What is safety? contemporary definitions and interpretations across North America

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ABSTRACT

Definitions form the foundation of every scientific discipline. Lack of precise definition hinders the scientific community, preventing the testing of hypotheses, replication of protocols, and debate on conclusions. The term 'Safety' is widely used in myriad different contexts, creating the impression that there is agreement about its meaning. This belief is reinforced by its frequent use, leading to a reasonable assumption that it is universally comprehended. However, there is very limited research on how safety is defined. Drawing on 518 qualitative responses from safety professionals across North America to the question 'what is safety?', thematic analysis reveals that we are still far from consensus. No single precise definition of safety emerged from within the community, and thus a shared definition remains elusive. A temporal lens could be applied to the various definitions shared, with safety considered in past, present and future terms, each with their own associated constructs. Whilst a single definition of safety appears improbable to attain, common definitions are needed to advance collaboration among stakeholders across various sectors. Further work is needed to drive consensus towards such definitions to better underpin comparable and consistent safety research, able to advance safety practices and enable practitioners, researchers, and organizations to collectively work together towards safer environments that benefit all.

1. Introduction

The term 'safety' is used so frequently and in such a wide variety of different contexts that there is the unavoidable impression that there is a simple definition and shared understanding of its meaning (Ball and Frerk 2015). As a result, there is usually no perceived need for individuals to seek clarification or determine a definition when discussing safety. This assumption of a common interpretation is widespread throughout various standards, guidelines, and dissertations, all of which frequently fail to provide a clear definition for safety (Hollnagel 2014b).

Despite several safety definitions present in the literature, and previous work undertaken within the fields of both safety science (e.g., Aven 2014; Hollnagel 2014a; Vandeskog 2024) and risk science (e.g., Möller et al. 2006; SRA 2018, Aven 2022), there has been limited progress in establishing a *common* definition within the safety community. Table 1 provides an overview of some prominent definitions. Since definitions are based on shared understanding and community acceptance, rather than scientific evidence, none of these definitions can be deemed inherently correct or superior to the others. Instead, these definitions simply take different perspectives and approaches. At one end of the spectrum, safety is explained as the absence of risk or incidents (Reason 2000; Möller et al. 2006; Shojania and Duncan 2001), while on the other, it is viewed as the presence of capacity or capabilities (Dekker 2014). Even dictionary definitions used in safety literature vary greatly. The Oxford English Dictionary defines safety as "freedom from danger and risks" while Merriam-Webster Dictionary describes it as "the condition of being safe from undergoing or causing hurt, injury, or loss.".

These differing viewpoints on safety have also been suggested to limit the capacity to influence safety practices and decisions, hindering effective communication and collaboration (Manuele 2013), and reduce effectiveness in managing accidents (Balderson 2016). An established definition provides clear communication of ideas by setting boundaries around a phenomenon, enabling a common understanding of a word or subject, facilitating meaningful conversations, and promoting better decision-making. The consequences of our current ambiguity also extend to multiple organizational levels, as varied interpretations of safety between senior leadership, management, and workers can lead to

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Table 1

Summary of some existing safety definitions.

Definition of Safety	Reference
Safety is the preservation of positive value	(Vandeskog 2024, p. 5)
"An ability for a system to perform its intended purpose, whilst preventing harm to persons"	(Provan et al. 2020, p.1; Vandeskog 2024, p. 3)
"Safety is a complex concept often defined by a particular condition. This condition denotes the absence of potential harm, including risks such as injury to individuals or animals, financial loss, or any other form of damage or loss."	(Li and Guldenmund 2018, p.95)
"The antonym of risk (the safety level is linked to the risk level; a high safety means a low risk and vice versa)"	(SRA 2018, p.7)
"The application of hazard control through the workplace, person and system by integrating into the organization sustained actions, accountability and reducing risk to as low as reasonably practicable to mitigate potential injury."	(Balderson 2016, p. 68)
Zero Harm	(Balderson 2016, p.64)
"The condition where the number of adverse outcomes is as low as possible by trying to make sure things do not go wrong by eliminating the causes of malfunctions and hazards or by containing their effects."	(Hollnagel 2014b, p.23)
Freedom from unacceptable risk	(ISSO/IEC 2014, p.2)
"Safety is a conceived of as a state of low risk: the lower the risk, the higher the safety."	(Möller et al. 2006, p.421)
"A state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community."	(Maurice et al. 2001, p. 238)
"The ability of individuals or organizations to deal with risks and hazards so as to avoid damage or losses and yet still achieve their goals."	(Reason 2000, p.5)

differences in understanding that hinder the achievement of safety objectives (Montante 2008).

Efforts have been made to emphasize the need for a shared definition of safety. Notably, a collaborative effort was initiated in 1996 by two World Health Organization (WHO) Collaborating Centers on Safety Promotion and Injury Prevention worked to establish a common understanding of safety (Peden 2004). The outcome emphasized that establishing a common definition of safety would enhance collaboration among researchers and community program workers within the safety promotion discipline (Maurice et al. 2001). The initiative proposed a definition of safety as "a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community" (Maurice et al. 2001, p. 238). However, a key challenge was that while the WHO's definition included both objective (measurable) and subjective (perceptual) dimensions of safety, many injury prevention programs and researchers focused primarily on the objective aspects, such as reducing injury rates, resulting in an imbalance in application. The emphasis on measurable outcomes likely contributed to the difficulty in applying the WHO's broader definition, which also encompassed subjective safety perceptions, and thus a lack of holistic uptake. Balderson (2016) also emphasizes that a precise definition of safety is essential for stakeholders to establish a common understanding of the subject which can lead to meaningful discussions and informed decision-making.

Prior research of this topic has focused on theoretical approaches and has often introduced new definitions rather than fostering consensus on a unified definition. Rather than offering another definition, this study seeks to augment existing perspectives with empirical evidence by unpacking, comparing, and discussing definitions of safety through the analysis of a dataset gathered from professionals and practitioners. This will provide insights and explanations able to enhance current understandings of safety, illustrating its multifaceted nature and the diverse perspectives that influence its interpretation. Findings have the

potential to bring greater clarity to the field and provide the foundational basis necessary for eventually defining 'safety' in a formal scientific way. Additionally, the results may lead to safety promotion across different domains, provide a common understanding among stakeholders, and enhance collaboration between researchers.

2. Context

2.1. On definitions

Definition is a crucial tool in the world of science, discourse, and intellectual discipline. Definitions add precision and clarity to language, allowing for the unambiguous communication of ideas and concepts (Abbott 2002). Definitions perform two main critical functions in communication: (1) they reduce inherent ambiguity found in common language that is frequently lacking in precision and often relies on context and (2) they establish boundaries of what a term encompasses and efficiently differentiate the term from other concepts. Thus, they prevent uncontrolled and confusing proliferations of discourse and serve as the linchpin that sustains the integrity of a discipline, ensuring that its language remains disciplined and that its ideas are effectively conveyed.

Accepted definitions form the foundation of every scientific discipline. As safety is a relatively young subject to be addressed by science (Le Coze et al. 2014), there is a serious need to establish a shared definition. Lack of precise definition hinders the scientific community, preventing the testing of hypotheses, replication of protocols, and debate on conclusions (Abbott 2002; Jax 2007). Irrespective of how definitions are structured, they need to be established and maintained, and researchers should adhere to them, even if they disagree, until they can persuade the entire research community to reconsider and revise them (Bayona et al. 2023).

There are various types and classifications of definitions, including descriptive, normative, intensional, extensional, and more (Abbott 2002; Harms-Ringdahl 2004). The application of a specific type of definition depends on many factors including the context and the requirement for precision and clarity in communication or academic discourse (Fodor et al. 1980). Fields of study often mature along with their key definitions. The evolution of the definition of a planet in astronomy provides a fascinating example. Initially, the definition was extensional, simply listing observable planets like Pluto in our solar system. However, after seventy years, the International Astronomical Union (IAU) underwent a transformative process, adopting an intensional definition for a planet. According to the new definition, a planet must orbit a star, have sufficient mass for a nearly round shape, and "clear the neighborhood" around its orbit. Under this revised definition, Pluto no longer qualified as a planet and was therefore reclassified as a dwarf planet (Brown 2012). Despite some resistance to this change, the scientific community embraced the new definition, recognizing it as an improved understanding of natural phenomena also able to enhance clarity and rigor in astronomical scientific research from that point forwards.

The occupational safety field arguably finds itself in a similar scenario, but decades behind. The meaning and understanding of safety currently encompass numerous shifts that have occurred over the past century. The field of safety may be at an inflection where alignment on definitions can be revisited.

2.2. A brief history of the meaning and definitions of safety

Examining etymology provides a valuable starting point to understand how the definition of safety has progressed. By uncovering the historical origins and evolution of the word "safe" and related terms, we gain valuable insights into the original concept of safety and its development over time, aiding us in crafting more effective and aligned definitions for the future.

According to etymologist Douglas Harper (2001), the term "safe"

was incorporated into the English language around 1280, derived from the Old French word "sauf," which itself originated from the Latin term "salvus" meaning "uninjured, healthy, safe." This Latin root is associated with related ideas such as "salus" (meaning "good health"), "saluber" (meaning "healthful"), and "solidus" (meaning "solid"), all stemming from the Proto-Indo-European foundational word "solwos" that conveys the concept of wholeness. These early definitions can be considered inward-looking, relating to a person and the contemporary state of their body, rather than anything external to the individual.

The term "safety" emerged in the late fourteenth century, used to describe a state of being free from danger. Later, in the 1580 s the term "safe" took the form of an adjective to describe conditions or situations "without risk" was first recorded (Harper 2001). These definitions are slightly different in their nuance to the very first iterations of safety because they look outwards and speak to an individual's environment rather than the state of the individual themselves. These latter definitions reflect more contemporary simple generic definitions of safety, such as "the absence of unwanted outcomes like incident or accident"(Hollnagel 2014a, p. 1; Manuele 2013, p. 2). This view, and associated definitions of safety, have undergone changes and development from various perspectives to take us to our present situation (Borys et al. 2009).

2.3. Contemporary views of safety

The conventional perspective of safety arguably revolves around studying failures and striving for a scenario where "nothing goes wrong." More recently, this perspective has faced challenges by new theories such as High Reliability Organizations (HRO), Resilience Engineering, Safety Differently, Safety-II, and Human and Organization Performance (HOP) (Ball and Frerk 2015; Conklin 2019; Provan et al. 2020). These theories emphasize an adaptability in organizations created by learning from both success and failure withing complex systems (Provan et al. 2020). For instance, Hollnagel (2008, 2014a, 2014b) and Dekker (2017) argue that we should focus on "what goes right rather than what goes wrong" and Conklin (2019) proposes that safety is "not just the absence of events; it is the presence of defenses" (Vandeskog 2024, p.3). These theories collectively shift the focus to maximizing success in complex systems. Put simply, the ideological foundations of these 'new views' (Le Coze 2022) emphasizes that a system (as distinct from an individual) is not considered safe only due to the absence of recent adverse outcomes.

2.4. Summary

Safety has historically been defined from myriad perspectives, emphasizing its multifaceted nature. It's etymological roots show how contrasting perspectives have developed over time, from inward looking personal constructs of safety to those that look outwards to the environment as the place in which safety 'exists'. Most recently, this has focused on the system rather than the individual as the 'place' in which safety 'happens'. Yet despite significant progress, the lack of a common definition of safety has arguably hindered effective communication and scientific advancement. To seed progress, it is essential to establish a common definition that can be governed and applied by the safety community. Through a shared understanding of safety, practitioners, researchers, and companies can collaborate to create improved metrics, test hypotheses, and communicate more clearly.

3. Research Method

The aim of this study was to unpack, compare and discuss understandings and definitions of safety through the analysis of data collected from professionals and practitioners across North America. To achieve this aim, a simple and straightforward qualitative survey was employed asking just one question: 'what is safety?' Data were collected

from a total of 518 participants representing a wide range of sectors, diverse professional backgrounds, and varying levels of experience.

3.1. Method of data Collection and sample

The survey was administered using the Qualtrics online survey platform. The data were collected by voluntary participation from interested parties, thus resulting in a self-selecting sample. This was deemed acceptable as those taking the time to respond are, by nature of their participation, likely to have vested interests in safety, safety operations and performance, and are therefore a highly relevant group to sample given the aim of this study. The survey was launched through the internal network of the [organization name redacted for anonymity purposes during peer review] and was also shared through their LinkedIn page. This resulted in a diverse sample with the demographics as shown in Tables 2 to 4.

3.2. Method of data analysis

A combination of thematic and content analysis was adopted for this study. Thematic analysis is a systematic approach used to identify and organize patterns of meaning within a qualitative dataset. It enables the interpretation of significant aspects of the phenomenon under investigation, whilst offering flexibility for both inductive and deductive approaches to the data (Gupta et al. 2019). This study followed the guided step-by-step process outlined by Braun and Clarke (2012). The analytic process adopted is therefore iterative and not strictly linear, with researchers navigating back and forth based on data demands and analytical development.

The analysis process consisted of six distinct phases following the guidance of Boyatzis (1998) and Gupta et al (2019):

1. Three thorough readings of the dataset to establish thematic familiarity, followed by thematic analysis using the latent approach
2. Generating initial codes through manual and computer-assisted methods, with provisions for decoding and recoding.
3. Searching for themes, utilizing all initial codes to establish main and sub-themes.
4. Reviewing and refining themes for coherence.
5. Defining, refining, naming themes, and ensuring their alignment with the dataset.
6. Drawing conclusions and reporting through visuals.

To supplement this traditional thematic analysis, Word Trees were also generated for particular words and phrases within the survey responses (Henderson and Segal 2013). A word tree is a visual representation that showcases the relationship between a specific word or phrase and others. It employs a branching system to visually display these connections (Wattenberg and Viegas 2008) which, in this study, enables the visualization of all the sentences used within the specific theme.

Table 2
Distribution of Participants by Sector.

Sector	No. of Participants	%
Commercial Construction	154	30
Utilities	131	25
Oil and Gas	103	20
Other	59	11
Infrastructure	41	8
Consultancy	16	3
Technology	7	1
Residential Construction	5	1
Academia	2	<1

Table 3
Distribution of Participants by Profession.

Profession	No. of Participants	%
Safety Professional	270	52
Executive Management	69	13
Field Manager/Supervisor	58	11
Other	46	9
Construction Manager	33	6
Architects	15	3
Consultants	14	3
Academic	9	2
Front-line employee	4	1

Table 4
Distribution of Participants by Experience.

Experience (Range in Yrs.)	No. of Participants	%
Over 20	233	45
11 to 20	152	29
6 to 10	64	12
1 to 5	57	11
Less than 1	8	2
Other (not mentioned)	4	1

3.3. Research validity and limitations

A key limitation of this study was the composition of the sample. This was a self-selecting sample drawn mainly from North America, which limits the external validity of the findings. This geographical specificity of the data has been clearly acknowledged in the paper title, thus no claim for generalizability beyond that context is made.

Although compromising generalizability, the aim and nature of this research necessitated a purposive sample to ensure the capture of meaningful data from those who regularly work in the field of safety. The resultant sample composition, whilst admittedly serendipitous, suggests a high level of validity given the large proportions of safety professionals (52 %) and others who are involved with safety as part of their professional life. 45 % of the sample also had over 20 years' experience in their fields, which also helps support the validity of the resultant findings. This purposive sampling was essential to gather insights from experienced professionals, thus making the data highly relevant to real-world safety environments within the geographic scope of the study.

Moreover, the sample size and the composition could also have an impact on the external validity and thus generalizability. However, the number of responses (n = 518) and varied sample composition suggests a relatively high level of external validity. The data originated a diverse array of industries such as Commercial Construction, Utilities, Oil and Gas, among others. Moreover, the diversity of professions represented, including Safety Professionals, Supervisors, Executive Management, and a variety of roles, clearly depicts the comprehensive nature of the data.

4. Findings and discussion

Fig. 1 presents the summary of the themes that emerged from this study. Furthermore, a weighted percentage of the most prominent words is presented in Table 5 and explained within the context of their respective themes.

Table 5
Weighted percentage of the highest words used in responses. Generated by NVIVO14.

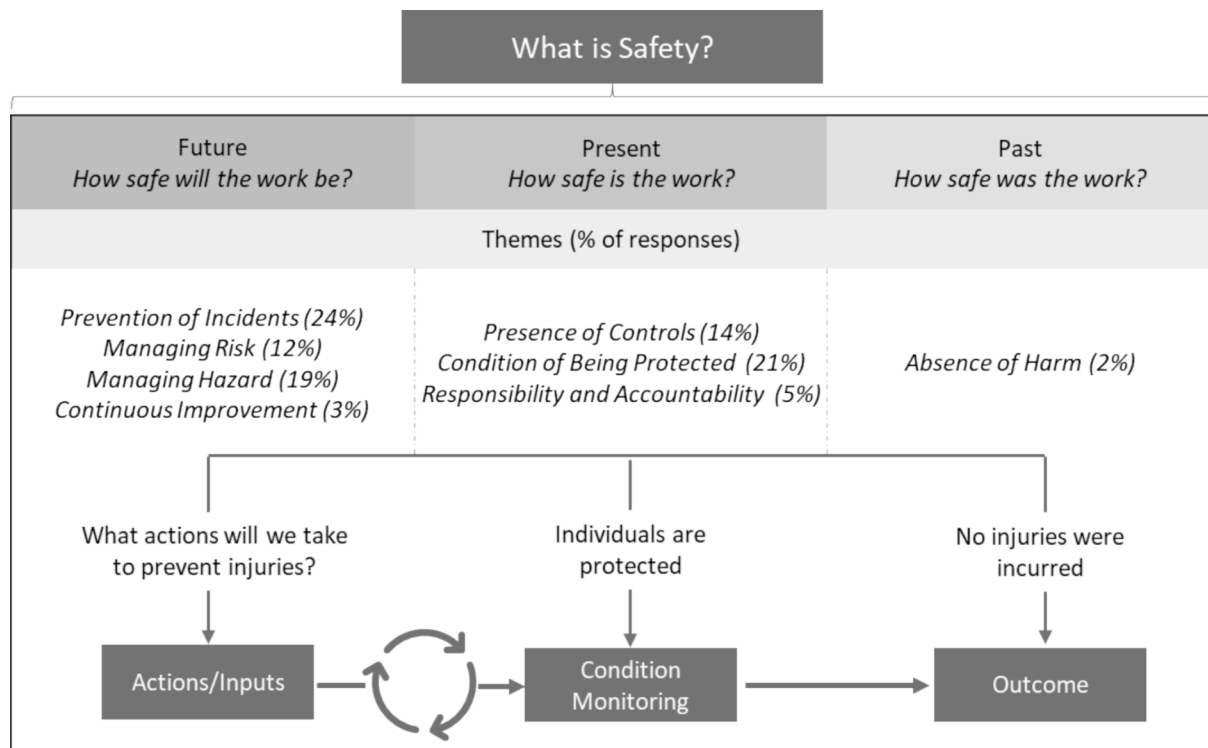| Word	Weighted Percentage (%)	Similar Words
Risk	3.53	risk, risking, risks
Hazard	3.19	hazard, hazardous, hazards
Protect	2.93	protect, protected, protecting, protection, protective, protects
Harm	2.77	harm, harmed, harmful, harming
Control	2.61	control, controlled, controlling, controls

Fig. 1. Summary of themes.

4.1. Safety is about the future – How safe will the work be?

In the first family of themes, participants defined safety as actions or processes to prevent or mitigate harm, injuries, or incidents. The sub-themes included managing risk, managing hazards, and continuous improvement. These sub-themes converge to one idea: safety as the actions taken to ensure that the work *will* be safe.

This convergence is illustrated in the word tree in Fig. 2, which shows how various actions, programs, and measures link to the unwanted consequences on the right, such as injuries, harm, incidents, and damage through the word "to prevent." The most prominent sub-themes are described in detail below.

4.1.1. Safety as the prevention of Injury, Incidents, and accidents

The most prominent sub-theme within the data overall (mentioned by 24 % of the respondents) defined safety as the prevention of injuries, accidents, incidents, and near misses. For example, as stated by one participants, safety is *"the effort to prevent illness/injury/loss"* and *"a program aimed to prevent workplace injuries, illnesses, and deaths, for workers, their families, and employers."*.

This sub-theme constructs safety through the lens of accident prevention. The terms used (accident, incident, near misses, injuries) are categorized as unwanted outcomes or events (Jones et al. 1999). This definition of safety is described as the prevention of unwanted consequences in the literature (Balderson 2016; Hollnagel 2014a). The fact that this thematic viewpoint received the highest response rate is unsurprising because many believe that prevention of injuries or accidents is fundamentally the core objective of safety science (Fu et al. 2020; Ge et al. 2022) and throughout the history of safety, accident prevention has been a highly significant focus (Le Coze 2022).

Although defining safety as the prevention of accidents or injuries may seem simple and straightforward, it is also vague and indirect (Aven 2022). This is due to the indirect link between safety and accidents, meaning safety will only be present if there are no accidents or injuries. Thus, according to this thematic view, safety would be nothing but studying accidents or injuries – or focusing on the lack of safety (Vandeskog 2024; Hollnagel 2014a).

This definition also presents challenges for measuring safety, as quantifying instances (i.e., adverse outcomes) that have not occurred yet is not feasible or practical (Reason 2000). Simply put, there is nothing to observe or measure. This approach in organizational settings tends to evaluate safety when it is absent rather than present, creating an inaccurate representation of the actual state of safety. Injury rates imply that hours without recorded injuries are safe, while those with injuries are unsafe. However, this assumption overlooks instances where work might be performed unsafely without resulting in injury, attributing safety to luck rather than proper practices. These philosophical limitations translate to statistical invalidity. As empirically demonstrated by Hallowell et al. (2021), using injury rates to measure safety performance creates statistical instability that renders the metrics meaningless for nearly all business decisions or research studies.

4.1.2. Safety as managing risk

In this sub-theme (shared by 12 % of the participants), safety is defined as the process of identification, assessment, and control of risks to create a safe environment. It emphasizes the importance of systematic risk assessment, and the implementation of preventive measures. For instance, one participant stated that, *"safety is the identification of risks and the subsequent steps to eliminate and/or minimize the identified risks to create an environment that allows employees to safely complete their required tasks and avoid injuries."* Participants also shared that, *"safety is the freedom from unacceptable risk' or 'the control of risks as low as reasonably possible."* These viewpoints illustrate the other side of this view, which emphasizes the goal of achieving an environment with minimal or zero risk.

Safety as managing risk captures the commonly held definition of safety as the opposite of risk, implying that safety increases as the level of risk decreases (Balderson 2016; Möller et al. 2006). The Society for Risk Analysis (SRA) Glossary, developed by a broad group of experts with input from SRA members, also defines safety as "the antonym of risk (the safety level is linked to the risk level; a high safety means a low risk and vice versa" (SRA 2018, p.7). This idea emerges in two forms: managing risk to a level where 'no risk' remains or managing risk to be 'as low as reasonably possible.' These two points are also commonly termed the absolute and relative concepts of safety in the literature (Möller et al. 2006). Although popular, researchers have pointed out some major shortcomings of an absolute definition of safety as the absence of risk. For instance, Manuele (2013) argues that describing
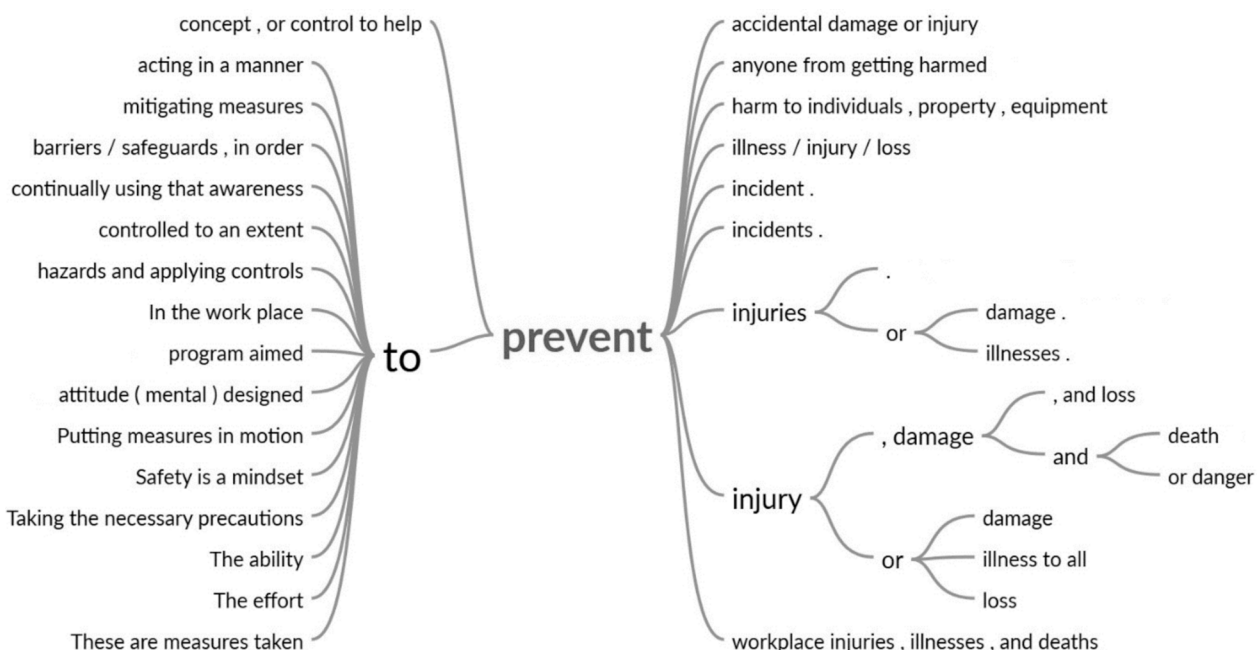

Fig. 2. Safety from Future-Oriented Perspective (Word Tree for "prevent").

safety as managing risk to zero level indicates a lack of understanding of the relationships between risk and safety. Even when risk is significantly mitigated, a residual risk always remains unless the operation ceases entirely. Hence, assuming a scenario where the probability of a harmful event is completely zero is both infeasible and unrealistic. Thus, some have instead described safety as managing risk to an acceptable level. Additionally, Aven (2014) argues that defining safety as the antonym of risk is a simplistic view, often based solely on probabilistic measures and failing to account for the inherent uncertainties in real-world contexts. He contends that a broader conceptualization of risk—one that includes both uncertainties and potential consequences—provides a more comprehensive understanding of safety. In other words, safety can be considered the antonym of risk, but only when risk is defined to include the complexities and uncertainties beyond mere probability assessments.

Lowrance (1976, p.8) stated that "a thing is safe if its risks are judged to be acceptable." The International Organization for Standardization (ISO)/IEC Guide 51 (ISO/IEC 2014) also defines safety as freedom from intolerable risk, prompting the clarification of acceptable risk levels. Similarly, the SRA defines 'safe' as "without unacceptable risk" (SRA 2018, p. 7). As a result, the principles of 'As Low As Reasonably Practicable' (ALARP) or its US equivalent 'As Low As Reasonably Achievable' (ALARA) emerged to address this need and are mandated by regulations (Jones-Lee and Aven 2011). Thus, a situation is deemed to be safe if it meets the ALARP or ALARA definitions. Put simply, acceptable risk is defined as minimizing the probability and severity of incidents to ALARP levels (ANSI/ASSE 2011; Manuele 2010, 2013p.3). However, the exact threshold of acceptable risk remains elusive.

4.1.3. Safety as managing hazards

The complex interaction between risk and hazard has led to the interchangeable use of these concepts, which sometimes even impedes their effective application (CCOHS 2020). Staying true to the clear distinction between hazard and risk, where a hazard is a source of danger and a risk is the potential occurrence of harm (Hallowell 2008, p. 8), this view surfaced from 19 % of the participants who defined safety as variously the understanding, identifying, assessing, controlling, and mitigating hazards. For instance, in the words of one participant *"safety is identifying and preventing hazards", "is an approach which possible hazards are identified and mitigated" or "safety is action(s) taken to protect people from hazard."*.

This sub-theme presents the concept of safety through the perspective of hazard management. Hazard management encompasses the identification, assessment, control, and mitigation of hazards (Kasperson and Hohenemser 1985; Fischhoff et al. 1987). Table 1 reveals that safety has been defined or approached in the literature as "hazard control", "a state where hazards are controlled", or "the application of hazard control". However, no references were found that provided a definition of safety with integrating all aspects of hazard management.

A significant reason behind the emergence of this view may be attributed to the pivotal role of 'hazard' in the domain of safety, since it forms the foundation upon which safety practices are typically constructed (Manuele 2010). Failure to recognize hazards is often identified as the root cause of injuries, illness, and accidents (OSHA 2024). It is apparent that hazard management serves as a linchpin to control and prevent harm. This has resulted in the establishing of objectives aimed at achieving a 'zero' state of harm and the establishment of a harm-free environment, something that emerged as another sub-theme within this study, which is discussed later in Section 4.3.

4.1.4. Safety as continuous improvement

Safety is also described by 3 % of respondents as an ongoing process that demands continual assessment, reflection, and enhancement. This sub-theme emphasizes the value of learning from past incidents and sharing those lessons with others. For example, one participant stated that *"safety is learned behavior developed through our experiences", "safety is based on experiences and knowledge developed throughout the life span", or "commitment to continuously improve."*.

This view captures an integral part of continuous improvement (CI). CI is rooted in Deming's management philosophy and can be defined as a programs processes that aim to increase successes and minimize failures (Singh and Singh 2015). The interpretation of CI varies across fields, but it is based on two principles: change and improvement. In safety, CI implies consistently assessing safety data, addressing system vulnerabilities, and continuously improving (Kukoyi and Adebowale 2021). A probable reason for this type of definition could be the proliferation of CI focus in the safety space. However, no definition was found in the literature where safety was explicitly defined as "continuous improvement.".

4.2. Safety is about the present – How safe is the work?

The following subsections encompass sub-themes that illustrate safety as the present condition. In other words, this theme positions safety firmly within the parameters of *how safe the work is in the present*. The theme again comprises different topics, including the presence of controls, the condition of being protected, and responsibility and accountability, all converging to one juncture, which focuses on ensuring that individuals are protected, or the work *is* safe.

The word tree depicted in Fig. 3 elucidates the preceding explanation. The size of each word in the word tree corresponds to its frequency of usage (Henderson and Segal 2013). It is evident that the path "condition of being protected…" exhibits the most substantial and consistent branch, portraying safety as the condition or state of being protected in the present moment.

4.2.1. Safety as the presence of capacity and controls

This sub-theme, representing 14 % of respondents, defined safety as the presence of controls against potential hazards rather than the absence of injuries. As shared by the participants, *"safety is presence of controls that prevent harm to the worker",* or *"safety is not the absence of injuries, it is the presence of safeguards."* This view also stresses that safety is about the presence of necessary resources, capabilities, and controls to build resilience, handle unexpected events, and mitigate the consequences of failures, or 'fail safely.' As added by other participants, *"safety is the presence of capacity to fail safe,"* or *"safety is having the capacity to absorb failure."* This perspective reflects a contemporary view that directly contrasts with the traditional yet still common theme that safety is simply the absence of injuries (Conklin 2019; Dekker 2019; Hallowell 2021, 2023; Erkal and Hallowell 2023).

Contrary to traditional views, the 'new view' of safety emphasizes enhancing normal work processes to improve safety (Gantt and Ramon 2017), focusing on system performance variability and successes rather than only on failures (Righi et al. 2015). However, some literature critiques this view, questioning its empirical validation and real-life applicability (Cooper 2022; Le Coze 2022). Indeed, Cooper (2022) suggest that a successful result would be to combine the traditional and new views of safety by implementing risk controls as defenses between layers of energy present in any potential incident trajectory.

4.2.2. Safety as condition of being or feeling protected

Within this sub-theme, shared by 21 % of the respondents, safety is defined as the condition of being or feeling protected from harm, danger, or risk. Participants stated that *"safety is the condition of being safe from conducting a task or causing hurt, injury, or loss"* or *"safety is the condition of being protected from danger, risk or injury."* This sub-theme also emphasizes the importance of having a safe working environment where individuals remain unharmed, ensuring everyone returns home safely. As mentioned by one respondent, *"safety is ensuring that all operations, tasks, and areas are setup that each and every worker or person finishes their day and goes home without any negative health or physical injuries."*.
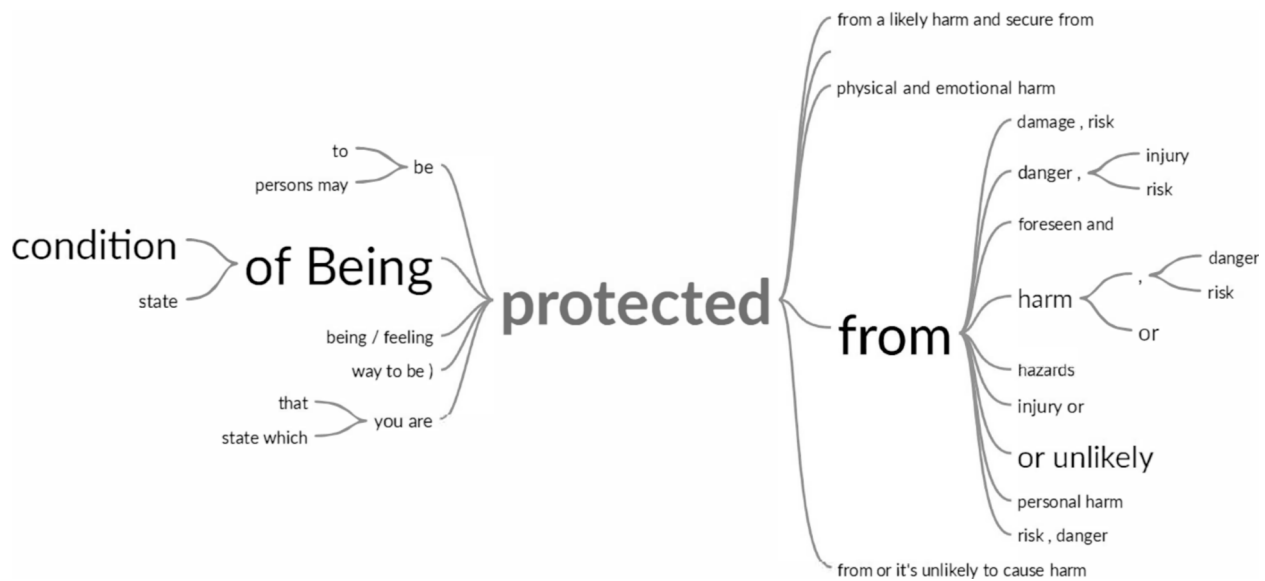
Fig. 3. Safety as Present Condition (Word Tree for "condition").

The term "protected" emerged prominently in survey responses. As shown in Fig. 3, the high frequency of the phrasing and limited branching and connections with other sentences suggests common and uniform language. That is, many defined safety consistently as "the condition of being protected." This consistency may be attributed to the prevalence of this definition in dictionaries and scholarly literature (Montante 2008), thereby establishing a widely recognized point of reference within the safety space. For instance, the Merriam-Webster Dictionary defines safety as "the condition of being safe from undergoing or causing hurt, injury, or loss," while the Oxford Dictionary defines it as "the state of being safe and protected from danger or harm." As previously discussed however, such absolute statements can be problematic.

Although most responses focused on protection against hazards and dangers, some underscored the importance of 'well-being' and 'feeling protected.' For instance, one participant viewed safety as "*conditions in place to help support the health and well-being of employees.*" These terms broaden the concept of safety beyond physical protection to encompass mental and emotional well-being. In essence, safety encompasses shielding individuals from harm that could adversely affect their psychological and mental well-being.

4.2.3. Safety as responsibility and accountability

Safety was described by 5 % of participants as a collective responsibility or accountability within the workplace environment. Participants articulated safety as actively protecting oneself and others from hazards and risks through a sense of awareness, care, and proactive actions. This perspective encompasses elements such as situational awareness, personal responsibility, and fostering a conducive work environment. For example, respondents describe safety as "*the ability of everyone to protect themselves, others, and the environment from risky conditions or injury*" or "*a commitment to ensuring protection from risk, danger, or injury for oneself, family, peers, and coworkers.*".

This understanding of safety as 'responsibility and accountability' is captured in the Total Safety Culture (TSC) model. As explained by Geller (1994), TSC posits a framework wherein all members of an organization assume responsibility for safety and actively pursue it daily. Roughton and Mercurio (2002) characterize TSC by four fundamental attributes: feeling responsible for others, protecting others, caring for others' well-being, and a shared commitment to safety values. Geller (2001) also distinguishes between responsibility and accountability within safety culture, emphasizing that TSC thrives on employees actively caring for

each other, remaining vigilant to unsafe behaviors, and providing immediate feedback. It is evident this thematic view reflects safety from the lens of safety culture and management.

Furthermore, 'responsibility and accountability' are fundamental within the framework of 'Just Culture.' 'Just culture' aims to handle errors and failures appropriately, fostering learning while upholding accountability for unacceptable behavior (Dekker and Breakey 2016; Heraghty et al. 2020).

There was no definition found in previous literature where safety was itself defined as 'responsibility or accountability'. This view may be influenced by the increased focus on organizational culture. Following the recognition that accidents are not solely the result of technological failure or human error, organizational failure and safety culture gained prominence (Hale and Hovden 1998). Consequently, safety management began to incorporate organizational factors, including safety culture, recognizing their significance (Dekker and Breakey 2016; Hollnagel 2014b). Thus, safety culture has become integral to organizational safety practices, shaping definitions of safety within the context of safety culture, particularly what is termed as 'just culture'.

4.3. Safety is about the past – How safe was the work?

The final theme to emerge from the data was much more limited, and constructed safety as an *outcome*. In other words, the theme considers safety to be about the past or understanding how safe the work *was*. Specifically, safety is defined as the absence of harm, accidents, or injuries which essentially views safety as an outcome aimed at achieving fewer or no incidents. The word tree shown below in Fig. 4 clarifies the above explanation.

4.3.1. Safety as the absence of Harm, Accidents, and injuries

From this perspective, safety is defined as the absence of harm, accidents, or injuries. For example, participants shared that safety is "*the absence of accidents or harm*", or "*the absence of danger, risk, or injury.*" Interestingly, particularly given the current prevalence of zero within occupational safety management (Zwetsloot et al. 2017), this view of safety was only shared by a small fraction of participants (2 %). Yet this relative reluctance to equate safety with zero in any of its forms by the survey participants could be reflective of the challenges zero has faced in practices as to its effectiveness as a tool for safety management (Sherratt and Dainty 2017). However, it is crucial to recognize that preventing harm and injuries remains the core focus of the safety field. After all, the
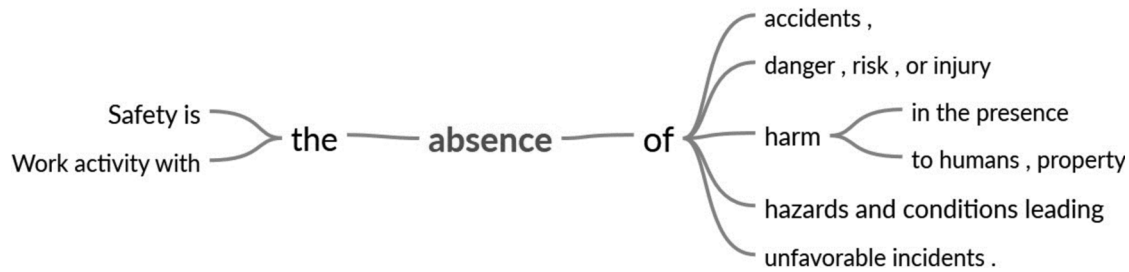
Fig. 4. Safety from Past-Oriented Perspective (Word Tree for "Absence").

entire purpose of safety management is to minimize and ideally eliminate incidents.

Defining safety solely as the absence of harm appears simple at first glance but introduces notable measurement complexities. Describing safety as "the absence of accidents or harm" indirectly portrays safety as an outcome dependent on the non-occurrence of accidents or incidents. In other words, safety involves examining the occurrence or non-occurrence of accidents or harm rather than studying safety itself. Therefore, the subject of study is the absence of safety rather than safety (Vandeskog 2024). Hollnagel (2014a) characterizes this as an epiphenomenon, signifying that safety becomes a secondary outcome or by-product of a primary phenomenon when defined in terms of outcomes. This poses challenges in controlling what we aim to manage and deriving meaningful insights from both success and failure (Hollnagel 2014a; Vandeskog 2024) whilst effectively 'closing the loop' back to the theme first discussed here: the outcome reflecting the ambitions set when safety is constructed as the prevention of injury, incidents and accidents..

5. Reflection

As expected, the analysis revealed a wide range of viewpoints on what safety means to safety professionals, with no single dominant theme. This means that, although safety professionals may be passionate about and confident in their personal definition of safety, it does not represent a pervasive view. Although there is a divergence in individual understandings of safety, the themes are however also not mutually exclusive; rather, they may complement one another, thus forming a holistic understanding of safety and suggesting that a single definition may not be achievable for such an overarching and social concept as 'safety'.

Furthermore, this research also found a growing recognition of new perspectives on safety. Specifically, the data indicated that the safety community has readily embraced the relatively contemporary concept of safety as the 'presence of controls' or 'capacity'. This suggests that a fixed definition of safety might also be beyond reach, the dynamic nature of safety management through which new ideas are readily adopted and implemented in practice, inevitably also influencing shared understandings of the concept itself. It is however notable that while literature on contemporary definitions of safety primarily consists of theoretical discussions, empirical evidence demonstrating practicality is lacking.

It is important to acknowledge that the varied definitions of safety observed in our study will in part reflect the extensive efforts already undertaken within safety science to clarify the concept over the years. Significant work has been dedicated to elucidating the interpretation and meaning of safety, particularly from risk science perspectives. These developments have undoubtedly deepened understandings of safety. However, such efforts have also – perhaps inevitably – also resulted in a proliferation of different definitions mobilized by different groups and specialisms, leading to a lack of focus in establishing a consistent and specific definition of safety across the field.

The disparities within the findings clearly reveal a variety of perceptions of safety currently held within the community, which in turn confirms that we simply do not have a commonly agreed-upon understanding of the concept itself. This lack of a commonly agreed definition is a crucial problem for safety research to grow as a scientific field. If simply defining safety is so problematic, it raises questions about how we can think about it, define its objectives, manage it, and, importantly, how we are able to research it meaningfully. These distinct definitions create competing fields that create boundaries in communication and limit our ability to collectively enrich ideas effectively. More seriously, without a common agreed definition, it is not possible to establish boundaries for safety science to prevent uncontrolled and confusing proliferations of discourse. Put simply, it is not possible to decide what kind of phenomena should be included or excluded from the study of safety, which will likely result in the perpetuation of a fragmented, disparate and disjointed field of study.

6. Conclusion

At the highest level, the safety profession in North America has a broad understanding of safety that can be summarized through three themes: future, present, and past. This creates a multifaceted 'definition' of safety that can vary depending on the temporal lens through which it is viewed.

From a future-oriented perspective, safety is about proactive *actions* or *activities* aimed at preventing injuries. This forward-looking perspective focuses on the measures and initiatives taken to ensure that upcoming work environments will be safe. The focus in this view is on the planning and implementation of preventive strategies as a set of *inputs* that prioritizes anticipation and preparation for future safety conditions.

Safety from a present-oriented perspective is about ensuring that individuals are protected from harm at any given moment. From this view, safety is a present *condition* that emphasizes the immediate and ongoing state of safety, focusing on the importance of real-time attention and control.

Lastly, from a retrospective perspective, safety is understood as an *outcome*. In other words, safety is how safe the work was by analyzing past incidents or injury rates. This past-oriented perspective reflects a philosophy that values learning from historical performance to inform future safety practices and improvements.

This study emphasizes that by integrating these three aspects, safety has the potential to become a holistic concept that involves preventive actions, current conditions, and historical outcomes. Depending on the temporal lens (future anticipation, present conditions, or past outcomes) through which safety is viewed, its definition and emphasis can differ. It is crucial to reiterate however that these aspects are interconnected and influence each other. This is because actions planned serve as inputs that eventually impact present conditions at some point in time. These present conditions are monitored, and their results are evaluated once the work is completed.

We hope this work will help support the development of safety as a

science, and indeed welcome further input, comment and critique from colleagues in the field to that end. There is arguably hard work to be done to establish safety research as a valid scientific endeavor. The lack of agreed definitions necessary to create strong foundations being the first hurdle to overcome. Additionally, unlike fields such as astronomy, where a single scientific entity governs definitions, the safety community lacks such an organization, which could play a pivotal role in addressing this gap. However, given the nature of the field this is an essential undertaking, vital to ensure the science of safety is optimized to support and underpin robust research able to improve safety where it matters most; on the jobsites and in the workplaces where too many people are still being hurt and killed in practice.

CRediT authorship contribution statement

Yaqoob Raheemy: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Fred Sherratt:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Matthew R. Hallowell:** Writing – review & editing, Resources, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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