



Conflict across representational gaps: Threats to and opportunities for improved communication

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Often, the senders and receivers of scientific communication have different knowledge bases. While such communication is essential for solving the complex social and technological problems that affect multiple stakeholders, a diversity of knowledge among communicators can create representational gaps (rGaps). rGaps occur when senders make assumptions that receivers do not, creating conflict over the meaning and value of the information communicated. Such conflict could, if managed, promote learning and innovation as communicators reconcile their assumptions. More often, however, rGaps cause conflict to transform from a debate that informs to an argument that divides. Managing rGap conflict so that it does not degrade communication requires relationship building to mitigate the negative by-products of persistent conflict while maintaining appropriate levels of cognitive distinctiveness among diverse stakeholders. Thus, we provide a framework for identifying and leveraging rGaps through managed conflict so that communication between those with different perspectives builds rather than burns bridges.

conflict | communication | cognition | teamwork | interdisciplinary

Effective science communication happens when it promotes understanding and appreciation. When people understand scientific information, they are more likely to appreciate its value and adopt opinions that are consistent with scientific evidence (1). Even if scientific information is not directly relevant to people, they can be excited by scientific findings, which also promotes esteem for the scientific approach (1). Because science seeks to solve problems that affect many different kinds of people, it is also important that scientific communication accommodate the perspectives of diverse groups (1). It is this last goal that presents a crucial challenge for understanding and appreciation of scientific communication. When diversity implies different knowledge bases, the perspectives that communicators take can have misaligned and incompatible assumptions between them—what we call representational gaps (rGaps) (2). (In presentations to general audiences, we often refer to these as “perceptual gaps” as an easier elocution of the term. In the literature, they are called rGaps. We have used the rGap term in this article to maintain consistency and connection with the literature.) rGaps limit people’s capacity to either understand or appreciate the information that science communicates, and mitigating rGaps is not a simple matter of filling a deficit in information (1). Bridging rGaps requires perspective change, which is a more involved process.

For example, imagine that you and your partner are buying lightbulbs and see a \$0.50 incandescent lightbulb and a \$1.50 compact fluorescent (CFL) bulb. The CFL bulb claims to last 9,000 more hours than the incandescent bulb and to reduce energy cost by 75%. If your partner grabbed the incandescent bulb, would you be surprised or confused? Would you try to explain how CFL bulbs cost more to produce, justifying the \$1 to protect the environment? If so, then you may be falling into the snare that rGaps present—thinking that your partner lacks knowledge when they actually have a different perspective (3). Your partner might realize all of what you said but assume that

charging three times the price is taking advantage of people’s sympathies. If you disagree with that assumption, then you and your partner have an rGap.

Bridging an rGap often requires changing people’s assumptions. This can be a learning process, where one helps another create a new perspective. For instance, your partner seems to assume that cost equals the purchase price, but economic science teaches that cost is a function of replacement frequency and usage expense. Educating your partner about lifecycle cost can change his or her perspective so that the assumption of price gouging is not relevant. He or she may appreciate this new understanding and use it to understand cost in other situations as well. This kind of education, informing audiences that have a more limited understanding of a topic, is an important function of scientific communication.

However, scientific communication must also persuade people who already have sophisticated perspectives. If your partner is an artist who hates CFL light quality, the rGap becomes more challenging to bridge, because light quality is a completely different kind of concern than cost. Bridging requires educating each other about light quality and cost as well as developing schemes for how to make appropriate tradeoffs. This kind of bridging can do more than educate; it can also invent. Through the blending of concepts from different perspectives, new kinds of knowledge can be created and applied to the problems that science seeks to solve (4–6). You and your partner may conceive a plan to limit the use of incandescent bulbs to the areas where your partner needs good light. (While this is clearly a modest innovation, it is not unlike carbon credit trading, which is not a modest innovation.) However, such solutions only emerge when parties appreciate each other’s expert knowledge; without appreciation, neither side will be motivated to try to understand or use what the other teaches.

While perspectives are cognitive structures that change through learning, they are mostly implicit, and they are not value free. Thus, they can unconsciously motivate reasoning. A study found that the mere presence of “protect the environment” on the packaging of a CFL bulb, like the one that we described, reduced purchase intent from 80 to 30% as people’s conservatism increased (7). Without this label, the bulb was equally attractive across levels of conservatism. Implicit value-based assumptions about the utility of environmental protection degraded

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the appreciation of objective information about the bulb's usefulness. If you find yourself reacting negatively to these results, then you also see how your own implicit values can effortlessly and automatically create conflict with those on the other side of an rGap. Importantly, while we have used the lightbulb purchase to demonstrate how rGaps diminish understanding and appreciation of information, these dynamics are identical to those that we observed in the reconciliation of high-stakes technical problems being solved by cross-functional teams (2).

rGaps thus lead to conflict over the meaning and value of communicated information. Ironically, such conflict can be the most useful tool for surfacing rGaps. However, it is not enough to simply uncover why people see the task differently. What two metaanalyses (8, 9) have shown is that conflict that is supposed to inform and educate by elucidating task disagreement often fails. Rather, it becomes personal as conflict wears on and animosity degrades people's capacity to listen to each other (10, 11). Thus, mitigation of this downward spiral must necessarily be relational rather than cognitive. When people trust, respect, and like each other, it can buffer against the negative by-products that emerge from the protracted conflict—frustration, negative attributions, and defensiveness (12–14).

This paper thus summarizes and synthesizes what we know about how rGaps disrupt scientific communication and what people can do about this issue (Fig. 1 links the concepts that we review). We start by describing why diverse groups have rGaps and how that affects information processing. We then describe how cognitive integration could allow people to leverage rGaps to learn and innovate through communicating. We then explain how, unfortunately, rGaps most often create misunderstanding that leads to conflict. Unmanaged rGap conflict tends to degenerate from its productive form (debate) to more unproductive forms (argument, undermining), ultimately undermining both understanding and appreciation of other's information. We end by describing how to bolster interpersonal relationships through affective integration, which will maintain motivation to increase cognitive integration while minimizing the entrenchment and defensiveness that come from rGap conflict. Cognitive and affective integration thus increase the capacity for appreciation and learning from scientific information.

rGaps as a Challenge for Comprehension

Fundamentally, rGaps create misunderstanding between communicators. Such misunderstanding is not simple to identify, because the rGap exists between the perspectives of those communicating. (Perspective goes by many names, including frame, problem representation, script, and schema. In all cases, it represents a cognitive structure that controls the focus of attention and recall of knowledge.) Perspectives are automatically generated frameworks of assumptions (15, 16) used to interpret

what is communicated. They are typically implicit and taken for granted. That is, people are rarely cognizant of the assumptions that they make and thus, struggle to recognize how such assumptions limit their thought.

The following riddle illustrates how incompatible assumptions disrupt understanding. Explain: "Bill has married 20 women in town. He has divorced none of them, and they are all still alive, yet he is not a polygamist." If the explanation is not obvious, it is because there is an rGap between you, the reader, and us, the authors. This rGap exists as an incorrect assumption. However, telling you that an assumption is wrong or even that the answer is obvious does not help you find the rGap. Furthermore, because perspectives provide guidance for deliberate thought, people seek to maintain their assumptions. If you assume that Bill is married to the women, it is easier to suggest complex explanations, such as the marriages were so short that they did not count or it is one woman with 20 personalities, than it is to change this assumption to find the simpler explanation—Bill is a priest, rabbi, or other officiate. Thus, the priest riddle illustrates the strong but implicit influence that perspectives have on comprehension. In this riddle, although the perspective is ad hoc, there is no incentive to maintain it, and most are well aware that weddings have officiates, about 75% of people struggle to get the answer (4).

There is a basic cognitive reason that people cling to their implicit perspectives: working memory has limited ability to process potential meanings of information (17). For example, it is hard to interpret the situation "Don wants to go home but is afraid to because there is a man at home wearing a mask and holding something round," because it does not cue a perspective. Without one, working memory has too many possible roles and relationships among the elements of the situation (e.g., the round thing, the mask, home, etc.) to process. Furthermore, until one has an accurate perspective, more information may not clarify. Explaining that "Don left home not long ago, he has made two lefts and is about to make a third. Many people are watching what is happening. Now he is more afraid because if he does not get home soon he may never get to go home" does not inform, because there are still too many possible interpretations. With the right perspective—this is a baseball game—working memory can use the assumptions that make up the perspective to determine a more tractable set of possible meanings for the information communicated. Ironically, while a perspective sets up boundaries on meaning (e.g., home is a plate and not a dwelling), these are actually generative, because perspectives bring coherence to what is perceived. Perspectives also suggest additional inferences that enrich understanding. One could infer that Don is concerned, because there are probably two outs. If one realized that Don was baseball legend Don Mattingly, one could make even more nuanced inferences with that knowledge.

The priest and baseball riddles are designed to demonstrate how strongly and implicitly our perspectives influence information processing in working memory. Perspectives determine the direction and depth of understanding of communicated information. However, perspectives can vary across individuals. While riddles create rGaps with the phrasing of communication, they can easily be bridged, because people share knowledge about weddings and baseball. More often, rGaps emerge because people are using different knowledge and experience to encode the communication, and bridging these is more challenging.

Origin of rGaps

People's perspectives come from their knowledge (18) and experience (19, 20). As such, "Profits are down this quarter so there may be layoffs" is assumed to be an accounting problem to accountants, a marketing problem to marketers, and a management problem to managers (21). Social or cultural communities

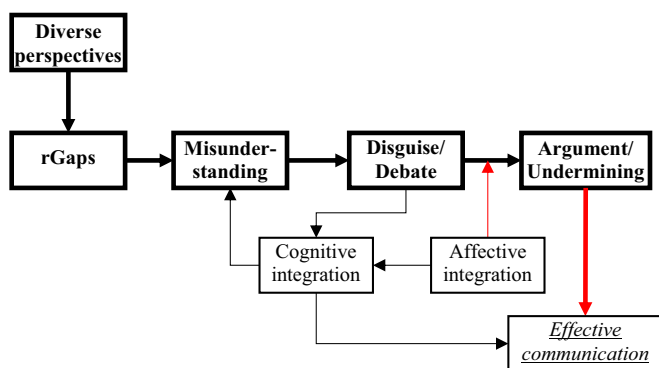


Fig. 1. How rGaps affect conflict and communication.

can also provide distinct knowledge bases (22). An individual's history matters too; people can have different perspectives in the same industry (19), organizational system (20), or team (23) when they use different experience to make assumptions and form a perspective.

The more expert a person is, the more nuanced and sophisticated their perspective will be (24). We might think of experts and novices in terms of subjects or skills. However, most people are "experts" in their experience. Furthermore, when people hear new information, even when it relates to an unfamiliar problem, they do not simply put away their experience. Experience provides the foundation for understanding and seeing the value in (i.e., appreciating) new information. Although experience can be narrow or idiosyncratic, it can still be relevant to shared problems and is thus important for communication. It is how the goal of "accommodating different perspectives of relevant stakeholders" (1) is achieved.

Perspectives require integration. When people communicate, they use their perspective to encode messages, and they also use their perspective to decode meaning from what they perceive. Thus, perspectives need to align between communicators so that the meaning that one intends fits with the meaning that the other encodes. Such communication interaction is how people develop a shared understanding about common situations; communication is the conduit through which perspectives can be combined and aligned. Ideally, the integration of perspectives does not simply homogenize them; it blends them, yielding new kinds of knowledge and solutions (23, 25). It is why many innovations and scientific discoveries have come from bending different perspectives (4) or mixing knowledge from different domains (5). It is why interdisciplinary teams are assembled when creative solutions are desired (2, 13, 25).

However, diverse perspectives do not automatically integrate. Sometimes assumptions do not fit or are in direct conflict, because people's knowledge and experience do not align. For instance, if the accountant's perspective is that inflated costs are shrinking profits, it is hard for the marketer to value this information, as it suggests spending less on marketing. In this case, the rGap is over the assumed utility of spending on marketing, and the disagreement stems from elaborate and relatively fixed professional knowledge about the importance of controlling costs vs. expanding marketing. The accountant, for instance, cannot simply share more information [a la the deficit model (1)] about why marketing dollars are not money well spent, because that argument relies on accepting the accountants knowledge and assumptions, which the marketer does not. The rGap itself hampers the process of bridging rGaps. Also, it is not feasible to tell constituents to take each other's perspectives. Unless one has a facsimile of the other's knowledge, there is no basis to do so (4, 13). The accountant cannot simply choose to think like a seasoned marketer. Perhaps most importantly, to maintain creativity, one does not want conformity (23, 25). Integrating perspectives needs to accommodate the integrity and uniqueness of the perspectives as much as possible, and therefore, it takes a different kind of process to bridge rGaps that we call cognitive integration (13).

Cognitive Integration

Cognitive integration is the degree to which one can translate between perspectives and thus, understand the intended meaning of what others communicate. If your pulmonologist suggested a diuretic to improve breathing, the more you understand why she has suggested this and what is implied, the more you are cognitively integrated. Cognitive integration is not about agreement—you could understand the basis for the recommendation (high cognitive integration) but not concur with it, or you could accept the recommendation without understanding why you should (no cognitive integration). Cognitive integration is thus about capacity to comprehend as opposed to the inclination to concur. Such

capacity comes from having enough of a facsimile of others' knowledge to approximate their perspective. Cognitive integration thus requires acquiring knowledge that one does not already possess.

Cognitive integration increases from the processes of enrichment, expansion, and reconciliation. Imagine a sender and a receiver to have knowledge bases represented by the circles in Fig. 2. Sometimes what one person knows, another does not. This is where one might enrich the knowledge of the other (region 1 in Fig. 2). In some cases, neither person has knowledge needed to link their perspectives, requiring exploration to find the knowledge (region 2 in Fig. 2). Sometimes both parties have knowledge on a subject, but it leads to contradictory assumptions that require reconciliation (region 3 in Fig. 2). Each process represents a different way that senders and receivers can create knowledge that will bridge rGaps.

Enrichment. Sometimes an rGap exists when a sender makes assumptions that the receiver is incapable of making, because he or she lacks the background knowledge. This is a common situation when experts communicate to novices. Without these assumptions, the receiver will have an impoverished understanding of the information communicated. (Perspective goes by many names, including frame, problem representation, script, and schema. In all cases, it represents a cognitive structure that controls the focus of attention and recall of knowledge.) Thus, a sender needs to help the receiver enrich his or her knowledge base so that it can approximate the sender's perspective. Building cognitive integration through enrichment is much like teaching people about unfamiliar subjects.

What the expert in this situation must realize is how slow and incremental enrichment can be. For example, we can communicate that "Ни пуха ни пера" translates to "neither down nor feather." Unless you understand Russian culture and idioms, all you glean from this translation is what the individual words mean. It does not convey the phrase's meaning or usage. One develops enrichment by connecting foreign knowledge to one's own, learning, for instance, that neither down nor feather is used like "break a leg" is in English. Even so, cognitive integration still proceeds incrementally. You may now understand the ironic nature of the phrase but may also need to clear away incorrect assumptions based on one's own knowledge. One might assume based on break a leg that neither down nor feather relates to acting and has no response. In actuality, it wishes a person failure in hunting, and the appropriate response is "To hell!" Knowledge enrichment thus requires that a communicator takes time to be certain that the recipient has the knowledge necessary to make appropriate assumptions when interpreting the communication.

Since perspectives are automatic and implicit, it can be easy for an expert to overlook all of the assumptions that the novice is not going to make when they interpret a communication. As such, novices fail to grasp the importance of the information.

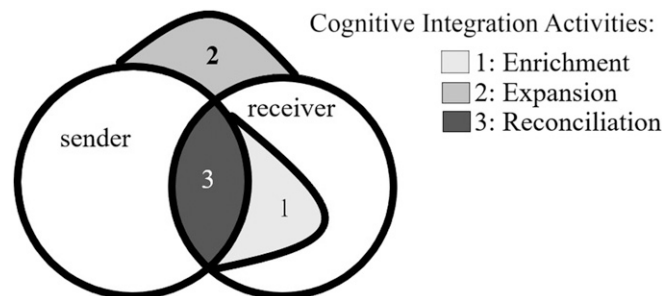


Fig. 2. Bridging rGaps.

Cybersecurity exemplifies this perfectly, where computer emergency response teams warn the public “Microsoft Windows task scheduler contains a local privilege escalation vulnerability in the Advanced Local Procedure Call (ALPC) interface, which can allow a local user to obtain SYSTEM privileges.” To most people, this is opaque (<https://www.kb.cert.org/vuls/id/906424>). If people were more educated about the threats implied by this warning, this same information would be much more useful and impactful. Instead, it seems like the information technology (IT) experts are not considering the computer users’ limited perspective (26, 27). Users’ limited understanding means that they do not understand or appreciate warnings like these (28).

Scientific communication often involves communities of experts attempting to inform a nonexpert population. In such conditions, there will almost surely be unrecognized rGaps. This means that enrichment has to be a deliberate step before communication, and that enrichment may take real effort. With more effort devoted to enrichment, understanding is more efficient and more impactful, because the receiver understands how the information relates to his or her own perspective. Such cognitive integration can be the foundation for improved future enrichment and communication as well.

Expansion. Sometimes rGaps exist when both senders and receivers have expert knowledge, but they seemingly have no relevance to each other. Such rGaps are common between experts from different domains, but they can also emerge when people invent. Thus, together, the communicators will need to explore new kinds of knowledge that can build bridges between their perspectives. In contrast to enrichment, where the expert guides the novice, expansion is an exploratory process, because communicators are trying to find unknown unknowns. Thus, the process will feel similar to the blind search processes common to invention and discovery (17, 29). It is why expansion often leads to discovery.

The challenge with expansion is that the discovered knowledge does not make sense in light of existing knowledge. For example, Christiaan Huygens’ conjecture of Saturn’s ring was an assumption that did not fit with astrophysical knowledge. Ringed planets were unknown unknowns at the time. A ring explained Saturn’s observed profile but raised questions in other cosmologists of where it would come from or how it could continue to exist among the gravitational forces in space. Without this knowledge, other experts dismissed Huygens’ explanation for years (30, 31). Luckily, some worked to expand astrophysical knowledge to discover how the ring could exist. Exploration thus requires that communicators take their knowledge as a foundation for what could be true, not a boundary on what is true.

Communication between different kinds of experts can help people see past domain boundaries. Again using cybersecurity to illustrate, research shows that the oddity of character combinations has no effect on the security of passwords (32), but it does limit user’s ability to remember the passwords and thus, creates maladaptive behavior (such as writing passwords down where they can be found). However, most websites and networks continue to require ever-stranger character combinations. The IT community might get out of this rut if they worked with psychologists who understand how human memory works and what tasks are easy for a person but hard for a machine. It might be even better to include an expert user for thoughts on usability. However, for the experts to understand and appreciate each other’s knowledge, they need to connect it back to their own. Identifying assumptions can help make those connections.

Luckily, assumptions always serve functional roles in a perspective (4). Assumptions categorize the people involved, the type of situation, the desired goals, the possible actions that can change the situation, and the parts of the situation that are changeable. Asking about these roles directly raises the level of

conversation from the conclusions that people draw to the basis for those conclusions. That is, if a person asks another “What are you trying to do here?,” the answer will likely be a conclusion that emerges from the other’s perspective. Asking about the functional roles—“What role are you taking, and how do you classify this situation? What are you intending to change? How will that achieve your objectives?”—is more likely to elicit the assumption that supports a conclusion, thus giving insight into the source knowledge. Such knowledge will not suddenly yield new solutions, but it does provide raw material with which to explore new possibilities built from combinations of knowledge that individuals would not have conceived.

Reconciliation. Sometimes rGaps emerge because the sender and receiver draw conflicting assumptions about the same information. Such rGaps are common when people’s knowledge also leads them to make value judgements. This situation requires reconciliation of the underlying knowledge to align assumptions. This is hard, because perspectives emerge from people’s knowledge and experience as the “right” way to understand a situation. Right is a value judgment, and people’s values resist change.

Values can motivate people to reject others’ knowledge, even if they understand it. For instance, one-half of Americans do not believe in human-caused climate change (33). One might think that scientists need to close this rGap using enrichment, but it is not just that people lack knowledge. Scientifically knowledgeable conservatives are more likely to refute climate change information, because they are more capable of taking sophisticated perspectives that discredit the legitimacy of such information (34–36). Such reasoning is motivated by the negative assumptions that conservatives tend to have about the effectiveness of environmental policy. This is a particular example of a more general motivated reasoning process (37). It means that values create rGaps that are reinforced by a person’s existing knowledge base. In fact, most knowledge and experience that people hold are value laden.

A clear example of how much values can motivate reasoning even on “objective” problems is provided by research that shows how undergraduates with Tycho Brahe’s data on Mars’ position can derive Mars’ orbital functions in about an hour (38). In contrast, it took Kepler 10 y to derive these (39). Values explain this difference. Modern undergraduates see no intrinsic value to any particular shape or speed profile for an orbit, and therefore, any would be plausible. For Kepler, however, God made the universe, God is perfect, circles are perfect, and so forth. These values made ellipses inconceivable, not just to Kepler but to Galileo, who never abandoned the “circles within circles” perspective on planetary motion, despite Kepler’s findings (39). Galileo’s resistance is especially remarkable when one considers that he risked his life advocating a heliocentric perspective based on similar kinds of discrepant data. The point is that reconciliation is not merely an objective process but a motivated one.

It may not always be necessary to engage in reconciliation. There is a value to maintaining disagreement so that there is always some creative friction (40, 41). If everyone has the same truth, people are more likely to reinforce each other’s common assumptions and disregard discrepant information (42). Such homogenization would essentially undermine the reason that people use cognitively diverse groups in the first place. It might be easier and actually better just to have some people yield to the assumptions of others, especially if the disagreement is not particularly consequential to the person yielding.

However, if the rGap is consequential, then reconciliation will probably require enrichment and exploration as well. Enrichment can help people understand and appreciate why others make conflicting assumptions. Exploration may help find innovative ways to reconcile the seemingly unfitting perspectives (41)—this a

process not unlike finding the interests that underlie people's positions when they negotiate (43), and this process can be exciting (44). However, since value judgements imbue people's knowledge, reconciliation will most likely cause disagreement rather than bridging. Most people do not interpret a discovered rGap as something that they are missing; they interpret it as a place where others are wrong. It is why rGaps most often lead to conflict, and the rGaps themselves are why that conflict is hard to resolve.

rGap Conflict

rGaps cause conflict when people take incompatible positions in response to information (2). It can be difficult to recognize that such conflict comes from an rGap, because perspectives are implicit. However, in the context of rGaps, conflict communication is critical, because it plays multiple roles. Engaging in rGap conflict provides people the opportunity to discover and understand the nature of the rGap. Conflict is also a focusing mechanism to identify where knowledge needs to be enriched, expanded, and reconciled.

However, conflict communication can easily escalate into unproductive argument, because rGaps themselves limit understanding while accentuating threat to parties' values. When this occurs, conflict is more likely to escalate and spiral out of control (45). What should be a debate over how to understand information becomes an argument about who is right and who is wrong, or worse, it becomes an argument about why one side's knowledge is irrelevant or unimportant. We might say that the current political divisiveness in the United States is a sad example of this; most Americans value the same things at core, but the national rhetoric leads people to generate perspectives that have huge gaps between them. Such gaps become trenches as people withdraw from those who have other perspectives. If people understand how this happens, then they can understand the means to mitigate such spirals.

Expressions of rGap Conflict

The expression of conflict (12) is a communicative act that transmits both information and emotion from a sender to the recipient. Both are interpreted together; affect provides information (46), and emotion colors information (47). Others who perceive the conflict expression will have their own informational/emotional response, thus setting into motion a communication cycle. Ideally, such conflict communication informs rather than divides, and the type of expression has a direct effect on this.

Conflict expression varies along two dimensions: directness and oppositional intensity (12). Direct conflict is unambiguous in terms of what the disagreement is about as well as what parties are thinking and feeling. Intensity relates to the force of the opposition, which can be defensive via entrenchment in a position or offensive via the subversiveness of one's actions. Entrenched communications reaffirm and bolster one's own position (e.g., "I can't go any further on this issue"), while subversive communications undermine others (e.g., "Everyone knows your ideas don't work"). When dealing with rGaps, both directness and oppositional intensity will affect learning and motivation. Understanding how directness and oppositional intensity operate is critical to understanding how to manage conflict expression when communicating across and trying to bridge rGaps (12).

The most productive conflict expression is debate, where the points of contention are clear (high directness) but people remain open to the information coming from the other side (low oppositional intensity). Debate thus maximizes the potential for both learning and understanding. When the problem is clear, then the route to dealing with the problem is clear (even if it comes out that people must agree to disagree). At the same time, when oppositional intensity is low, it minimizes the natural defensive

reactions that can lead people to shut down and withdraw (48) or become angry and escalate the conflict (45).

When an rGap is the source of disagreement, debate is less likely. rGaps detract from directness, because each party is communicating as though others have similar perspectives (3). As such, the receiver's reaction to disagreement is not going to be "I wonder if you are making different assumptions" as much as it is going to be "What are you **thinking**?" Furthermore, the sender can believe that the expression is quite direct, yet for the receiver, the meaning can seem quite nebulous (think of the riddles we used above—without the right perspective, the simple answers were inscrutable). rGaps thus covertly reduce directness and can take debate and turn it into disguise—low-intensity, low-directness conflict (12).

Disguised conflict provides "ambiguous information about the presence and substance of the conflict, [making it] difficult to discern the sender's interests or intentions" (ref. 12, p. 247). Disguise is not a productive means of conflict expression, because it obscures the problem and thus, also obscures the solution (12). While people do intentionally disguise their conflict through avoidance, deflection, or even passive aggressive behavior (12), rGaps create a kind of unintentional disguised conflict. This is even more nefarious, because if the sender does not intend to express conflict yet the receiver is oppositional, both people can sense that there is a conflict but struggle to make sense of why. Without such understanding, opposition may seem baseless, and thus, the disagreement may seem like intentional disguised conflict. This can lead to irritation, confusion, or guilt (12). Put simply, if one cannot figure out why another is disagreeing, it is easy for one to assume malice and subversion as motivation.

Unfortunately, rGaps do more than simply obscure the directness of conflict. As noted earlier, perspectives include values. When people's values are called into question or even seem to be, it is threatening to their sense of self (49). It is why questioning a person's expertise is threatening (49, 50). It is why "informational" disagreements can evoke defensiveness (51). When people feel defensive, oppositional intensity can increase. Debate thus turns into argument—high-intensity, high-directness conflict. It can also happen that disguised conflict turns directly into argument if people start accusing each other based on the attributions of malice. Ironically, while argument can be direct in terms of the accusations and attributions, the rGap root of this conflict may remain disguised. However, even if parties discover the rGap, argument is less productive than debate, because when people feel negative emotions, attention must be devoted to managing those feelings, which takes away from information processing capacity (52).

Argument is an emergent process toward which conflict easily evolves. Negative feelings, whether from indirect or direct opposition, take time to dissipate (53) and can thus build over time. The more negatively one feels, the more likely such feelings creep into the expression of conflict. What is more, felt negative affect in the expresser is likely to be picked up by both receivers and other observers; this can even happen subconsciously (54). This self-reinforcing feedback loop—that conflict increases negative feelings, which increase opposition and in turn, increase conflict—means that oppositional intensity of conflict expression can grow exponentially. This is how conflict spirals out of control (45).

There is typically a limit to how much direct conflict people can handle before they withdraw (55). This can cause a shift to undermining—low-directness, high-intensity conflict. Undermining takes place when people seek to discredit the opposing party or that party's position in a subversive way, such as being dismissive or sarcastic toward others on the opposite side of the conflict. Subversive behaviors are generally rude or unprofessional, and therefore, this is not where we imagine the conflict expression

starting. However, as conflict wears on, relationships between the communicators can devolve to the point where negative affect increases aggression. One who has been disrespected or demeaned may want to retaliate (56, 57) and thus, will have fewer inhibitions to undermining others (58).

Fig. 3 summarizes how conflict expression types relate to each other in terms of directness and intensity. The black arrows represent forces that rGaps create, and these push conflict toward less productive forms of expression. Cognitive integration can limit and even counteract the misunderstanding that rGaps create, thus maintaining the directness needed for rGap bridging. However, threat and frustration still build over time with protracted conflict.

Limiting the Threat of rGap Conflict

At minimum, an rGap diminishes the capacity to learn from others. Over time, a slow rate of learning coupled with the emotion from attempting to reconcile conflict can cause frustration, leading people to abandon attempts to bridge the rGap. Perhaps what is most insidious is that, while the conflict can stop and the negative emotions subside, the negative attributions about others can persist and widen the rGap (2). Climate change policy camps are examples of such entrenchment as are gun control camps. The “us/them” mentality exists because of prior conflict experience and makes the sides assume that communicating with each other is a lost cause. Such beliefs lead people to make personal assumptions (e.g., “you can’t reason with those people”) that will be hard to reconcile. While we have used a high-profile political example, this same situation is not hard to imagine between any identifiable groups who have a history of conflict. Such factions are exactly what we perceived in our original work on rGaps between designers and engineers. The relationship degradation that comes from rGap conflict widens the rGap through negative assumptions, be they imagined or real, about the people, not just the knowledge.

The catch is that people need the conflict to bridge the rGap. Even if the task is simply to enrich other’s knowledge to improve understanding and appreciation, the novice will often need to revise familiar routines and beliefs in favor of new and sometimes inscrutable ones, and this can provoke frustration and resistance. It means that cognitive integration also requires relational supports to mitigate the emergence of negative attributions about the people from whom one is trying to learn. We call this support affective integration. It is represented in Fig. 3 as what counteracts threat and frustration.

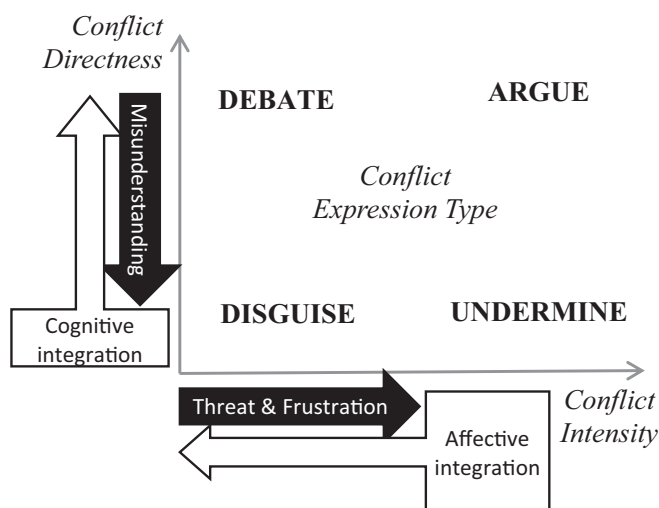


Fig. 3. rGap conflict expression and transformation.

Affective Integration

The enlightenment that comes from successfully bridging rGaps can be exhilarating and energizing (44). This hearkens back to the very first goals of good scientific communication—to get people excited about what science has discovered (1). As we just discussed, it takes effort and persistence to get to that point. People must be willing to continue trying to bridge rGaps despite the frustration, and what seems to be the first line of support for this is affective integration (13). In a very general sense, it represents how positively disposed people are to another person or group. Affective integration mitigates entrenchment and subversion by limiting the maladaptive reactions to it. Affective integration also increases the utility of directness by maintaining openness to what is communicated, thus increasing the capacity for cognitive integration. Affective integration is based in liking, trust, and respect for another (13). The level of each component provides different benefits, and therefore, each component can be its own kind of tool for the development and use of affective integration.

Liking promotes attraction between affectively integrated parties. It increases their motivation to interact with each other (59) and to do things for one another (60). Attraction makes people enjoy their time together, and therefore, over time, liking will maintain engagement in the effortful process of building new knowledge or at least slow the withdrawal from rGap conflict. Liking is also a force that can bring people back together after they have withdrawn. The willingness to do things for one another is what increases cooperation and decreases both entrenchment and subversiveness.

Liking is easy to create; it can build naturally with repeated exposure and increases with common interests or experiences (59, 61, 62). While liking is easy to create, it also is weak. Friends typically do not ask each other to change their values. Thus, liking is good for knowledge enrichment and expansion where people’s knowledge is not in conflict. Liking is less effective for reconciliation where people are asked to dismiss what they might hold dear. In addition, friends attempt to balance their exchanges, and therefore, positions that people give up become debts to be repaid. Thus, liking can lead to compromise, which is not a negotiation strategy that either creates value or produces innovation (25, 63). As part of developing affective integration, liking is thus best thought of as tool to be used in the early stages of rGap bridging.

Trust promotes the willingness to be vulnerable to another, typically when a person is perceived to be benevolent and competent and to have integrity (64, 65). Trust increases receptivity to communication by limiting the inference of subversiveness (because of the benevolence implied) and increasing the believability of the information (because of competence and integrity). Such openness to information would clearly improve learning even in the absence of conflict. When conflict does emerge, trust reduces the perception of threat (66) and decreases defensiveness, making people more likely to share their own information, because they are less fearful that it will be used against them (67). Reducing threat helps people let go of their own assumptions and to explore others’ assumptions (53). It means that trust is critical for accepting and not dismissing others knowledge regardless of whether it is unfamiliar (and thus, used to enrich or expand) or contradictory (and thus, must be reconciled) to one’s own knowledge.

Trust can emerge quickly (68) or may even be preexisting due to reputation (67). Developing trust requires that one be vulnerable to the other without being harmed. Over time, affective integration develops out of such trust events via reciprocity (69). Note, however, that, if one loses trust, it is particularly hard to regain (70). The caution here is that (when rGap conflict persists), if a lack of progress becomes attributed to malice rather than difficulty, it will undermine both benevolence and integrity,

reducing trust. Lowered trust leads to more inferences of malice, causing trust degradation to spiral (71). To counteract this while negotiating rGap conflict, one should recognize that one's motives may be hidden by the rGap. Thus, extra openness with respect to why one is taking a particular position is a good strategy.

Respect is the esteem in which one holds another; it emerges when one person admires another (14). Respect improves interpersonal treatment among those who are affectively integrated (60), because it motivates them to keep conflict civil and can prevent them from acting subversively toward each other (72). It also lessens entrenchment by increasing compliance with others' undesirable demands; people show deference to what respected others value (73). Respect has a cognitive benefit of increasing attention to other's ideas. This is especially important in exploration with others, as many ideas will seem strange or implausible (4). However, the attention and motivation that respect instills come from faith in the person, not the demonstrated instrumentality of the idea (14). Thus, respect is an important complement to trust for increasing cognitive integration—trust makes people accept others' knowledge as true, and respect makes people see the knowledge as valuable. Without respect, people may choose to expend little effort on enrichment, exploration, or reconciliation, because others' knowledge is assumed to be inconsequential.

Respect is probably the hardest facet of affective integration to develop. It is earned through positive actions in meaningful circumstances. Respect does not increase by simply sharing fun experiences; respect comes from navigating challenges. Luckily, resolving an rGap conflict is often such a challenge, and therefore, positive resolutions can increase respect. The difficulty during rGap conflict is continuing to acknowledge the legitimacy of the other side's position. While this may seem patently obvious, when rGaps are around values (e.g., gun control) or have grown very oppositional, negative emotions can lead to treating a conflicting belief as stupid or using ad hominem attacks.

Affective integration develops via the liking, trust, and respect that people have for one another. Such positive evaluations can help rGap conflict remain as debate rather than degenerating (12). It also opens people to the knowledge coming from others and thus, increases the rate at which people will learn from others. Even if people cannot find a way to reconcile the rGaps, affective integration encourages yielding to others. People are far more likely to yield to others if they like them, because people want to see their friends benefit; if they trust them, because people do not fear harm from those who they trust; and if they respect them, because people believe that those who they esteem deserve to have their voices heard. Yielding is thus an expedient way to close or negotiate rGaps when the knowledge being created does not need to be contested (43). Again, we must caution that yielding must be done judiciously. Yielding means that neither learning nor innovation will take place.

Conclusion

When people communicate, they automatically and implicitly take a perspective on what is de facto true, and they assume that

others know and believe these truths as well. However, when people have different knowledge and experience, they may not share such assumptions, leading to rGaps. Such rGaps distort the intended meaning of communications. rGaps thus degrade communication, because people are unlikely to appreciate or learn from what they do not understand. Furthermore, misunderstanding between communicators produces confusion and potentially, disagreement that is likely to lead to divisive and personal conflict. rGap conflict can seem to be an attack on one's values, in which case parties are less motivated to appreciate or learn from each other no matter the "objectivity" of the knowledge or problem.

Thus, on discovering a point of disagreement when communicating with another, especially when the disagreement seems unexpected, the right response is not to justify your own view but rather, to understand their view so that you increase CI. Communicators must realize that the explanations that they offer might still fail to persuade or even make sense to others. People's understanding is limited by their perspective, and therefore, even when people are trying to be open and honest with each other, it will take some work to understand where others are coming from. To bridge rGaps takes time and patience, because one is literally building new knowledge for at least one person, and reconciling such new knowledge with what one already knows is not easy for all of the cognitive reasons that we reviewed.

While diverse perspectives may be the initial cause of rGap conflict, relationship degradation is the effect. The reaction to "I don't understand you" is less often "I must be missing something" than "you are wrong." Such disagreement easily spirals into argument and undermining, limiting people's motivation to learn from each other. It takes affective integration to guard against this motivational decrement and the subsequent mind closing that can happen as frustration increases. Affective integration builds from substantial activities where parties across an rGap can cooperate, and such affective integration will have multiple benefits to both the capacity to understand/appreciate and the motivation to do so. It paves the way for cognitive integration, which can prevent future rGap misunderstanding. When scientific information comes to a person who has a different perspective, he or she may still disagree with the information or not find it to be particularly compelling. At least such evaluations will come from legitimate reasons, and trying to reconcile them will be a more productive process.

When experts realize that novice misunderstanding comes from legitimate knowledge gaps and not malice or stupidity, they can be more patient and effective in teaching others through communication. When people are assumed to have legitimate reasons for their beliefs, they are less defensive in the face of discrepant knowledge (53). The payoff is learning—at the very least, a more informed citizenry but maybe even new discoveries made possible by closer inspection of "it cannot be done," the typical rGap retort.

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