

Beyond amplification: revisiting risk attenuation alongside amplification within the SARF and future research directions

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Abstract. The Social Amplification of Risk Framework (SARF) provides a classical lens for understanding how risk information is amplified or attenuated and its social consequences. This paper reviews SARF's theoretical and empirical foundations, integrating individual-level factors (trust, media, risk attributes) with cultural and political perspectives on social structures and interest-driven contestation. It identifies a bias toward amplification over attenuation, and underscores media and trust as central: media shape perceptions via framing, trust moderates reception and dissemination as an implicit "valve". Yet existing research remains confined to single events or platforms, lacking systematic inquiry into the interplay between amplification and attenuation, multi-actor coordination, and trust fluidity across evolving media ecologies, and rarely treats the public as active participants. In response, we propose four future directions: public-actor perspective, comparative analysis of amplification and attenuation, multi-actor ecology, and longitudinal designs to move risk communication toward a more contextualized and comparative paradigm, offering insights for digital risk governance.

Keywords: risk amplification, risk attenuation, Social Amplification of Risk Framework (SARF), media, trust

1. Introduction

The Social Amplification of Risk (SARF) theory, established in the 1980s, has been widely applied in research across fields such as food safety, health and environmental risks, and climate change [1]. SARF refers to the amplification of risk arising from risk events through individual and social factors, known as the 'ripple' effect [2]. It is primarily used to assess technical risk issues and their interaction with psychological, sociological and cultural perspectives on risk perception and risk-related behaviour. These human behavioural issues cannot be regarded as mere surface phenomena in technical risk analysis, as hazards and technical issues that may lead to amplification effects interact in various social ways. They influence not only public cognition and responses, but also the risk itself [3]. This framework seeks to address the fragmentation in research on risk perception and risk communication by developing a comprehensive framework capable of explaining risk. It incorporates findings from a wide range of studies, including media research, psychometrics, research on cultural risk perception, and organisational and societal responses to risk.

According to the social risk amplification framework, risk amplification typically occurs in two stages: the risk information transmission stage and the social response stage. During these two stages, risk signals are processed by individuals or social entities, which are referred to as 'amplification stations'. Among these, 'individual stations' include, for example, scientists who disseminate risk assessment results; 'social stations' include the media, communities and interpersonal networks [4]; Furthermore, public institutions, risk management organisations, social activists and opinion leaders are also major risk amplification stations. The amplification of perceived risks among the public may trigger further behavioural responses, thereby generating secondary effects, known as 'ripples'. 'Stigmatisation' is a typical example of a ripple phenomenon.

Certain hazards and events that experts assess as posing a relatively low risk are referred to as 'risk amplification' when they become the focus of particular public attention and political activity; conversely, other hazards deemed more serious by experts receive relatively little public attention, a phenomenon known as 'risk minimisation'. Such 'minimisation' may be influenced by values or a deliberate avoidance of systematic thinking. With regard to 'risk amplification', there are two types of amplification stations: 'societal' and 'individual'. Perceived amplified risks may lead to behavioural responses, which in turn result in secondary effects or 'ripples'. Through mechanisms of public psychology, risks may lead to stigmatisation, thereby triggering avoidance behaviour [5].

The Social Amplification of Risk Framework (SARF) has not only been extensively applied in empirical studies but also proven instrumental in facilitating qualitative research. For instance, in their analysis of offshore wind energy controversies in the United States, Ram and Webler observed that SARF enables researchers to systematically organize qualitative data—such as interviews, media coverage, and public opinions—rendering them more coherent and amenable to analysis, while simultaneously deepening the understanding of participatory risk governance [6]. This raises the question: what specific factors influence the amplification and attenuation of risk?

2. Why risks are amplified or attenuated

Regarding the 'why' and 'how' risks are 'amplified' or 'attenuated', SARF describes the mechanisms and processes through which risk events lead to risk amplification via individual and social factors [2]. This is a comprehensive system encompassing social, psychological, cultural and communicative dimensions, among others, and includes the influence of numerous factors such as individual risk literacy [7], emotional biases [8] and the media [9].

2.1. Factors contributing to risk amplification

From the perspective of individual cognition and perception, prior inquiries into why risks become amplified have largely relied on empirical studies grounded in the psychometric paradigm. Such studies, which gauge the manifestations of risk amplification at the individual level, have identified a range of factors that shape amplified risk perception, including trust, media coverage, risk attributes, pre-existing attitudes, and others [10].

In other words, there is no absolute distinction between 'real' risk and 'perceived' risk; the key lies in the interaction between information systems and individual characteristics. With regard to research on individual characteristics, negative emotions such as fear and anger tend to reinforce an individual's perception of high risk [11]; the Chinese public's pre-existing negative emotional bias towards Japan, a country known for discharging sewage, has contributed to a perception of high risk [12]; Compared with men, women are more concerned about risks associated with nuclear energy and nuclear contamination [13]; the core reason lies in

the specific impact of radiation on the health of women and their offspring [14], and this concern is particularly pronounced among women with young children at home [15]; Individuals with lower levels of scientific and media literacy tend to have a more one-sided understanding of risk information and are unable to view risk events and their consequences more objectively [7].

In 1982, Douglas and Wildavsky introduced a sociological approach to the analysis of risk, thereby overcoming the limitations of the psychometric paradigm in research on the relationship between risk perception and behavioural responses. They argued that individuals holding different cultural values—such as hierarchical, individualistic, egalitarian and fatalistic values—tend, based on their specific patterns of social relations, to prioritise risks that reinforce their way of life whilst downplaying those that threaten it. At the same time, the general public exhibits typical cultural cognitive biases: firstly, a tendency to adjust one's views to align with group positions; secondly, a tendency to selectively accept evidence that reinforces existing beliefs; and thirdly, a tendency to prioritise catastrophic events that align with one's own cultural inclinations. Furthermore, risk amplification is deeply embedded within political processes, with interest groups pitting specific risks against cultural identities, thereby either magnifying or minimising those risks [16].

2.2. Factors contributing to risk attenuation

In the past, although 'risk attenuation has long been recognised as an important and widespread phenomenon, the majority of research on SARF has focused on the amplification effect. In fact, although SARF is termed 'amplification', it is also used to explain how social and individual factors interact to reduce our perception of risk [17]. Within the SARF research framework, only a small number of studies have addressed risk attenuation; for example, some scholars have investigated how emphasising 'risk uncertainty' can weaken the risk reduction effect [18]; Cantor et al., whilst investigating the utility of SARF in explaining both risk attenuation and amplification in the context of the opioid crisis, pointed out the academic community's neglect of economic incentive signals in studies of risk attenuation [19]; Research on social risk reduction regarding BSE in Canada revealed that the social context at the time was the primary factor; media reports on mortality rates associated with the US–Iraq War, SARS and West Nile virus diminished public concern about the risks of BSE, and, compared to these risks, the human health risks posed by BSE were characterised by a certain degree of future uncertainty [17].

Overall, the combined characteristics of these systemic risks contribute to a narrowing of social risk perception; for instance, there is a lack of trust in scientists' judgements, as most people are unable to verify the accuracy of scientific claims and therefore often rely on cues to assess credibility. However, these cues change over time and are often contradictory, leading people to favour silence over taking the risk of making the wrong decision; The 'echo chamber' effect generated by digital media algorithms drives a polarisation in risk knowledge and perception; members of the public who are exposed to more information that 'downplays' risks are more inclined to believe that the risks are minimal. Furthermore, factors such as psychological distance from the risk and high levels of risk ambiguity can all be used to explain risk downplaying [20]. In summary, previous research has identified the following main factors influencing risk minimisation: high risk ambiguity; the diversion of public attention by economic signals; the downplaying of risks when compared to the perceived risks of other events; a lack of trust in scientists' risk assessments; and media algorithms creating information silos regarding risk minimisation, coupled with a greater psychological distance from the risk.

3. Two key factors: media and trust mechanisms

The author has summarised the factors influencing the amplification and attenuation of risk. According to existing research, amongst all influencing mechanisms and drivers, media and trust are particularly crucial. Therefore, the focus will be on further examining these two aspects.

3.1. The role of the media in risk amplification or attenuation

The root cause of social risk amplification lies in the social experience of risk, which encompasses both individuals' direct experiences and their indirect experiences through the reception of information. When direct experience is lacking, individuals obtain risk information through others or the media. Of all factors, the media is a key influencer in the amplification or attenuation of risk. Among the characteristics of information that influence the amplification effect are information content, the extent of dissemination, the degree of dramatisation, and the symbolic connotations of the information [2]. The global development of social media has made the 'ripple effect' of risk even more pronounced. Specifically, this manifests as follows: economically, a decline in business revenue in affected areas, a depreciation in property values and an economic downturn; politically, shifts in political objectives, the political climate and cultural norms; in terms of the nature of risk, the strengthening or weakening of risk feedback mechanisms, and changes in the methods or content of risk regulation; and socially or technologically, changes in relevant employment and education, a decline in public trust in social workers, and other phenomena of social disorder [21].

As the Social Risk Amplification Framework (SARF) was developed prior to the emergence of social media, many scholars have argued that the specific implications of SARF in the social media era should be continually re-examined; furthermore, the role of the media in risk communication in this era requires re-evaluation. In this context, the amplifying effect of social media has been overwhelmingly emphasised in research: a defining characteristic of social media as an amplifying platform is that people's amplification of risks runs parallel to their motivation to pursue personal gain [22]; other studies have compared the roles of traditional media and social media in shaping public perceptions of risks such as dengue fever and forest fires, finding that social media's effectiveness in amplifying risks may be more pronounced, likely due to its advantages in sharing images [23]; Chong and Choy revealed the role of Facebook in stimulating public emotional responses, thereby amplifying risks [24]; Furthermore, the technical architecture of social media leads to a lack of consensus regarding risk information; that is, there is no global consensus on issues such as truth and value orientations, and certain experiential views or group norms may be enforced. For social media platforms, misinformation holds value, and promoting 'moral and inflammatory topics' can yield greater profits [25].

Only a handful of studies have revealed that social media can simultaneously amplify and mitigate risks [26]; for instance, it has been argued that during the COVID-19 pandemic, social media, by disseminating misinformation, acted both as a mediator for risk mitigation and as an amplifier of risks through false information [27].

Kasperson et al. highlighted the influence of factors such as the volume of information, its characteristics and the extent to which it is questioned on the amplification of risk perception. In particular, they emphasised that a greater volume of information reinforces perceptions of high risk [28], but subsequently added that high-density, sustained media coverage is not always correlated with public risk concerns [29]. With regard to research on the influence of traditional and new media on risk perception, overall, the manner in which the media—particularly state-run media—reports on risks significantly influences whether perceptions are 'amplified' or 'downplayed'. Following the nuclear accident in Japan, the Japanese media's tendency towards scientific reporting of the incident reduced the Japanese public's perception of risk [30]; simultaneously,

exposure to new media also shapes individuals' perceptions of risk, with empirical research indicating that misinformation on social media exacerbated people's perception of the risks associated with the Zika virus [31]. Compared with traditional media, social media exposure to information on environmental and health risks [23], and smog-related issues is a stronger predictor of heightened risk perception [32]; however, other studies suggest that exposure to new media information does not significantly influence perceptions of the risks associated with the discharge of nuclear wastewater [12].

It is evident, therefore, that the role played by the media may vary across different risk scenarios, or may be complex and multi-layered. Rip criticised many existing studies for 'focusing on the media's tendency to blame the public for irrationality and moral failings', emphasising that more efforts should be made to understand the reasons why the media may amplify or mitigate risks [33].

3.2. Another key factor : mechanisms of trust

Apart from the media, trust is another key factor influencing risk perception. Trust is widely recognised as a concept of great importance to social interaction; it is defined as an individual's expectation that others and organisations within social relationships will act in a competent, reliable, predictable and caring manner. Trust is characterised by being easily lost and difficult to gain [34]. Existing research has revealed a correlation between higher risk perception and lower trust, and between lower risk perception and higher trust; the lower the level of social trust, the higher an individual's perception of environmental risk [35]. For example, the public is more likely to accept X-rays or medication that carry a certain degree of risk based on their trust in doctors; conversely, lower trust in government officials responsible for regulating nuclear power leads to greater fear of the risks associated with nuclear power. In the absence of trust, the more information released by scientific research and risk assessments, the stronger the public's sense of distrust becomes; even if the information provided by scientists does not point to evidence of high risk, the public will still feel greater concern [5].

Distrust is an individual's expectation that others and organisations within social relationships are likely to act in ways that are incompetent, erratic, indifferent, or even potentially harmful [36]. Among these, trust in experts is particularly fragile; once this trust is broken, it is difficult to rebuild [37]. As mentioned earlier, the lower the level of social trust, the higher an individual's perception of environmental risk [35]; conversely, the higher the level of social trust, the lower the perception of risk. As a form of institutional trust, a high level of trust in government leads to a lower perception of risk by shaping the public's sense of ontological security [38]. Previous research has found that public anxiety and resistance towards nuclear waste disposal schemes are viewed as a crisis of trust, namely a systemic distrust of scientists, government officials and industry practitioners in the nuclear sector [39].

In summary, existing research has focused on the theory of social risk amplification, identifying the driving factors behind risk amplification and attenuation from multiple dimensions, including the characteristics of risk information, public psychological cognition and the social environment; Building on this, the mechanisms through which the media and trust—as key influencing factors in risk communication—operate have attracted widespread attention: the media not only convey risk signals but also profoundly influence the public's risk perceptions and response behaviours through framing, discursive strategies and agenda-setting; meanwhile, trust exerts a moderating effect across the processes of information reception, decoding and dissemination, acting as an implicit 'valve' in risk communication. These findings provide a solid knowledge base for understanding the social construction of risk.

However, it should also be recognised that current research largely focuses on individual events or specific media platforms, and there remains a lack of systematic examination of the dynamic interplay between risk

amplification and attenuation, the synergistic effects of multiple actors, and the fluid nature of trust across different media ecosystems. In particular, as social media has become the main arena for risk communication, the traditional media-centred analytical paradigm faces challenges, and the role of the public as active participants has not yet been fully theorised. These unresolved issues represent the areas where future research needs to focus its efforts. In light of this, subsequent research may explore the following areas.

4. Research prospects: toward a new agenda in risk communication

Firstly, shifting from an 'expert perspective' to an 'actor's perspective' to explore the public's production of risk knowledge and risk-related practices. SARF provides a rich framework for comprehensively understanding the process of risk communication and the factors influencing the public's perception of risk; however, as some scholars have criticised, it is characterised by a strong 'expert' perspective. Busby et al. suggest re-exploring a more relativist approach, shifting the focus from issues of epistemological hegemony to risk actors—that is, how the public holds views on risk. "Today's public comprises a broader demographic base and possesses richer knowledge; focusing on how they, as risk actors, construct their responses to risk" [40]. This helps to make the 'tacit knowledge' in risk communication visible, thereby supplementing the shortcomings of existing empirical research in its focus on the production of meaning at the micro-level.

Secondly, by examining the 'amplification' and 'attenuation' of risk in tandem, we reveal the intrinsic mechanisms underlying their coexistence and transformation. Previous research has tended to focus on measuring and interpreting a single dominant effect (amplification or attenuation) within a given risk event, with few studies systematically comparing the two within a single analytical framework. However, in reality, risk communication often presents a complex picture in which 'amplification in one respect and attenuation in another' occur in parallel—within the same event, different issues, different groups and even different communication channels may give rise to diametrically opposed perceptual effects. Future research should endeavour to examine the conditions and boundaries under which amplification and attenuation coexist, as well as the mechanisms of their dynamic transformation, by asking 'under what circumstances, through what communication pathways, and on which groups do specific effects occur?', thereby advancing risk communication research from single-factor explanations towards a contextualised and comparative analytical paradigm.

Thirdly, by adopting a multi-actor, multi-modal perspective on the communication ecosystem, we should re-examine the dynamic relationship between the media and trust. Existing research has largely focused on analysing the effects of traditional media or individual social media platforms, whilst lacking systematic attention to the complex interactions between media types, communication actors and shifts in trust within the current converged communication ecosystem. Future research should focus on examining the discursive roles and trust dynamics of different media attributes (such as authoritative media versus self-media, and text-and-image content versus short videos) and different actors (official bodies, experts, opinion leaders and the general public) at various stages of the evolution of risk-related issues. Particular attention should be paid to 'trust drift'—the highly dynamic process by which trust flows, shifts and even collapses abruptly amidst repeated fluctuations in information.

Fourthly, by adopting a long-term, cross-event tracking design, this study reveals the socio-cultural cumulative effects of risk perception. Current research on risk communication largely consists of cross-sectional analyses of individual events, making it difficult to capture the diachronic evolution and cumulative logic of public risk perception. Future research could attempt to conduct long-term tracking of multiple risk events within the same issue domain, or undertake comparative analyses of similar events across different

cultural contexts, in order to reveal how risk perception is shaped by social memory through repeated exposure, and how it crystallises into stable cognitive structures within localised cultural concepts. This approach not only addresses SARF's initial concern regarding the influence of 'culture and social institutions', but also holds the potential to drive a paradigm shift in risk communication research from an event-driven to an institution-driven framework.

5. Conclusion

The Social Amplification of Risk Framework (SARF) remains a valuable heuristic for tracing the pathways through which risk information gains or loses salience and triggers societal responses. Our review confirms its theoretical richness, integrating individual-level determinants—trust, media exposure, and perceived risk attributes—with macro-level cultural and political dynamics that shape how risks are contested and institutionalised. A persistent imbalance, however, has emerged: amplification has drawn disproportionate scholarly interest, while attenuation, arguably equally consequential, remains underexplored. We further establish that media and trust operate as twin pivots in this process—media not only convey but also construct risk realities through framing, whereas trust functions as a gatekeeping mechanism that conditions whether information is accepted, rejected, or further circulated. Yet the literature remains fragmented, bound to isolated case studies and platform-specific analyses, and thus falls short of capturing the recursive interplay between amplification and attenuation, the coordinated actions of multiple actors, and the shifting nature of trust across an increasingly hybrid media environment. Moreover, the public is still predominantly cast as passive receivers rather than co-producers of risk communication. To redress these gaps, we advocate a research agenda that repositions the public as active agents, places amplification and attenuation in direct comparison, adopts a multi-actor ecology lens, and embraces longitudinal designs. These pathways, we argue, will push the field beyond linear, one-off explanations towards a more nuanced, contextualised, and comparative understanding—one that is urgently needed for effective risk governance in today's digitally mediated world.

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