

Celebrating the First Four Years of IEEE TTS

Abstract—December 2023 completes the fourth year of the *IEEE Transactions on Technology and Society (IEEE TTS or Transactions)*; an interdisciplinary publication launched in January 2020. This Editorial presents an account of the first 16 issues comprising the first 4 volumes of the *Transactions*. It also presents the historical backdrop dating back to 2016, outlining the motivations for *TTS*. This paper furthermore documents how *TTS* volunteers have shaped the publication's trajectory toward an internationally recognized and reputable interdisciplinary and transdisciplinary outlet. This has been achieved through interactions between authors, reviewers, associate editors, co-editors, the publications board, steering committee and editorial board-at-large, led by the co-editors-in-chief and the Vice President (VP) of Publications at the IEEE Society on the Social Implications of Technology (IEEE SSIT). SSIT is an established society that celebrated its Golden Jubilee in 2022. *TTS* resides within IEEE SSIT with co-sponsorship from the IEEE Robotics and Automation Society and the IEEE Computer Society. It is one of three official periodicals of the IEEE SSIT, alongside the 42-year-old *IEEE Technology and Society Magazine*, and the long-standing IEEE SSIT Newsletter. The reader is invited to celebrate the first four years of *TTS*, where the *Transactions*' foundational pillars and vision of the publication are shared in this Editorial, and where we invite you to join our growing community.

Index Terms—IEEE, Transactions, IEEE Transactions on Technology and Society, IEEE TTS, TTS, technology, society, regulation, ethics, public policy, public interest technology, human factors, IEEE Society on the Social Implications of Technology, IEEE SSIT.

I. INTRODUCTION

IT WAS not long after the search had begun for a new Editor-in-Chief of the *IEEE Technology and Society Magazine (TSM)* in 2016 that discussions commenced in the Board of Governors (BOG) about the possibility of a transactions-level publication in the IEEE Society on the Social Implications of Technology (IEEE SSIT). Since 2014, it had been the hope of Professor Emeritus John Impagliazzo of Hofstra University, IEEE SSIT's Vice President of Publications, that a periodical would be introduced to showcase the depth and breadth of research in the multi-, inter- and trans- disciplinary space of technology and society. Other board members agreed that so long as SSIT did not have a transactions-level publication, that the Society would have fallen short in its mission, presenting a visible gap in supporting the global outreach of research relevant to its pillars and membership. It was expressed that such a transactions-level publication should be representative, evidence-based, and strive for demonstrated excellence.

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The decision to proceed with an SSIT-backed transactions had financial implications for the small society with direct impacts on human resources. In 2016, after two years of BOG discussions about the possibility of a Transactions, SSIT VP tasked the then Editor-in-Chief of the *IEEE TSM*, Professor Katina Michael, to lead the development of a full-length proposal to the Technical Activities Board (TAB) Periodicals Committee, to be submitted at the IEEE headquarters in Piscataway, New Jersey. There were five steps in the process (see Table I) prior to the approval of the *Transactions*. This was followed by a market survey, conducted in 2018, which is a requirement for a new periodical at the IEEE. The aim of a market survey is to gather quantitative evidence to support the qualitative data being presented by a given Society. SSIT commissioned the survey of the IEEE readership through the IEEE Strategic Research group at the IEEE Operations Center (see Table II). Upon approval, the first issue of the publication launched in March 2020.

This paper presents fundamental outcomes to date and additional background information that can provide readers, prospective authors and (guest) editors with details regarding the *Transactions*' scope, coverage, contributions to interdisciplinarity and interdisciplinary fields, and its global-to-local real-world application. Furthermore, this Editorial is dedicated to celebrating the first 4 years of the *IEEE TTS* as it has reached several milestones. The first milestone is that the publication outlet has experienced an increase in submissions requiring an expansion of its editorial board. This has resulted in the approval of a second Editor-in-Chief, as of May 9, 2023, and the establishment of a Co-Editors-in-Chief (Co-EICs) model within SSIT [1]. It is also exemplified in the recent call for up to 7 Senior Editors and 30 Associate Editors [2]. The journal has additionally undergone significant and sustained accelerated growth since the beginning of 2022, as demonstrated by IEEE Xplore Analytics, in terms of monthly HTML views and full-text PDF downloads [3]. The second milestone is that the *TTS* has participated in its first full Periodicals Review and Advisory Committee (PRAC) evaluation, a mandatory assessment mechanism for all IEEE periodicals.

The remainder of this Editorial provides further background information in Section II, details pertaining to scope and coverage of *TTS* in Section III, an overview of papers published since the launch of the journal in Section IV, with our *TTS* vision presented in summary in Section V. In Section VI we present an afterward incorporating *TTS*' foundational pillars. Finally, the papers in the December 2023 issue of the *Transactions* are identified and summarized in Section VII.

TABLE I
IEEE TTS PROPOSAL STAGES

Stage Number	Title	Date
1	Letter of Intent (LOI)	October 26, 2016
2	New Periodical Proposal Approval Phase One Form	January 30, 2018
3	Technical Activities Board Budget Discussions	June 4, 2018
4	New Periodical Proposal Approval Phase Two Form	June 21, 2018
5	Presentation to Technical Activities Periodicals Committee	June 21, 2018

TABLE II
IEEE TTS - NEW TRANSACTIONS SURVEY REPORT 2018

The abstract of the 54-page report titled “IEEE Transactions on Technology and Society - New Transactions Survey Report” stated the following: “The purpose of the *IEEE Transactions on Technology and Society* New Transactions Survey was to assess interest in a new Transactions. 5,093 Members of the IEEE (including 1,093 members of the IEEE Society on the Social Implications of Technology, and 4,000 randomly sampled IEEE members) were surveyed using a self-administered, online questionnaire. Results: Half of all respondents were likely to read this Transactions. A vast majority of respondents stated that this Transactions is a good fit for Xplore”. The survey results indicated a considerable interest in *TTS*. The response to the survey was approximately 11%, whereby 85% of the respondents believed the new publication was a good fit for Xplore. Furthermore, 50% of respondents said they would read the new publication and 24% said “they would submit between one and five (or more) manuscripts in a twelve-month time frame” to the new Transactions. Overall, 83% of the respondents thought the subject matter was growing in demand, and 78% believed the subject matter would still be important in ten years.

Source: IEEE Strategic Research Group, IEEE Operations, 2019.

II. BACKGROUND: ABOUT IEEE TTS

In 2016, SSIT began discussion around the introduction of a periodical to complement the award-winning *IEEE Technology and Society Magazine (TSM)* [5], published since January of 1982 (see Fig. 1 for the quarterly covers of *IEEE TSM* published between 2013–2017), and the long-standing *IEEE SSIT Newsletter* [6]. Following the success of *IEEE TSM* in the prestigious FOLIO Awards [7], [8], it was felt necessary to expand the SSIT publications portfolio with a view to host highly developed research that would make major contributions to theory and practice in the social implications of technology.

The intention was that a transactions-level publication would grow over time to become SSIT’s flagship technical publication appealing to both IEEE members and constituents, and external stakeholders, given the deliberate interdisciplinary focus and desire to support truly transdisciplinary projects and outcomes. The new periodical would also seek to be the catalyst in addressing the historical tensions associated with publishing high quality and impactful interdisciplinary



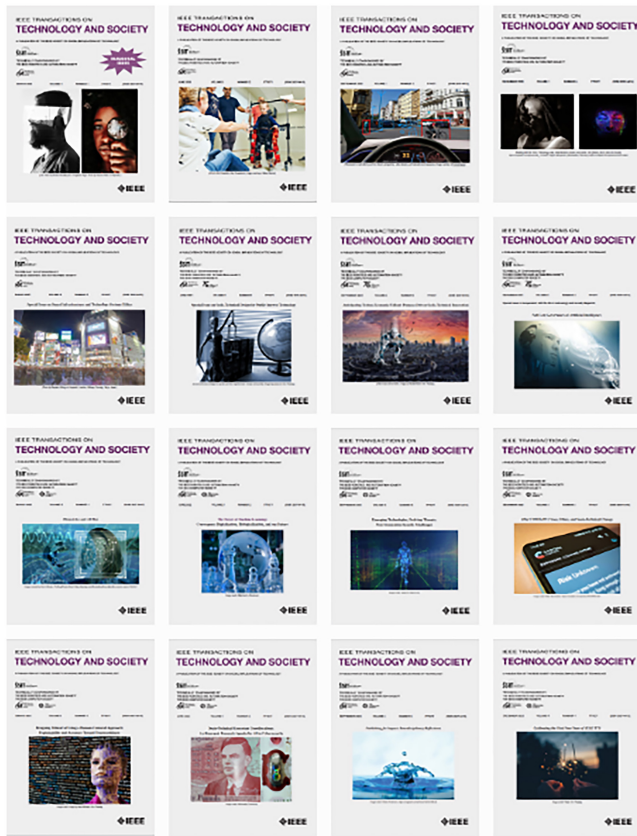
Fig. 1. IEEE TSM Covers 2013–2017 [10].

and transdisciplinary work [9]. For instance, there are limitations and constraints that are commonly experienced by interdisciplinary scholars and stakeholders, both individually and collectively, as they navigate academic pressures.

III. THE ESTABLISHED SCOPE AND FIELDS OF INTEREST OF TTS

IEEE TTS [11] publishes research papers on the interactions between technology and society, and the impact of such interactions at the individual (micro), organizational (meso) and societal (macro) levels. The focus also extends to ethical, professional, and social responsibility in the practice of science, technology, engineering and mathematics, creating and sustaining a forum for open discussion of resultant issues (Fig. 2).

Within this scope, the *Transactions* covers a broad range of topics in such areas as information and communication technology; the social implications of emerging technologies and innovations; Science, Technology, Engineering, Arts and Mathematics (STEAM) education; health and safety; life



* see Appendix E for higher resolution

Fig. 4. *IEEE TTS* Covers 2020–2023.

January 2024. For a complete listing of citations per paper, see Appendix F in the supplementary material for Scopus listings, and Appendix G in the supplementary material for Google Scholar listings. Table IV presents the top 25 most downloaded/viewed articles in the *IEEE TTS corpus* according to IEEE Xplore. For a complete listing of most downloaded/viewed articles see Appendix H in the supplementary material. In terms of thematic coverage, the two most cited works according to Scopus pertain to themes of biometrics, [AI/algorithmic] bias, and facial recognition, while the top three cited articles in IEEE Xplore focus on artificial intelligence.

B. Semantics, Concept Maps and Usage

The main themes addressed in the *IEEE TTS corpus* are illustrated in Fig. 5. The top 10 semantic terms are: information, technology, system, data, research, example, con, work, development, and process. Much can be summated about the kinds of articles submitted to *IEEE TTS* from this high-level semantic word cloud; for example, there is a notable emphasis on the ‘con’ or undesirable consequences of technology and the corresponding link with systems, data, development environments and processes embedded within a real-world context or explored through a representative example.

TABLE III
THE TOP 25 MOST CITED ARTICLES IN *IEEE TTS* 2020–23 ACCORDING TO IEEE/SCOPUS LISTINGS

Rank	Article Title	1st Author
1	Demographic Bias in Biometrics: A Survey on an Emerging Challenge	Pawel Drozdowski
2	A Comprehensive Study on Face Recognition Biases Beyond Demographics	Philipp Terhörst
3	Artificial Intelligence in Digital Media: The Era of Deepfakes	Stamatis Karnouskos
4	Challenges of Deep Learning in Medical Image Analysis—Improving Explainability and Trust	Tribikram Dhar
4	Issues Related to Face Recognition Accuracy Varying Based on Race and Skin Tone	K. S. Krishnapriya
5	Face Morphing Attack Generation and Detection: A Comprehensive Survey	Sushma Venkatesh
5	Responsible AI—Two Frameworks for Ethical Design Practice	Dorian Peters
6	Z-Inspection®: A Process to Assess Trustworthy AI	Roberto V. Zicari
7	AI Ethics in the Public, Private, and NGO Sectors: A Review of a Global Document Collection	Daniel Schiff
8	Design Lessons from AI’s Two Grand Goals: Human Emulation and Useful Applications	Ben Shneiderman
9	Tracking Anti-Vax Social Movement Using AI-Based Social Media Monitoring	Fahim K. Sufi
9	Automated Classification of Societal Sentiments on Twitter with Machine Learning	Piyush Vyas
10	AI Certification: Advancing Ethical Practice by Reducing Information Asymmetries	Peter Cihon
11	Digital Psychiatry: Risks and Opportunities for Public Health and Wellbeing	Christopher Burr
11	Assessing Trustworthy AI in Times of COVID-19: Deep Learning for Predicting a Multiregional Score Conveying the Degree of Lung Compromise in COVID-19 Patients	Himanshi Allahabadi
12	AI Ethics Principles in Practice: Perspectives of Designers and Developers	Conrad Sanderson
12	Automatic and Efficient Framework for Identifying Multiple Neurological Disorders from EEG Signals	Md. Nurul Ahad Tawhid
12	Biometrics in the Era of COVID-19: Challenges and Opportunities	Marta Gomez-Barrero
12	“As It Is Africa, It Is Ok”? Ethical Considerations of Development Use of Drones for Delivery in Malawi	Ning Wang
13	Wastewater Monitoring Raises Privacy and Ethical Considerations	Danielle Jacobs
13	Socio-Technical Design for Public Interest Technology	Roba Abbas
13	Biometrics and AI Bias	Katina Michael
13	Personalized Chatbot Trustworthiness Ratings	Biplav Srivastava
14	Machine Learning, Convergence Digitalization, and the Concentration of Power: Enslavement by Design Using Techno-Biological Behaviors	Roba Abbas
14	Likelihood of Questioning AI-Based Recommendations Due to Perceived Racial/Gender Bias	Carlos M. Parra

* As of 26 January 2024

TABLE V
IEEE GENERATED THESAURUS ON *IEEE TTS* 2020–23

Ethics, Artificial intelligence, Law, Social networking (online), COVID-19, Stakeholders, Government, Special issues and sections, Privacy, Face recognition, Medical services, Technological innovation, Machine learning, Organizations, Task analysis, Sociology, Pandemics, Training, Data privacy, Engineering profession, Regulation, Statistics, Safety, Codes, Security, Psychology, Biometrics (access control), Production, Sustainable development, Surveillance, Software, Deep learning, Public policy, Decision making, Computer security, Cognition, Philosophical considerations, Media, Sensors, Tools, Economics, Sociotechnical systems, Interviews, Monitoring, Business, Public healthcare, Automation, Systematics, Fingerprint recognition, Guidelines, NIST, Social factors, Standards, Taxonomy, Faces, STEM, Internet of Things, Weapons, Analytical models, Sentiment analysis, Industries, Pipelines, Collaboration, Data models, Human factors, Prediction algorithms, Education, Employment, Costs, Cultural differences, Drones, Buildings, Cyberattack, Human computer interaction, Human intelligence, Ontologies, Uncertainty, Classification algorithms, Predictive models, Regulators, Exoskeletons, Lenses, Urban areas, Databases, History, Human in the loop, Medical diagnostic imaging, Autonomous systems, Games, Knowledge based systems, Blockchain, Cyberspace, Planning, Critical infrastructure, Cyber-physical systems, Engineering students, Leadership, Measurement, Robots, Crowdsourcing, Encryption, Information integrity, Market research, Smart contracts, Standards organizations, Autonomous vehicles, Certification, Ecosystems, Estimation, Malware, Writing, Companies, Fake news, Testing, Cloud computing, Feature extraction, Internet, Performance evaluation, Protocols, Publishing, Computer vision, Design methodology, Navigation, Solution design, Symbols, Africa, Benchmark testing, Complexity theory, Correlation, DNA, Degradation, Dentistry, Humanoid robots, Iris recognition, Neural networks, Open source software, Open systems, Pregnancy, Computer science, Cost accounting, Decision support systems, Encoding, Fats, Gender issues, Motion pictures, Power industry, Servers, Bioinformatics, Computer security, Inspection, Knowledge engineering, Particle measurements, Physiology, Quality of service, Reflectivity, Reliability, Semantics, Bibliometrics, Big Data, Blogs, Coronaviruses, Ecology, Europe, Legged locomotion, Personal protective equipment, Radiology, Search engines, Sports, Traffic control, Vocabulary, Annotations, Approximation algorithms, Career development, Indexes, National security, Pediatrics, Physical layer, Reflection, Social computing, Vehicle safety, Attenuation, Authentication, Biological system modeling, Cleaning, Creativity, Electroencephalography, Frontal lobe, Intelligent sensors, Journalism, Mathematical models, Modeling, Multi-party computation, Procurement, Prototypes, Renewable energy sources, Robustness, Strain, Chatbots, Convolutional neural networks, Epidemics, Limbic system, Neurological diseases, Older adults, Patient rehabilitation, Raw materials, Recruitment, Rehabilitation robotics, Scholarships, Brain-computer interfaces, Educational technology, Electronic mail, Financial management, Focusing, IEC Standards, Injuries, Lung, Machine learning algorithms, Passwords, Payloads, Public infrastructure, Real-time systems, Sensor systems, Skin, Trust management, Water quality, Data science, Diseases, Man-machine interfaces, Mobile handsets, Neurotechnology, Program processors, Research and development, Road vehicles, Scientific publishing, Supply and demand, Telemedicine, Threat assessment, Wearable computers, Advertising, Bit error rate, Brain modeling, Currencies, Hospitals, Manuals, Natural languages, Peer-to-peer computing, Psychiatry, Robot sensing systems, Supply chains, Biology, Climate change, Clustering algorithms, Electronic healthcare, Fuels, Genetics, Phishing, Pragmatics, Process control, Random forests, Recommender systems, Smart phones, TV, Videos, Algorithms, Automotive engineering, Blockchains, Contracts, Government policies, Hazards, Image recognition, Legal factors, Operating systems, Professional societies, Signal processing algorithms, Voting, Behavioral sciences, Biometrics, Chatbot, Emulation, Entertainment industry, General Data Protection Regulation, Maintenance engineering, Natural language processing, Dams, Distortion, Epilepsy, Ethical aspects, Genomics, Information management, Instruments, Social sciences, Solar energy, Tourism industry, Data aggregation, Data mining, Dogs, Economic indicators, Environmental factors, ISO Standards, Observers, Organizational aspects, Problem-solving, Routing, Smart cities, System dynamics, Vaccines, Wastewater.

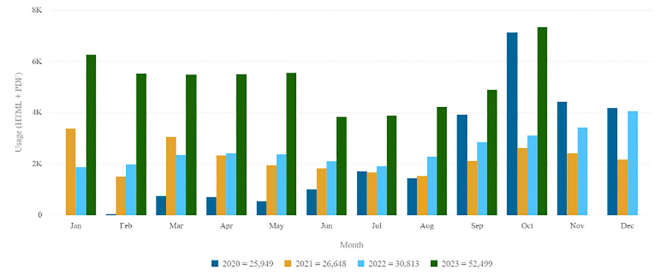


Fig. 7. Total Usage Statistics 2020–x2023.

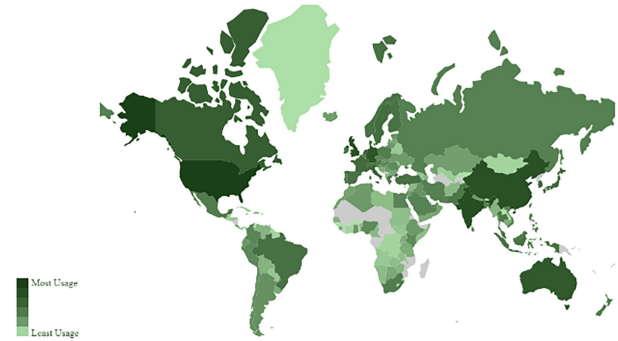


Fig. 8. Global Usage of *IEEE TTS* Articles 2020–2023.

United Kingdom, Germany, Australia, Canada, Netherlands, Italy, Taiwan, Province of China, Republic of Korea, France, Japan, Sweden, Hong Kong, Brazil, Turkey, Norway, Spain, Finland, Singapore, Switzerland, and Indonesia. One can derive from this list that “technology and society” issues are pertinent areas of discussion internationally, and that the truly global nature of the publication in authorship and readership was well anticipated. *IEEE TTS* is a focal point drawing studies from across the globe to participate in the presentation of key works on the social implications of technology.

For a complete listing of papers published in the first 4 volumes of *IEEE TTS* and a detailed overview of peer-reviewed paper summaries, see Appendix J in the supplementary material. End-to-end index subjects covered, and individual author/co-author listings are also available for each volume [13], [14], [15], [16].

C. Special Issues 2020–2023

Since 2020, 11 special issues have been published (Table VI) in *IEEE TTS*, including collections stemming from international projects, conferences, and workshops (e.g., with The Alan Turing Institute/ Oxford Internet Institute/ U.K. National Cyber Security Centre, among other entities). It is also important to note that members of the Senior Editor team have led special issues, thereby setting a standard and benchmark for desired special issues within the *Transactions* and aiding in the establishment of a global TTS network, increased exposure and the amalgamation of disparate communities (e.g., Rafael A. Calvo of Imperial College London led a guest edited issue “After COVID-19: Crises, Ethics, and Socio-Technical Change” in volume 3, issue 3).

Example special issues contributed to by the Senior Editor team included: volume 2, issue 1 on “Smart Infrastructure and Technology Systems Ethics” and volume 2, issue 3 on “Anticipating Techno-Economic Fallout: Purpose-Driven Socio-Technical Innovation,” in addition to other issues. The following Associate Editors also contributed to guest edited issues and accompanying editorials: Jordan Richard Schoenherr, Pablo Rivas, Theresa D. Anderson, Anas Aloudat, Tamara Bonaci, Lindsay J. Robertson, Michael Zimmer, and Jason Sargent. The TTS Editorial Board is also proactively seeking special issue proposals [17].

V. CELEBRATING AND SUPPORTING IMPACTFUL INTERDISCIPLINARY WORK: OUR VISION

IEEE TTS is emerging as a leading interdisciplinary outlet globally, demonstrated in the quality, breadth, and representation of published manuscripts. That there is an interdisciplinary transactions-level periodical in a technical institute such as the IEEE, supported by an established society such as SSIT, is certainly worth celebrating. Through initiatives and outlets such as *TTS*, the IEEE can point to advancing humanity through the careful consideration of ethical, legal and social implications of technology. *IEEE TTS* therefore fills a gap in facilitating dialogue between disparate fields relevant to technology and society.

As we continue to strive for excellence, a range of innovations and processes will be instituted relating to our policies and procedures, Editorial Board and internal network, community outreach, training opportunities for diverse stakeholders, industry engagement, impact-related projects, and support of academic and other stakeholders in the public interest and through an interdisciplinary emphasis. Our vision is for continued development toward a globally recognized interdisciplinary publication outlet that both supports and celebrates truly interdisciplinary work. The research community has enthusiastically responded to our vision, and the first four years have provided ample validation for this initiative. Thus, we invite you to join us in this endeavor and in celebrating the first four years of *IEEE TTS*.

VI. AFTERWARD

We send our appreciation to those on the inaugural *IEEE TTS* editorial board, steering committee, publications board, co-editors, reviewers, administrator and managing editor for their dedicated collaboration in the establishment of a reputable outlet that aligns with multi-stakeholder perspectives [18]. We also thank the authors who supported *IEEE TTS* from its inception, believing in its mission and vision, and sharing in our hopes for a future where real-world problems could be addressed through sustainable solutions [19]. Your papers are meaningful, within and beyond academia. They can change the world and begin dialogues afresh. They can inspire a future generation. We can never underestimate the power of the word to ignite action.

As we reflect on our journey to date, we have remained faithful to the history of SSIT, established more than 50 years ago by conscientious and diligent engineers who dealt

TABLE VI
SPECIAL ISSUES PUBLISHED IN IEEE TTS SINCE 2020

ID	Special Issue Title	Vol./Iss.	Guest Editors
11	Publishing for Impact: Interdisciplinary Reflections*	September 2024 (vol. 4, no. 3)	R. Abbas, K. Michael, K. Conboy, M. Janssen, Y.K. Dwivedi, C. Veloutsou, T. Papadopoulos, R. Dubey
10	Socio-Technical Ecosystem Considerations: An Emergent Research Agenda for AI in Cybersecurity*	June 2024 (vol. 4, no. 2)	M. Taddeo, P. Jones, R. Abbas, K. Vogel and K. Michael
9	Designing AI Using a Human-Centered Approach: Explainability and Accuracy Toward Trustworthiness^	March 2024 (vol. 4, no. 1)	J.R. Schoenherr, R. Abbas, K. Michael, P. Rivas, and T. D. Anderson
8	After COVID-19: Crises, Ethics, and Socio-Technical Change*	December 2023 (vol. 3, no. 4)	R.A. Calvo, S. Deterding, C. Flick, C. Lütge, A. Powell and K.V. Vold
7	Emerging Technologies, Evolving Threats: Next-Generation Security Challenges^	September 2023 (vol. 3, no. 3)	T. Bonaci, K. Michael, P. Rivas, L.J. Robertson and M. Zimmer
6	Machine Learning, Convergence Digitalization, and the Concentration of Power: Enslavement by Design Using Techno-Biological Behaviors^	June 2023 (vol. 3, no. 2)	R. Abbas, K. Michael, M.G. Michael, C. Perakslis, J. Pitt
5	Biometrics and AI Bias^	March 2023 (vol. 3, no. 1)	K. Michael, R. Abbas, P. Jayashree, R.J. Bandara and A. Aloudat
4	Effective and Trustworthy Implementation of AI Soft Law Governance+	December 2022 (vol. 2, no. 4)	C.I. Gutierrez, G.E. Marchant and K. Michael
3	Anticipating Techno-Economic Fallout: Purpose-Driven Socio-Technical Innovation+	June 2022 (vol. 2, no. 3)	R. Abbas, K. Michael, J. Sargent and E. Scornavacca
2	Socio-Technical Design for Public Interest Technology+	June 2022 (vol. 2, no. 2)	R. Abbas, J. Pitt and K. Michael
1	Smart Infrastructure and Technology Systems Ethics^	March 2021 (vol. 2, no. 1)	K. Michael, R. Abbas, R.A. Calvo, G. Roussos, E. Scornavacca and S.F. Wamba

* Targeted calls for papers through "external" process.

+ Closed call from US-based workshop participants; or from a special issue ensuing from *IEEE International Symposium on Technology and Society (ISTAS)*.

^ Emerged from content submitted without a public call for papers. Co-themed papers were brought together over a 12-month period and content was collocated for maximum impact.

with criticism despite their pioneering efforts to introduce ethics into the profession to ensure the health and safety of citizenry. This history also includes 42 volumes of *IEEE TSM* carefully curated by eleven editors-in-chief [see Appendix K in the supplementary material], that showcased technological controversies and potentials that are still being discussed today and propelled further through technological convergence and a multiplicity of global tensions. Additionally, consecrated

by annual SSIT sponsored international conferences (e.g., the International Symposium on Technology and Society (ISTAS) since 1989 [refer to Appendix L in the supplementary material]), SSIT members have provided a suitable forum for people to discuss both their hopes and fears with respect to the social implications of technology, and potential ways forward. These gatherings remind us that we are not alone, that there is a community of interdisciplinary thinkers that seek to better design systems for users, indeed every human being, and every facet of life for generations to come, mitigating the risks that so often are a byproduct of technological innovation.

And, if we have learnt anything at SSIT, it is that humans have agency and that we must be considered an integral part of any system. We are not at the mercy of our technological breakthroughs. We are able to shape how we use the tools we invent, and in what we invest our time and money. Additionally, we are accountable for the technologies we design, develop and implement and must therefore adhere to the highest ethical standards and assume responsibility for these technologies. To be sure, we come to an awareness of our strengths, individually and collectively empowered through public interest technology initiatives [20], as our shared voice manifests through culture, grassroots narratives, beliefs and experiences. A monthly *IEEE SSIT Newsletter* now exists which continues to share news with thousands of subscribers worldwide, consistently containing notable outcomes, announcements, and opportunities for event participation and other calls. The Society's web site www.technologyandsociety.org has also provided access to freely available content pertaining to technology and society and is synced with social media accounts that have enjoyed a growing subscriber base. Each of these are SSIT assets and we need to cultivate their continued development, and ensure succession planning within the membership and throughout all IEEE regions [21], to have the greatest impact globally, though all change is local and driven by context. While our tools have commercial value, we would rather shift the emphasis to our greatest assets: our people and the places within which they reside. This is what we leave behind as a legacy to future generations. And in this article, we celebrate the beginnings of our latest conception: *IEEE TTS*.

A. Foundational Pillars

When we established *IEEE TTS*, a number of us came together to discuss what our foundational pillars for the *Transactions* would be and how these would form a schema. We had known one another for decades, and worked together on a number of projects that interfaced on the boundaries of disciplines, where new discoveries are found. We had deep respect for each other's intellect, experience, and application in academia, industry, not-for-profits, non-government agencies, and other community/professional services. We knew that decisions in the real-world were never made by a single entity and we sought to collaborate to infuse the academic research process with our learnings and lifeworlds from within and outside academia. We thus chose to build our *Transactions* on ten pillars that have served till today as the fundamental basis

for the kinds of manuscripts we have attracted and continue to publish.

1) *Human Responsibility*: When confronted with an idea for an innovation, engineers typically think of the question: "Can we do this?" Additional questions may also include: "Should we do this?" and if so, "How should we go about this to get the most beneficial outcome for all?" These added research dimensions are distinct in the technology and society interdisciplinary space. Technologists are increasingly concerned with de-risking and how they can get the best product to market in the shortest amount of time and within budget. Good technology requires adequate time and funding; it also requires humans to adequately manage technology and execute on their responsibility in a given role, with commensurate succession planning and hand-off. Humans are ultimately responsible for the products and processes that are diffused into the market.

2) *Multi-Stakeholder Decision-Making*: Decisions about technology often do not incorporate stakeholder perspectives. This research space is where technical decisions and human values intertwine. Papers in the *Transactions* should feature that interplay wherever relevant. Business and government entities should strive to incorporate different voices to ensure better decisions are made for all with long-term positive impacts.

3) *Scholarship and Advocacy*: Many existing publications allow for advocates to write persuasive pieces of journalism on themes related to issues of technology and society, but very few require claims to be supported with academic rigor using primary sources of evidence. The *Transactions* emphasizes scholarship and welcomes advocacy supported by primary evidence. Already *IEEE TTS* has published works from STEM-qualified independent researchers working in their local municipalities representing citizens with respect to emerging technologies in their geographic locale.

4) *Interdisciplinarity*: The *Transactions* addresses the effect of technology on society and how society shapes technology. *TTS* explores ways in which societal needs are driving technological developments, and industry is diffusing technology into the market with government agency oversight. The research analysis by its very nature is typically interdisciplinary: it can be multi-dimensional, multi-paradigmatic, trans-sectoral, and transdisciplinary. By bringing researchers from differing disciplines, organizations and institutions together, a variety of theories and methodologies may be explored to address a given problem in a novel way.

5) *Funded Grant Projects, Non-Funded Initiatives and Real-World Case Examples*: The *Transactions* will typically present strategies for responsible development in projects and real-world case examples. These projects will study socio-technical systems, their elements, and new design spaces. Projects that assemble more than one stakeholder to investigate a real-world case example(s) are publishable in *IEEE TTS* so long as they follow a rigorous research process. We also encourage project oversight by an independent third party that can ensure that these processes are followed accordingly. These projects can demonstrate the benefits of technology on society, and provide lessons learned going forward for other

stakeholders and grant bodies, as well as how to overcome challenges and prevent pitfalls.

6) *Insights*: The *Transactions* offers insights into emerging technologies by providing primary evidence through field observations, usability testing, industry perspectives, governmental positions, and analysis of social phenomena affected by technology. These insights can be presented at any stage of the innovation process: invention, commercialization (e.g., market testing, pilot, policy sandbox), as well as widespread diffusion. Patents, product lifecycle management (PLM), in addition to maintenance and product recalls (e.g., hazards, warnings, and safety related information), provide insight about current future innovations and innovation processes.

7) *Theory*: *Transactions* articles must incorporate theory, theoretical frameworks, theoretical extensions, and/or new applications of theory. This is fundamentally what distinguishes the *Transactions* from the *Magazine*. Theory development goes beyond the amalgamation of one or more theories but requires comprehensive definitions with adequate historical antecedents of terminology, testing, validation and end-to-end proofs.

8) *Methodologies*: The *Transactions* publishes works on socio-technical systems that adopt a research process using one or more methodologies applicable to the research phenomenon being studied in the technology and society space. These may include but are not limited to: case studies, interviews, focus groups, observations, ethnographies, surveys, questionnaires, Delphi studies, improved algorithmic approaches, experiments, the development of products and artefacts. Participatory action research, and participatory research methods, innovative new data collection and analysis techniques are encouraged (e.g., video analytics and sentiment analysis); as are traditional multi-method and mixed-method approaches (regression analysis, content analysis). Human research ethics/ internal review board approvals must be acknowledged by the institution or organization of the researcher(s).

9) *Evidence*: The *Transactions* encourages evidence-based research using primary sources. This evidence may be gathered directly from humans or non-humans through direct interaction. Indirect interaction may occur when a human or animal carries or wears/ bears a machine that collects data from the human/ animal subject (or proxy) and also gathers data from the environmental context. Data may emanate from confined short-term projects or even longitudinal studies; conducted at varying units of analysis. Algorithms, simulations, raw data sets (qualitative or quantitative) are welcome to be presented in the form of additional media files published in IEEE Xplore or through IEEE's Data Port [22] or Code Ocean [23]. This data should have been collected with informed consent, and be anonymized prior to being deposited so that no identifying information is contained within the file. Other researchers should be able to gain access to the data set, and incorporate it into their own studies or further research by citing the respective DOI. Secondary sources of evidence are welcome, but their storage is subject to ethical guidelines and/or copyright notices. Open source intelligence (OSI) or public sector information (PSI) may be used in studies but the chief investigators of the project need to have informed the

community of stakeholders (e.g., on a microblogging service). *IEEE TTS* does not condone web scraping or unauthorized surveillance of private communities.

10) *Clear Outcomes*: *Transactions* papers should provide clear outcomes that are actionable, such as design improvements, new tools for science and technology, community engagement, technology impact assessments and other evaluative assessments, and policy recommendations. We are thus moving from a model where papers are the only outcomes that matter, to one where individual data sets that can be shared with the rest of the research community and built upon may be considered outcomes. We are furthermore exploring other forms of impact derived from respective project outcomes and specifically from open data sharing practices across a range of project and geographical contexts, where feasible.

We hope that you might consider the adoption of these foundational pillars in your research, your research teams, and respective institutions and organizations, and contribute your outcomes to *IEEE TTS*.

VII. IN THIS ISSUE

The December 2023 issue is a general issue and as is custom in our editorials, we present a succinct summary of each of the papers. The first paper [1] is written by Alex John London and Motahhare Eslami from Carnegie Mellon University, Yosef S. Razin and Jason Borenstein from Georgia Institute of Technology, and Russell Perkins and Paul Robinette from the University of Massachusetts, USA. The work was supported by a National Science Foundation Grant IIS-2112633. The paper investigates the ethical issues pertaining to smart assistants for older adults as they experience cognitive decline, and how these technologies can act to mediate social interactions that may result in prosocial behaviors between other members in a social setting or support networks. The work considers whether these kinds of interventions may offer caregivers more utility and grant older adults greater autonomy and independence.

The second paper [2] is written by three researchers at Virginia Tech, Timothy R. Pote, Nicole V. Asbeck and Alan T. Asbeck. The work was supported by the National Science Foundation under Grant 1718801. The paper explores how exoskeletons are being used in industrial workplaces and whether an employers' mandate in order to mitigate worker injuries raises any ethical concerns given the power asymmetry between employer and employee. The paper explores whether exoskeletons can be fitted to all employees for reasons of body shape and size, whether workers may have privacy concerns given exoskeletons require to be fitted to measure appropriately, and whether or not it is right to add additional work tasks given the exoskeleton perceived advantage. Two frameworks are used to examine these issues and others inclusive of ways to overcome fundamental challenges of exoskeletons in the workplace.

The third paper [3] is written by Claas Digmayer of Rheinisch-Westfälische Technische Hochschule Aachen and Gregory P. Pogue of The University of Texas at Austin. The article is supported by an interdisciplinary research project

'DC Socio-Economics: Niche Readiness and Market Diffusion of DC Technologies' and is funded by the Federal Ministry of Education and Research (BMBF, FKZ 03SF0592), Flexible Electrical Networks (FEN) Research Campus. This paper uses interviews to identify community values and governance preferences with respect to the use of sustainable energy technologies. What do citizens want to happen? What are the underlying values of citizens toward energy use and how might this knowledge be harnessed demonstrator projects that might raise awareness further? The results of the study show that there are five values that influence perceptions of energy use in communities and these are: (1) growth, (2) independence, (3) sustainability, (4) affordable living, and (5) mobility.

The fourth paper [4] is co-authored by an international team led by K. Ahmad of Jeonbuk National University in South Korea. The co-authors include: M.A. Ayub and Nasir Ahmad from the University of Engineering and Technology, Peshawar, Pakistan; K. Ahmad with Munster Technological University, Cork, Ireland; J. Khan with AJOU University, Suwon, South Korea and A. Al-Fuqaha with Khalifa University, Doha, Qatar. The work was supported by the National Priorities Research Program (NPRP) under grant 13s-0206-200273 from the Qatar National Research Fund and focuses on an important environmental challenge that potentially affects every human being. The paper explores how we address the challenge of water quality by analyzing social media sources to be harnessed as an immediate feedback loop.

The fifth paper [5] is written by three authors from the Universidade de Vigo, in Luis A. Lopez-Valcarcel, Manuel Garcia Sanchez, and Enrique Costa-Montenegro. The work was supported by the Life Program of the European Union (Project Life16 Env/ES/000559, LifeTEC). The article is a case study of how locative communications technology, specifically geolocation data can assist emergency services in the field, even if network coverage is unavailable. The work presents a successful pilot of the proof of concept with first responders in the fire department and successfully validates the deployment of the LifeTEC application where the location of assets (human, machine and fixed or mobile infrastructure) can be presented on a visual map that can assist operations coordinators who are deployed in the field to make better and more timely decisions given extreme weather conditions. The case study demonstrates the utility of the platform outdoors, especially where there is limited or no alternative mobile coverage.

The sixth paper [6] is written by lawyer Michael Anthony C. Dizon of Curtin University in Australia (our only sole-authored article for the December issue). The work was supported by the New Zealand Law Foundation under Grant 2017/ILP/10 and the University of Waikato through the ENCRYPT and DECIPHER Research Project. The paper studies encryption from the viewpoint of technology, law and policy and emphasizes the importance of ensuring information security and data privacy but also acknowledges that encryption can also be used for nefarious purposes. Dizon conducts primary research into the importance of trust in security and examines the problem from three stakeholder types, inclusive of the general public, business and government entities. In particular, four direct

objects of trust are studied with respect to encryption including: the technology, particular persons of interest, institutions, and other stakeholders who are involved in encryption. The article's contribution is in emphasizing the need for regulation around encryption itself.

The seventh paper [7] has four authors led by Dirk van der Linden Northumbria University, U.K. and is co-authored by Brittany I. Davidson of the University of Bath, U.K.; Orit Hirsch-Matsioulas and Anna Zamansky from the University of Haifa in Israel. In a highly illustrative piece, the work supports more than just textual descriptions, and incorporates both qualitative and quantitative data to provide evidence of how digital technologies help people take care of their dogs. This piece speaks of the opposing technological forces at play toward dystopian and utopian visions of the future by using the human-dog bond as a metaphor. It poses the question whether technology will take on the human's role and negatively impact the human-dog bond, or rather will it augment human abilities in support of the human-dog bond. The thematic analysis has potentially far-reaching applications and implications. The underlying premise is one where the reader must consider how technology can support us in becoming better and more informed caregivers rather than a destructive fatalistic scenario where the human-dog relationship is utterly disentangled.

APPENDIX: RELATED ARTICLES

- [A1] A. J. London, Y. S. Razin, J. Borenstein, M. Eslami, R. Perkins, and P. Robinette, "Ethical issues in near-future socially supportive smart assistants for older adults," *IEEE Trans. Technol. Soc.*, early access, Jan. 16, 2023, doi: [10.1109/TTS.2023.3237124](https://doi.org/10.1109/TTS.2023.3237124).
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