodologies, and evolution of accessibility research over time. We extend their work by exploring the frequencies and trends of disability categories and computer science research domains in publications at ASSETS (N=1,678). Our results show that disability categories and research domains varied significantly across the publication years. We found that in the past 10 years, publications targeting *Mental-Health-Related* disabilities and the research domain of *AR/VR* show an increasing trend. In opposition, *Gaming*, *Input Methods/Interaction Techniques*, and *User Interfaces* domains portray a decreasing trend. Additionally, our results show that the majority of the publications utilize the *AI/ML/CV/NLP* domain (19%) and focus on people with visual disabilities (42%). We share our preliminary exploration results and identify avenues for future work.

CCS CONCEPTS

• **Human-centered computing** → **Accessibility theory, concepts and paradigms**; **Accessibility design and evaluation methods**; • **Social and professional topics** → **People with disabilities**.

KEYWORDS

accessibility, disability categories, research domains, frequency, trend, assets

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1 INTRODUCTION

With the increase in disability awareness, research focusing on accessible and assistive technology for disabled people has drastically increased over the past few years [3, 11]. While several venues exist for accessibility-related publications, the ACM SIGACCESS Conference of Computing and Accessibility (ASSETS) is amongst the premium forums for publications focusing on the design, evaluation, use, and education related to computing for disabled people [1]. Given its reputation for publishing top-tier work, ASSETS is the go-to conference for both seasoned and new researchers.

Understanding the evolution of accessibility research over time at ASSETS can reveal crucial information, including norms, gaps, and adoptions of technical and societal concepts in academia [6, 8, 11]. Such information is beneficial for researchers to reflect on the growth of accessibility as a research field and can guide them in identifying avenues for future work. Prior work has conducted literature surveys for sub-demographics within the disability demographic [4, 5, 10, 11, 13, 16–18]. Most relevant to our work is the recent exploration by Mack *et al.* [11] that seeks to understand the demographics, goals, research methodologies, and evolution of accessibility research over time. We build on their work by (1) extending their identified communities of focus to incorporate more nuanced disability categories; (2) investigating the utilization of computer science research domains over time; and (3) conducting

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Table 1: Overview of keyword counts and percentages, and trend analyses for each disability category and research domain in publications at ASSETS overall (2000-2021) and in recent years (2012-2021). N is the total keyword count and % is the percentage compared to the total keyword count for all the categories. τ is the measure of the ordinal association between categories/domains and their ratios (+ve τ values mean increasing trend and -ve τ values mean decreasing trend). p shows the statistical significance of the trend (α=.05).

	Overall (2000-2021)				*Past 10 Years (2012-2021)*			
	N	*%*	τ	***p***	*N*	*%*	τ	***p***
Disability Category								
Auditory	256	17%	.57	**<.001**	183	18%	.32	.243
Chronic Illness	11	1%	-.07	.740	6	1%	-.08	.838
Cognitive	188	12%	.03	.871	116	11%	-.07	.858
Learning	89	6%	.39	**.019**	67	7%	-.09	.788
Mental-Health-Related	13	1%	.60	**<.001**	12	1%	.60	**.026**
Mobility	175	11%	.08	.650	116	11%	-.11	.721
Neurological	55	4%	.01	.998	37	4%	-.32	.243
Older Adults	98	6%	-.08	.626	58	6%	.09	.788
Visual	643	**42%**	.15	.381	419	**41%**	.20	.474
Research Domain								
3-D Representation	71	3%	.54	**<.001**	62	4%	-.07	.858
AI/ML/CV/NLP	498	**19%**	-.32	.051	280	**18%**	.33	.211
AR/VR	75	3%	.32	.055	61	4%	.54	**.039**
Educational/Methodological/Theoretical	401	16%	.22	.194	256	16%	.47	.074
Gaming	103	4%	.23	.163	75	5%	-.51	**.049**
Hardware Tools	281	11%	-.11	.516	163	10%	-.07	.858
Input Methods/Interaction Techniques	252	10%	-.39	**.019**	139	9%	-.56	**.032**
Media/Graphics/Visualizations	283	11%	.28	.098	180	11%	.24	.371
Security/Privacy	44	2%	.31	.067	35	2%	.11	.721
Software Tools	299	12%	-.10	.559	180	11%	-.09	.788
User Interfaces	159	6%	-.55	**<.001**	68	4%	-.51	**.049**
Wearables	89	3%	.55	**<.001**	78	5%	.45	.088

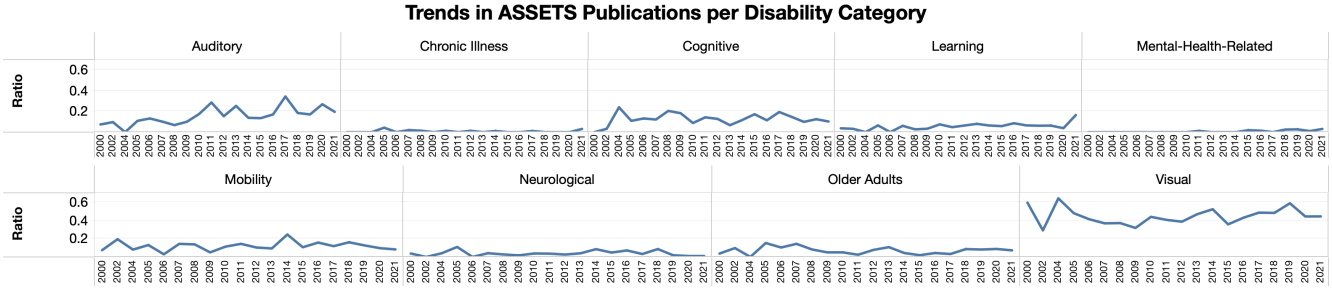

Figure 1: Trends for each disability category in ASSETS publications overall (2000-2021).

empirical statistical analyses to explore the frequencies and trends of each disability category and research domain.

To shed more light on the frequencies and trends in accessibility research, first, we scraped the keywords from ASSETS papers published since 2000, including poster and demonstration papers. Then, we manually categorized the keywords into nine disability categories and 12 research domains to analyze the frequencies and trends for each category and domain over time. We further analyzed our data by filtering the publications to only include those published recently (past 10 years; 2012-2021). Overall, we extracted 3,234 keywords from 1,678 papers.

We found that disability categories and research domains vary significantly across publication years. Visually disabled people were the largest targeted audience (42% overall and 41% in the past 10 years), and publications on *Mental-Health-Related* disabilities show

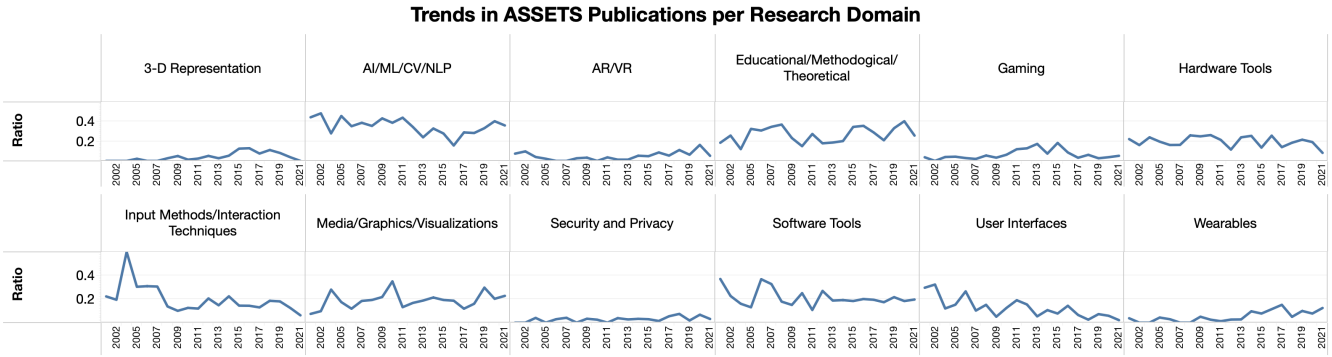

Figure 2: Trends for each research domain in ASSETS publications overall (2000-2021).

an increasing trend overall and in recent publications. Additionally, the majority of the publications employed the research domain of *AI/ML/CV/NLP* (19% overall and 18% in the past 10 years), with publications on *AR/VR* showing an increasing trend in recent years. In contrast, *Gaming*, *Input Methods/Interaction Techniques*, and *User Interfaces* domains showed a decreasing trend in recent years.

We contribute the empirical findings from our preliminary explorations. Specifically, we provide the results from our statistical analyses of frequencies and trends of (1) disabilities categories and (2) research domains over the past (1) 20 years (2000-2021; ASSETS skipped publications in 2001 and 2003) and (2) 10 years (2012-2021). Additionally, we identify avenues for future work.

2 FREQUENCIES AND TRENDS IN PUBLICATIONS AT ASSETS

We studied the frequencies and trends of disability categories and computer science research domains by extracting 3,234 keywords from 1,678 publications at ASSETS. We present our methodology, analysis, and quantitative results.

2.1 Data Collection & Procedure

We queried the ACM Digital Library to collect the author keywords of all the papers published at ASSETS (N=1,678) since its inception in 1994, similar to prior work [10, 11]. However, unlike these works, our data set included the poster, panel, and demonstration papers. Due to missing author keywords in publications from years before 2000 (only 59% had author keywords), we reduced our data set to publications from 2000 onward (90% had author keywords). After reduction, our data set included 3,234 keywords from 1,603 papers. We provide our collected keywords with their overall counts in the supplementary materials.

First, we defined the factor levels for disability categories and research domains. We selected the disability categories from prior work [15]. For the computer science research domains, we finalized the set through discussions with well-published researchers at ASSETS. Then, we manually categorized each keyword into appropriate disability categories and research domains (a keyword could belong to multiple categories and research domains). For research domains, categorization qualifications included applied work. We eliminated broad (e.g., "accessibility") and ambiguous (e.g., "Germany") keywords from our data set. After categorization, we calculated ratios for each category and domain per publication year. (Ratio was the frequency of the total papers containing a given category/domain's keywords divided by the total number of publications with at least one author keyword per year.) Our final set comprised a total of 1,885 keywords.

At least three researchers participated in the keyword categorization process to account for accurate categorization. We resolved any disagreements through mutual discussions.

2.2 Analysis & Results

Our goal was to examine the frequencies and trends of disability categories and research domains in overall (2000-2021) and recent (2012-2021) publications at ASSETS. Our preliminary analysis using Anderson-Darling [2] tests of normality showed that the ratios were conditionally non-normal. Therefore, we used a generalized linear model [7, 14] with Gamma distribution and log link function to investigate frequencies, as our data was positive and right-skewed. *Category* (C) and *Domain* (D) were the independent variables for analyzing disability categories and research domains, respectively, whereas *Ratio* (R) was the dependent variable. Additionally, we used Mann-Kendall [9, 12] test to evaluate temporal trends for each category and their respective ratios across the publication years.

2.2.1 Disability Categories. Our results show a significant main effect of *Category* (C) on R ($\chi^2(1, N=180)=363.83$, $p<.001$, Cramer's $V=.50$), with 42% of the publications on the disability category *Visual*. Filtering the publication years to include only the past 10 years (2012-2021) yields similar results, showing a significant main effect of C on R ($\chi^2(1, N=90)=253.32$, $p<.001$, Cramer's $V=.59$) and 41% focusing on people with *Visual* disabilities. These results indicate that the disability categories vary significantly in ASSETS publications. Figure 3 (Appendix A) and Table 1 show the percentages.

Our trend analysis for each disability category identifies an increasing trend for disability categories *Auditory* ($\tau=.57$, $p<.001$), *Learning* ($\tau=.39$, $p<.05$), and *Mental-Health-Related* ($\tau=.60$, $p<.001$) overall. However, in recent publications, only *Mental-Health-Related* category shows an increasing trend ($\tau=.60$, $p<.05$). Figure 1 shows the trends and Table 1 displays the statistical results.

2.2.2 Research Domains. *Domain* (*D*) also had a significant main effect on *R* for both overall ($\chi^2(1, N=240)=334.89$, $p<.001$, Cramer's $V=.36$) and in recent publications ($\chi^2(1, N=120)=207.43$, $p<.001$, Cramer's $V=.44$). Similar to *C*, these results indicate that the research domain employed in publications at ASSETS varied significantly. The majority of the publications employed the domain of *AI/ML/CV/NLP* overall (19%) and in recent years (18%). Figure 4 (Appendix A) and Table 1 show the percentages per domain.

The results from our trend analysis for each research domain reveal that *3-D Representation* ($\tau=.54$, $p<.001$) and *Wearables* ($\tau=.55$, $p<.001$) had an increasing trend overall, whereas only *AR/VR* had an increasing trend in recent publications. In contrast, *Gaming* ($\tau=-.51$, $p<.05$) had a decreasing trend in recent publications. *Input Methods/Interaction Techniques* ($\tau=-.39$, $p<.05$) and *User Interfaces* ($\tau=-.55$, $p<.001$) had a decreasing trend both overall and in recent publications. We show the trends in Figure 2 and statistical results in Table 1 for each research domain.

3 DISCUSSION & CONCLUSION

In this preliminary exploration, we examined the frequencies and trends of disability categories and computer science research domains in overall and recent publications at ASSETS, extending the findings from Mack *et al.* [11]. To achieve this goal, we extracted 3,234 keywords from 1,678 papers, including the poster and demonstration papers, and manually categorized them into nine disability categories and 12 research domains. Our results show that the focus on disability categories and research domains significantly varies across publication years. Additionally, we conducted trend analyses to identify the trends for each category and domain overall and in recent publications at ASSETS.

Similar to the findings by Mack *et al.* [11], our results showed that publications focusing on visually disabled people are disproportionately higher than those focused on other disability categories. Interestingly, our analyses did not identify a statistical increase or decrease in the trend for publications focused on this demographic, likely indicating consistency in the higher focus. On the other hand, the *Mental-Health-Related* category shows an increasing trend in both overall and recent publications, possibly attributing to the recently increasing awareness of mental-health-related matters. Future work can explore the correlation between public awareness of specific disability categories and their respective focus in publications at ASSETS to investigate knowledge diffusion.

Similarly, our analyses revealed an increasing trend of *AR/VR* in publications at ASSETS over the recent years, likely attributing to its growing technological focus within and outside academia. Surprisingly, the adoption of *3-D Representation* in publications shows an overall increasing trend but not for the recent publications. Our work provides avenues for researchers to explore and gather further insights into technology diffusion in accessibility research.

Since our work is a preliminary exploration, we only performed categorization using the author-identified keywords. Additionally, while ASSETS is considered the top forum for accessibility research, other venues for accessibility-related research, including the ACM Conference on Human Factors in Computing Systems (CHI), Web for All Conference (W4A), and other academic journals are also prevalent. Therefore, future work can employ our methodology and extend our work to analyze publications from other venues. We hope our work will inspire researchers to explore frequencies and trends in accessibility research, providing further insights into the growth of this field.

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REFERENCES

[1] ACM. n.d.. ASSETS Conference - Home. https://dl.acm.org/conference/assets. (Accessed on 06/08/2022).
[2] Theodore W. Anderson and Donald A. Darling. 1954. A test of goodness of fit. *Journal of the American statistical association* 49, 268 (1954), 765–769.
[3] GVU Center at Georgia Tech. n.d.. Workbook: Weaving CHI - Top Keyword Topics. https://public.tableau.com/views/WeavingCHI\protect\discretionary{\char\hyphenchar\font}{}{}TopKeywordTopics/TopKeywordTopics. (Accessed on 06/08/2022).
[4] Alexy Bhowmick and Shyamanta M Hazarika. 2017. An insight into assistive technology for the visually impaired and blind people: state-of-the-art and future trends. *Journal on Multimodal User Interfaces* 11, 2 (2017), 149–172.
[5] Emeline Brulé, Brianna J Tomlinson, Oussama Metatla, Christophe Jouffrais, and Marcos Serrano. 2020. Review of Quantitative Empirical Evaluations of Technology for People with Visual Impairments. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–14.
[6] Faye Ginsburg and Rayna Rapp. 2013. Disability worlds. *Annual Review of Anthropology* 42, 1 (2013), 53–68.
[7] John M Grego. 1993. Generalized linear models and process variation. *Journal of Quality Technology* 25, 4 (1993), 288–295.
[8] Alan M Jette, Marilyn J Field, et al. 2007. The future of disability in America. (2007).
[9] Maurice George Kendall. 1948. Rank correlation methods. (1948).
[10] Lior Levy, Qisheng Li, Ather Sharif, and Katharina Reinecke. 202. Respectful Language as Perceived by People with Disabilities. In *The 23rd International ACM SIGACCESS Conference on Computers and Accessibility* (Virtual Event, USA) *(ASSETS '21)*. Association for Computing Machinery, New York, NY, USA, Article 83, 4 pages. https://doi.org/10.1145/3441852.3476534
[11] Kelly Mack, Emma McDonnell, Dhruv Jain, Lucy Lu Wang, Jon E. Froehlich, and Leah Findlater. 2021. What Do We Mean by "Accessibility Research"? A Literature Survey of Accessibility Papers in CHI and ASSETS from 1994 to 2019. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '21)*. Association for Computing Machinery, New York, NY, USA, Article 371, 18 pages. https://doi.org/10.1145/3411764.3445412
[12] Henry B Mann. 1945. Nonparametric tests against trend. *Econometrica: Journal of the econometric society* (1945), 245–259.
[13] Aboubakar Mountapmbeme, Obianuju Okafor, and Stephanie Ludi. 2022. Addressing Accessibility Barriers in Programming for People with Visual Impairments: A Literature Review. *ACM Transactions on Accessible Computing (TACCESS)* 15, 1 (2022), 1–26.
[14] John Ashworth Nelder and Robert WM Wedderburn. 1972. Generalized linear models. *Journal of the Royal Statistical Society: Series A (General)* 135, 3 (1972), 370–384.
[15] Ather Sharif, McCall Aedan L., and Bolante Kianna R. 2022. Should I Say "Disabled People" or "People with Disabilities"? Language Preferences of Disabled People Between Identity- and Person-First Language. In *The 23rd International ACM SIGACCESS Conference on Computers and Accessibility* (Athens, Greece) *(ASSETS '22)*. Association for Computing Machinery, New York, NY, USA, To Appear.
[16] Katta Spiel, Christopher Frauenberger, Os Keyes, and Geraldine Fitzpatrick. 2019. Agency of autistic children in technology research—A critical literature review. *ACM Transactions on Computer-Human Interaction (TOCHI)* 26, 6 (2019), 1–40.
[17] METTE Warburg. 2001. Visual impairment in adult people with intellectual disability: literature review. *Journal of intellectual disability research* 45, 5 (2001), 424–438.
[18] Rua M Williams and Juan E Gilbert. 2020. Perseverations of the academy: A survey of wearable technologies applied to autism intervention. *International Journal of Human-Computer Studies* 143 (2020), 102485.

A PUBLICATIONS PER DISABILITY CATEGORIES AND RESEARCH DOMAIN PER YEAR

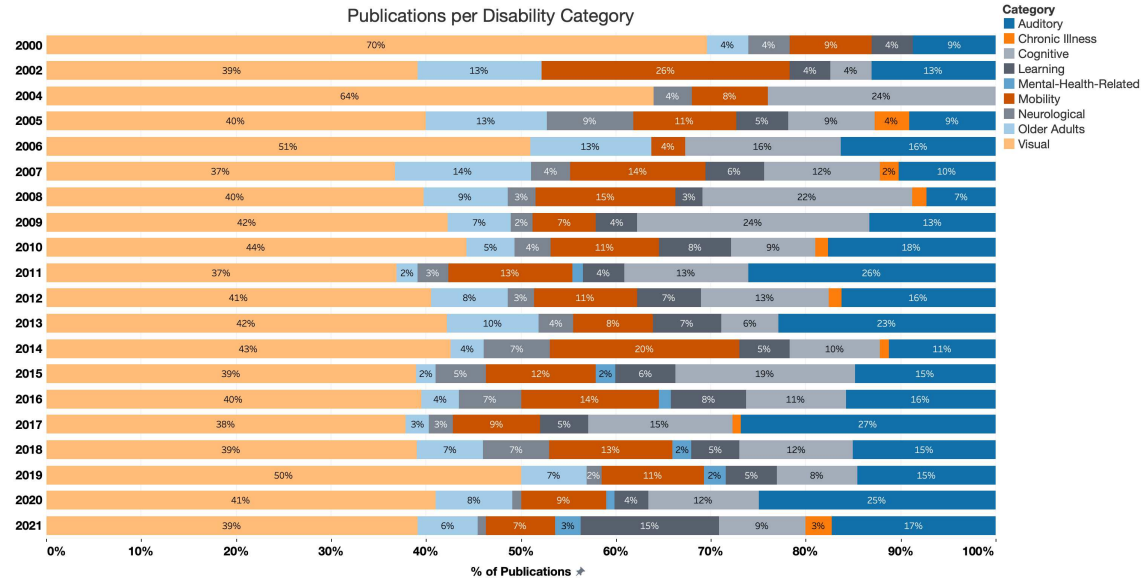

Figure 3: Percentage of ASSETS publications per year for each disability category.

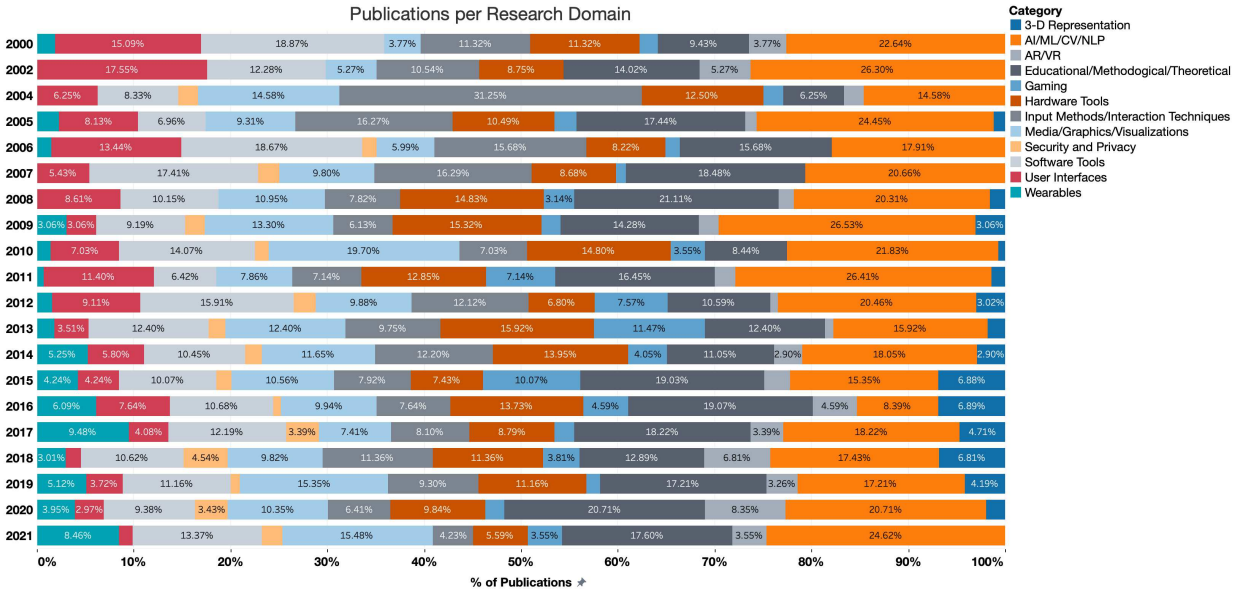

Figure 4: Percentage of ASSETS publications per year for each research domain.