Integrating Diverse Perspectives for Safer Fire Designs: The Case for Convergence Research & Practice

By: Sandra Vaiciulyte, Universidad Nacional Autónoma de México, México

By: Brian Meacham, Crux Consulting, USA

This article is the short version of the paper "Diverse Perspectives for Safer Fire Designs - The Case for Convergence Research" published in the proceedings of Interflam 2025.

Vaiciulyte, S and Meacham, B.J. (2025). "Diverse Perspectives for Safer Fire Designs - The Case for Convergence Research," Proceedings, Interflam 2025, Interscience Communications Ltd, London, July 2025.

Most fire safety researchers and engineers tend to take a narrow view of fire safety, often shaped by their specific areas of research or practice. This is not necessarily an approach that they consciously choose to follow, but rather, it is how the education system is structured, how research is funded, and how practice generally works (Cole, 2024; Meacham, 2022; 2024). However, time and again it has been shown that a narrow definition of a 'fire problem' and its 'solution' can overlook the complex web of factors that shape the real-world fire risks. This is particularly the case for fire risk as experienced by those people who are at risk, whether building occupants, community members, temporarily housed people or those without housing.

The Grenfell Tower tragedy illustrates many of the challenges and concerns, where inadequate fire engineering practices, fire risk assessment and poor interdisciplinary collaboration were a significant contributor (e.g., Kernick, 2021). While Grenfell is a tragic example still present in many fire engineers' minds, there is an ever-present fear that some residential building fire scenarios across the globe are still being labeled as 'very low' likelihood events and deemed 'acceptable' to regulators, risk assessors, fire engineers and building owners. This is particularly worrisome if the prevailing thought process is that "the regulations, if complied with, will result in a building that provides 'acceptable' fire safety," without adequately considering the potential range of fires that could occur and their potential harms, especially to vulnerable populations. It is imperative that the building occupants are not ignored and that their perception of the fire risk is not deemed uninformed or otherwise inappropriate, and that analysis of

building fire safety and risk takes into consideration how the building is actually used by those living there (e.g., perhaps doors propped open in flats to facilitate community interactions, extended families sharing living quarters, or other normal building uses).

Siloed thinking that misses critical factors is a motivator for this work. While there exists much research on individual aspects of fire safety, whether in terms of fire hazards alone, or coupled with building characteristics or human factors, there has been limited interrogation of the complex interactions between the fire, building (shelter), and human factors, with even less including the social and cultural components (Antonellis et al., 2022). Research that crosses these boundaries in a suitably joined-up way is scarce. In particular, the intersection of human, social, economic, and environmental factors with varying levels of building fire performance, from formal construction to informal or abandoned structures, remains largely unexplored, and sometimes overtly ignored for the sake of expediency. Ignoring these intersections often leads to siloed fire safety interventions that fail to capture the dynamic and systemic nature of fire risk, perpetuating the lack of interdisciplinarity and representation in fire safety realm / area / field (Vaiciulyte et al., 2024).

To overcome the barriers that are built into the 'system' as it works today, and work more collaboratively to define, assess and suitably mitigate fire risk, we argue that convergence research, and convergence approaches to fire engineering and fire risk assessment, is essential. Convergence research is about integrating knowledge across disciplinary boundaries – not just bringing different actors to the table – but assembling people who are actively willing to open their mind to new theories and new ways of thinking to tackle complex problems (Meacham, 2024). The US National Science Foundation notes that "a distinct characteristic of convergence research, in contrast to other forms of multidisciplinary research, is that from the inception, the convergence paradigm intentionally brings together intellectually diverse researchers and stakeholders to frame the research questions, adopt common frameworks for addressing them, and create and implement innovative scientific approaches for their solution." (NSF, 2024).

Convergence research is something much more than creating a research team by picking two from Discipline A, three from Discipline B, and one from Discipline C for good measure, where each goes about their research in the 'normal' way, without benefiting from the diversity of the team, and then compile a 'project report' and call it 'interdisciplinary' research. While many might argue that is not how things are done, our own experience on research project teams says otherwise. Furthermore, we have experienced the same phenomenon in engineering practice. While 'multidisciplinary teams' are often formed, each specific discipline generally does their own thing. Since much of design seems to be following the regulations, the benefits of interrogating the other disciplines go unseen, and often, are viewed as costing the project, either in more time for analysis, approval or otherwise.

We argue that a true convergence approach proactively and interactively discusses, debates, informs and challenges perspectives, needs, data and expectations, across a breadth of disciplines and stakeholders. If done appropriately, it serves to better define the problem, facilitate holistic, convergence driven solutions, and increase fire safety and reduce fire risk for all. This is not easy, and not something that can be forced. It has to be something that develops based on the proactive and open-minded approach by all involved. In our full paper, we, an engineer and a social scientist, explore the meaning of collaborating in a convergence type of research environment and how this can re-shape the thinking about fire safety problems. We provide examples of how our working together on building/shelter vulnerabilities and human vulnerabilities to fire fostered new more inclusive definitions, illustrated the lack of intersectionality (Chaplin et al., 2019) in fire vulnerability research, and pointed to the need for more

sociotechnical systems approaches within a convergence framework. We ask that you consider how you can do better in delivering increased fire safety and lower fire risk by setting aside your biases, opening your mind to a diversity of perspective, and allowing new and better ways to move forward emerge as a result of convergence research and practice.

References

[1] Antonellis, D., Vaiciulyte, S., Meacham, B.J., & Jennings, C.R. (2022). The Invisible US Fire Problem. Kindling, Inc. and the National Fire Protection Association.Cole, R. J. (2024, September 3). Research in a rapidly changing and increasingly uncertain world. Buildings & Cities, Commentary, https://www.buildingsandcities.org/insights/commentaries/research-changing-uncertain-world.html

[2] Chaplin, D., Twigg, J., & Lovell, E. (2019, April). Intersectional approaches to vulnerability reduction and resilience-building. Resilience Intel, Issue BRACED.

[3] Kernick, G. (2021). Catastrophe and Systemic Change. London Publishing Partnership.

[4] Meacham, B.J. (2022). "A Sociotechnical Systems Framing for Performance-Based Design for Fire Safety," Fire Technology, 58, 1137–1167, https://doi.org/10.1007/s10694-022-01219-0.

[5] Meacham, B.J. (2023). Fire Safety of Existing Residential Buildings: Building Regulatory System Gaps and Needs. Fire Safety Journal. DOI:10.1016/j.firesaf.2023.103902.

[6] Meacham, B.J., (2024, September 18), Why Convergence Research is Needed, Buildings & Cities, Commentary, https://www.buildingsandcities.org/insights/commentaries/convergence-research.html

[7] NSF (2024) Growing convergence research. US National Science Foundation, https://new.nsf.gov/funding/opportunities/gcr-growing-convergence-research

[8]Vaiciulyte, S., Underhill, H., & Reddy, E. (2024). Assembling fire: beyond engineering solutions. Disaster Prevention and Management: An International Journal, 33(3), 237-249.

[9] Vaiciulyte, S and Meacham, B.J. (2025). "Diverse Perspectives for Safer Fire Designs - The Case for Convergence Research," Proceedings, Interflam 2025, Interscience Communications Ltd, London, July 2025.