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Review Article

Sociocultural Orientation and Perceived Utility of Base Rates in Self and Social Judgments of Cyber Risk

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Abstract

Despite ground-breaking technological advances, scientists still have difficulty patching one of the most threatening bugs in the cyber world: human error. Individuals constitute a unique vulnerability in cybersecurity because they systematically make errors when perceiving their own risk. Specifically, individuals underestimate their own susceptibility to cyber-attacks. Among the most common ways companies seek to improve security is presenting clients and employees with base rate information on the prevalence of cyber threats and the likelihood of the general population to succumb to them. This strategy is intended to increase the accuracy with which clients and employees assess their threat levels. However, outcomes typically fall short of this goal. We review the differential use of base rate information as a cognitive and motivational bias that contributes to forecasting errors and accuracy in self and social risk assessment. We also examine two dimensions of sociocultural orientation: individualism-collectivism and tightness-looseness-and their potential influence on the use of base rate information. We discuss implications for interventions that could mitigate the threat of cyber-attacks

Introduction

In an ever-growing digital landscape, cybersecurity has become a key global issue. Especially during the coronavirus pandemic, an increased dependency on digital systems has led to a rise in cyber threats. For example, reports show over a 350% increase in malware attacks and over a 400% increase in ransomware attacks from 2020 to 2021 [1]. In the 2022 World Economic Forum's Global Risks Report, nearly 1,000 global leaders and experts ranked cybersecurity failure as one of the top 10 risks that have worsened over the pandemic, and the vast majority of these leaders-85% in fact-reported that ransomware attacks are a major concern for public safety [1]. It is also a major concern for economic stability, as the average total monetary impact of a single cyber-attack in the United States is over \$9 million [2]. Many of the cyber-attacks experienced by organizations originate internally-not from disgruntled employees, but from individuals who unintentionally expose confidential information. Cyber-attacks like these reflect individual employees' decisions with how to engage in socially engineered phishing scams. They often result in hacked credentials. Such attacks comprise almost half of all types of cyber-attacks [2]. Most typically, hackers send an email to an individual employee. This email contains a seemingly legitimate request for action, like verifying credentials, downloading a file, or clicking a link, but such requests or instructions actually mask a system intended to exploit an individual for information needed to infiltrate a company's internal infrastructure. Given the wide-spread nature of these types of threats, 98% of organizations surveyed by Cybersecurity Insiders in 2021 felt vulnerable to insider attacks [3].

To defend against such attacks, companies employ the services of cybersecurity experts who most commonly work to protect against phishing attacks by sharing base rate information about the prevalence of successful phishing scams. Using fear and intending to increase awareness and urgency, cybersecurity services disclose the percentage of people who succumbed to phishing scams, often within the companies themselves. Proofpoint, a leading cybersecurity company that provides software for email security, briefs its clients annually regarding trends in cyber threats, cyber risk management, and more. Responses from the over 3,500 professionals surveyed for the 2022 report revealed just how frequently individuals experience cyber-attacks. They reported that 83% of respondents received an email phishing attack and 52% of respondents had personal information exposed from a cyber-attack in the past year [4]. Additionally, the report revealed that more than half of respondents took a risky online action in the past year and, more specifically, that 42% of respondents interacted with a suspicious online communication by responding to a phishing email or clicking on a suspicious but alluring ad [4]. Though cybersecurity services present clients with base rates regarding the likelihood an individual in the company is susceptible to cyber-attack, this strategy, we believe, is largely ineffective. Our research has shown that people often underestimate their tendencies to engage in risky online behaviors, despite being shown base rate information on the likelihood of others to engage in such behaviors. In fact, individuals estimate that their own likelihood of cybersecurity risk was on average 22% to 33% lower than the risk they expect others would experience [5].

Of course, underestimates of personal risk relative to risk assessments waged about others' likely future experiences are not unique to cybersecurity. Individuals disregard diagnostic base rates and rely instead on idiosyncratic personal experiences, motivations, and desires in multiple domains [6]. Why might this be? People tend to believe that introspection and self-knowledge are more telling of their future behavior than information about group norms about the same behavior. Furthermore, knowledge about oneself is typically more readily available than information about others. These biases are deepened by individuals' tendencies to see themselves as invulnerable to the negative life events that may befall others [7]. Thus, while referencing information about others' online tendencies and behaviors would increase the accuracy of self-assessments of personal risk, individuals' reliance on self-relevant beliefs undermines accuracy in predicting future personal risk profiles [8]. However, we propose that such disregard for base rate information in self-assessment may reflect a cognitive process that is unique to certain sociocultural orientations. We focus on two cultural dimensions in particular: individualism-collectivism and tightness-looseness [9,10]. Societies with a stronger individualist orientation are "me-oriented" while those with collectivist orientations are "we-oriented." In an individualist society, people conceptualize themselves as independent of others, while in a collectivist society they consider themselves intertwined with others [9]. Similarly, tight cultures rely on strong social norms and are generally intolerant of deviations from these norms. A loose



culture, in contrast, holds weak social norms and assumes a high tolerance for deviant behavior [10,11]. Such differences in culturally prescribed orientations towards others would, we theorize, predict differences in the perceived utility of base rate information in self-assessments.

While organizations hope that presenting their employees with base rate information about cyber threats will better calibrate self-assessments of their risk levels, most people dismiss this information in favor of introspections and idiosyncratic personal experiences, which lead them astray. Many motivational and cognitive biases play a role in this, such as the belief that one is invulnerable to the calamities that others experience, and easy access to self-knowledge compared to information about others. However, these biases may be less prevalent in sociocultural orientations that emphasize group identity and adherence to social norms, such as collectivist and tight cultures. As such, belonging to collectivist or tight cultures may encourage the use of base rate information when making self-predictions of future behaviors, specifically risky online behaviors.

Bias in Self and Social Judgments

Self-enhancement

People believe they are likely to experience more positive futures than are other people. Even outside of cybersecurity, such a tendency toward self-enhancement is pervasive. For example, university students were asked if they would purchase a flower to support a fundraiser for the American Cancer Society, and 83% of participants responded affirmatively. However, only 29% of participants actually made a purchase—a 54% overestimation of their generosity [12]. Likewise, university students estimated their likelihood of engaging in nine different prosocial scenarios and estimated the likelihood that others would as well. Across all scenarios, participants predicted that they were 13% more likely to engage in prosocial behaviors than were others [13]. With respect to online behavior, individuals show similar patterns. American university students reported that their ability to use the internet to download movies, find a job or an apartment, and keep in touch with family and friends was much higher than others' ability [14]. If an individual believes that they are more likely than others to experience positive events in the future, it follows that they simultaneously believe themselves to be invulnerable to future negative life events relative to other people [6]. Across multiple domains, studies have reported that, on average, 80% of the general public displays this form of self-enhancement [15]. For example, American university students believed their chances of being stalked or harassed online, having their credit card information or passwords stolen, or personal information sold were much lower than others' chances [14]. In fact, across 32 scenarios, people predicted that they were significantly less likely to experience negative events, like getting into a car crash or developing a drug addiction, than others [16]. When assessing individual or group levels of absolute or even just relative optimism, people are not objective in their predictions but instead biased towards believing their futures will be better off than could possibly be true [17].

This bias does not simply impact one's outlook on life. It also impacts consequential decision making. If people underestimate their risk, they may fail to take proper precautions to protect themselves against harm. It is the case that personal risk assessments generally underestimate the severity of possible future threats. For example, individuals underestimate the odds of experiencing asthma, food poisoning, skin cancer, car accidents, or muggings compared to predictions they make about others [6,12,15,16,18,19]. In addition, there was no relationship between participants' actual cholesterol levels and their estimates of the likelihood they would experience a heart attack despite ample medical research to the contrary [16]. Moreover, these beliefs increase people's actual vulnerability to a threat because it discourages them from taking protective measures [6]. People who hold optimistic assumptions that they will not develop lung cancer in the future or that they are unlikely to get into a car accident may engage in harmful behaviors such as smoking or refraining from wearing a seatbelt [15]. However, when people feel more susceptible to negative life events, they are more likely to engage in preventative measures than those who feel immune. For instance, when participants watched an informational video about different diseases like cancer, heart disease, or tuberculosis, participants' perceived susceptibility to these diseases increased which in turn predicted increases in the perceived benefits of compliance with disease-related medical regimens [18].

The tendency to underestimate personal risk is observed even in the face of contradictory evidence. Sharot [15] found that people update their beliefs less in response to negative information about the future than positive information. For example, if someone learns that their likelihood of getting robbed is lower than

expected, they will update their beliefs about robbery to a greater degree than if they learned that their likelihood of getting robbed is higher than expected. The potentially disastrous consequences of this cognitive bias have been demonstrated on a global level as well. There is a large consensus within the financial industry and field of behavioral economics that self-enhancement bias was one of the causes of the 2008 stock market crash. Financial analysts, government officials, banks, and other actors all shared the unrealistic expectation that the market would continue growing, despite mountains of evidence to the contrary [20].

Differential weighting in self and social judgment and the consequences for accuracy in prediction

One way in which people come to hold unrealistically optimistic beliefs about themselves and their future prospects is that they weight some forms of information sub-optimally. When making decisions, individuals tend to favor introspection and case-based information over base rates describing the prevalence of experiences within the general population [5,21]. People believe that evidence relevant only to themselves, like their intentions and desires, are a better source of input for decisions than are rates regarding norms and distributions of behavior in similar or past situations within a larger group of which they are a part. Because people have case-based information readily available, they give less weight to information describing others' experiences. However, if they did rely on base rates, the accuracy of their predictions would increase (e.g., [5,21-24]). For example, Harvard University students were more inaccurate in predicting the likelihood they would actually vote in an upcoming political election compared to predictions waged about a random Harvard peer when provided with distributional information describing voter turnout at their university [8]. Simply put, individuals believe base rate information is less relevant than it actually is [6], which is one reason they fail to accurately forecast their own future experiences [5,21].

It is not simply that people are poor forecasters of human behavior. Researchers believe this is not the result of cognitive processing deficits, because when making social judgments—predictions about others and people in general—people tend to be more accurate in predicting others' future experiences despite being relatively inaccurate when predicting their own. Why might this be? People have fewer individuating pieces of evidence and less personalized information about other people. When thinking about a diffuse social group, like people in general, Americans, or the typical university student, the subject is abstract, and the mental representation of the target under consideration lacks a clear, vivid, and concrete image. Consequently, people may more naturally adopt an "external approach to prediction" [25]. What people know about others stems from what can be observed externally and they have relatively little insight into others' intentions and thoughts [26]. Indeed, when forecasting their own future experiences, study participants explained that they were "trying to get inside their head," but when making social judgments about the behavior of others, they tried to look "into theories of human behavior" [27].

A consequence of these differences in information availability may be differences in use of base rates. When predicting one's own future relative to that others may experience, the perceived diagnostic value of introspective and base rate information varies substantially. People see themselves as less susceptible to social influence—particularly negative social influence—than others, less conforming, more focused on introspective information, and less focused on behavioral base rates. In contrast, people believe others are likely to fall in line with norms, which increases reliance on base rate information when forecasting others' behaviors and choices [21]. Interestingly, even when people receive greater and greater amounts of base rate information, they continue to rely on their own self-knowledge to make self-predictions but show an increasing reliance on base rates as more information about normative behavior is provided when forecasting others' future experiences [28]. Overall, the availability of individuating, case-based information tends to decrease the accuracy of self-predictions as the cognitive and motivational biases associated with this kind of information widen the gap between self-predicted behavior and the reality of an individual's future actions. However, when such information is absent, as is the case when thinking about generalized populations or single unknown others, people rely more on distributional information about the rates of behavior that serves as a basis for increasingly more accurate predictions in social judgment.

Differential Use of Base Rates in Judgments of Cyber Risk

Accuracy of personal cyber risk assessments

Internet users display self-enhancing beliefs about their online privacy risks because of a unique feeling of invulnerability to cyber threat [29]. When considering the



likelihood that they themselves would click on a link in a suspicious email, download a file requested by an unknown sender, or update credentials from a company one has not accessed in a long while if ever, people underestimated their own risk relative to the risk others' might face. Specifically, individuals believed that they are 50% less likely to engage in these risky online behaviors than were others [5]. Across multiple scenarios presenting varied requests for online actions that differed with respect to the actual prevalence of responding in the requested way, personal predictions statistically tracked base rates to far weaker degrees than did social predictions.

Use of eye-tracking techniques to directly measure reliance on base rate information

Because social predictions about others' behaviors do correlate with base rate information, we believe the relative error in personal forecasts is not the result of a cognitive inability to understand what base rate information is or its utility in predicting future experiences. Instead, we assert that differences in integrating base rates across self and social judgment are the result of differences in use. Using covert eye-tracking techniques, where the location of eye gaze is measured without participants' awareness, researchers measured the number of times individuals fixated on base rate information to capture a direct measure of reliance on base rates [5,13]. When making judgments of others' cyber risk, people looked at base rate information about 14% more than when they made judgments of their own cyber risk [5], and such differences in visual fixation accounted for differences in the accuracy of self and social judgments about the likelihood of succumbing to email phishing scams. Taken together, both the statistical and eye-tracking results reveal that people make judgments about their own susceptibility to cyber risk that diverge from base rate information because they are not visually attending to that information when assessing their future behavior.

Sociocultural Orientations and Perceived Utility of Base Rate Information

Though base rate neglect in assessments of personal risk is common, we believe it may be more likely to occur among individuals with certain sociocultural orientations, particularly those that ascribe to independent, individualist rather than interdependent, collectivist orientations [9] and people within loose rather than tight cultures [10]. Members of individualist and collectivist cultures in addition to loose and tight cultures hold different understandings of the social environment which impacts how they construe themselves in relation to others [30,31], and as a result, we propose, the perceived utility of base rate information in prediction. Critically, we adopt the perspective that these dimensions reflect values and beliefs that are perceived to be widespread in one's culture rather than as people's personal values [32,33]. We also conceptualize sociocultural differences as reflecting an individual's understanding of behaviors that are typical of most members of their group, which captures the group's descriptive norms, also known as shared collective perceptions [34].

Individualism-collectivism

Individualist cultures emphasize the importance of having an identity separate from the group and the pursuit of personal goals, even when those goals go against the collective goals of the group. Individualists strive to stand out among their peers [30]. Individualist cultures contribute to independent self-concepts, defined by the belief in the inherent separateness of individuals [31]. Much like members of individualist cultures, people with independent self-concepts maintain the goal to express those aspects of the self that make them unique from others [35]. Moreover, those with independent self-concepts may be less attentive to others, which may result in less cognitive elaboration of the other [30]. Collectivist cultures, in contrast, emphasize an individual's place within the context of the group, their relationships with other group members, their adherence to social obligations, and the importance of collective goals over personal ones [30,36-38]. Collectivist cultures can give rise to interdependent self-concepts defined by the belief in the embeddedness of every group member within a larger social context [30,31,39], a characteristic descriptive of members acculturated in collectivist countries [40]. Those who conceptualize themselves in an interdependent manner strive to fulfill social obligations in the larger society [30,31] and do so by knowing their place in society, acting in accordance with those roles [41], and behaving in ways that meet normative cultural expectations [42].

Motivated differences in base rate use across individualism-collectivism: Given differences in cultural prescriptions for being aware of, paying attention to, and abiding by social norms, members of individualist and collectivist cultures differ in their respect to social and social forecasts about their own and others' future experiences [30,31,43-46]. For example, respondents of European decent estimated that their peers

would be 12 times more likely than they themselves would be to rudely walk away from a person asking for help. However, respondents of Chinese descent did not believe the likelihood of their rude behavior was any different than the likelihood of their peers [12]. Similarly, participants who had parents born in countries categorized as more individualist rather than collectivist were more optimistic about the likelihood of their own honorable actions when reflecting on their strength to overcome a moral challenge [47]. In addition, those from collectivist cultures were less likely to overestimate their future prosocial behaviors [47,48] and were more accurate when forecasting their own behavior [49]. Respondents from collectivist countries including Vietnam, Japan, China, and India in comparison to individualist countries like the United States, England, and Spain showed greater levels of insight into their own biases [50].

Such differences in self versus social judgments may be a consequence of collectivist cultures' pressures for greater awareness and understanding of social norms, social expectations, and, as a result, others' behaviors. Indeed, members of collectivist cultures are more accurate in predicting what other people will do. For example, Chinese help-seekers were more accurate than American help-seekers at predicting compliance with their request for assistance from someone in their own country [51]. Likewise, children from Mallorca and mainland Spain, relatively collectivist cultures, were accurate in predicting the generosity of their peers in opportunities to share candy with others than were children from England and other individualist cultures [48]. Because members of collectivist cultures hold informed understandings of socially normative behavior and are motivated to behave in ways that align with the norm, their expectations for themselves tend to align with their accurate beliefs about others' future actions.

Cognitive styles contributing to base rate use differences across individualism-collectivism: Differences between individualist and collectivist cultures in cognitive processing styles may contribute to differences in base rate use and neglect [52-58]. Specifically, those from individualist cultures tend to hold analytic processing styles, while those from collectivist cultures assume more holistic styles [54]. Individuals with analytic cognitive styles distinguish people and objects from their contexts and rely upon formal logic and reasoning to make assumptions about those objects and people [57]. Individuals with holistic cognitive styles place people and objects within the larger social and perceptual environment and reason about them intuitively and based on prior experience [52,58]. Individualists are more likely to group objects on the basis of taxonomic categories, while collectivists group objects on the basis of relationships [30,52-53].

In extension, individualist cultures tend to give rise to independent self-concepts among its members, while collectivist cultures give rise to interdependent self-concepts [30,31,39,59]. Because individuals with an independent sense of self define themselves as separate from others, they tend to engage in context-independent processing styles, separating social targets from their contexts when processing social information [60], and focusing more attention on the self [56,60]. Those with an independent sense of self often minimize the influence of others on the self and makes self-relevant attitudes and values more accessible [61-63]. Because information descriptive of social norms is gleaned from the surroundings about which these types of people are relatively less attentive, individuals assuming context-independent processing styles would be less informed about base rates of others' actions. In contrast, those with an interdependent self-concept engage in context-dependent processing styles, viewing social targets within the context of their social environment [64]. An interdependent self-concept encourages the assimilation of the other to the self and makes social norms more accessible in decision making [62,63]. In short, interdependent self-concepts leads individuals to assimilate the self with others. Because such people hold context-dependent processing styles, they tend to show greater attention to the environment, others' actions, and as a result, pay more regard to base rates. Indeed, two studies found that Americans neglected background probability base-rates and relied more heavily on focal, case-based information in estimating true probabilities, whereas Chinese participants showed little evidence of ignoring base-rates. However, when base-rate information is made focal, Americans used it to a far greater extent than they otherwise did [65].

Tightness-looseness

The cultural dimension of tightness-looseness is defined by the pervasiveness of social norms within a society, and the degree to which deviance from these norms evoke a negative response [66]. Tight cultures have strong, pervasive norms, a low tolerance for deviance, and a restricted range of appropriate everyday behaviors [67,68]. Moreover, individuals belonging to a tight culture exhibit raised levels of self-monitoring to avoid mistakes, strong impulse control, and have high conscientiousness



[66,69]. Alternatively, loose cultures have weak norms, a high tolerance for deviance, and a wide range of permissible behaviors [67,68]. Additionally, the self-concept tends to differ across tight and loose cultures; interdependent self-concepts are associated with tight cultures and independent self-concepts are associated with loose cultures [69].

Motivated differences in base rate use across tight and loose cultures: The strength of social norms, or the degree of cultural tightness, in a society can impact social judgment, in addition to awareness and use of base rates [70]. To successfully adhere to the strict social norms in a tight culture, one must look to others for information about what constitutes appropriate behavior. Indeed, research has shown that people in tight cultures tend to view themselves in relation to social norms and their environment, while people in loose cultures view themselves as distinct individuals [71]. As compared to individuals from loose cultures, those from tight cultures process information in relation to its context [56]. Furthermore, tight cultures facilitate increased behavioral monitoring as individuals must attend to social norms and evaluate the appropriateness of their behavior against others' behaviors [70]. Though little direct research has probed the moderating effect of cultural tightness and looseness on reliance or neglect of base rates in forecasting behavior, leading researchers have theorized that the tendency to overestimate the extent to which human behavior is governed by individuating dispositions rather than situational factors, which leads people to disregard base rate information, is more prevalent in loose cultures [72].

Implications for Cybersecurity

If our predictions regarding the increased utility of base rates among people from collectivist and tight cultures find support, there are several implications for increasing infrastructures' security. Organizations could encourage employees of think of themselves as a part of a greater collective. Indeed, research finds that visual attention and how people think can be changed when people are cognitively primed to think of themselves in more independent or interdependent terms [73,74]. For instance, event recaps, company newsletters, or memos could include descriptions with interdependent rather than independent themes [75]. Engaging with content that includes we/us/our in text rather than I/me/my increases the degree to which participants endorse individualist values (like freedom) and collectivist values (like belongingness; [76]). Moreover, when people are cognitively primed to think of themselves in more independent rather than interdependent ways, by for example thinking of their similarities to others rather than differences, individuals shift cognitive processing styles, focusing more on holistic information that integrates parts into a gestalt [64,77]. Overall, such evidence supports the possibility that encouraging people to reflect on their shared experiences within a larger group could increase the perceived relevance of base rate information about that group in tasks of social forecasting, including when self-assessing cyber risk. This is a critical first step in mitigating dangerous online behavior, as awareness of risk precedes prevention of harm [78].

Conclusion

The frequency of cyber-attacks is on the rise, many of which can be traced back to unintentional insider threats. These include employees or individuals within an organization who accidentally succumb to phishing scams which can compromise their login credentials, allowing socially engineered attacks on infrastructure. Organizations try to protect themselves against such attacks by sharing base rate information about the prevalence of successful cyber-attacks. Unfortunately, this strategy does little to reduce a company's cyber risk as people tend to dismiss this kind of information, relying instead on their own case-based knowledge about their personal intentions, motivations, and desires. However, certain sociocultural orientations, particularly collectivist and tight cultures, may give base rates more regard. Future research that directly tests base rate use and neglect cross-culturally and which assumes a social cognitive approach demarcating the social cognitive mechanisms that give rise to differential use of base rates can inform cybersecurity interests. Interventions could be designed to increase feelings of interconnectedness or organizational cultures could be created to induce a sense of tightness if in fact such sociocultural differences do increase reliance on base rates in forecasts of personal risk. Such cultural backgrounds could mitigate the cognitive biases that impair the ability to make accurate self-predictions of future behavior, including self-judgments of susceptibility to cyber threats.

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