

# Rules of Scientific Collaboration: Group Size

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## The Importance of Group Size for Scientific Collaboration

Group size is arguably the single most important factor shaping social dynamics in scientific collaborations. The shift from smaller to larger research groups leads to social transformations that affect social interactions and scientific performance. In larger groups, members tend to feel less responsibility for and commitment to the group, and interactions are characterized by increased social loafing, wherein individuals exert less effort when working with others (Simms & Nichols, 2014). The friendship, reciprocity, trust, and group flow that can enable research groups to develop novel ideas and take creative risks that cut against the grain of established scientific thinking are also more difficult to achieve in larger groups (Parker, 2026; Sawyer, 2007).

Communication and task coordination also increase in complexity with group size. Consider the formula for determining the number of potential links between group members:  $n(n-1)/2$ . Thus, a 5-person group has 10 possible connections among members, a 10-person group has 45, and a 15-person group has 105. There is also less average contact time between group members and leaders, more formal social interactions, a more complex division of labor, and greater standardization and hierarchy – in short, more bureaucratic structuring of scientific work. This has the potential to dampen group creativity by lowering intrinsic satisfaction, reducing rates of serendipitous discovery, and potentiating boredom and alienation (Lee & Walsh, 2022; Murayama et al., 2015). Larger groups also generate fewer ideas and tend to neutralize each other's viewpoints (Greenstein & Zhu, 2014; Paulus et al., 2013). All of these processes help to explain why small research groups are more likely to produce transformative scientific knowledge while large research groups tend to build incrementally on existing research (Wu et al., 2019).

## Addressing Group Size

Still, this is not to imply that all scientific collaborations must be kept as small as *possible*. The size of collaborations varies widely across disciplines. For example, the social sciences are typically characterized by small research groups of a few individuals whereas high-energy physics can involve 'hyper-authorship' with thousands of authors listed on a single publication. The size of collaborations also varies widely within disciplines. For instance, a study of the world's .01% most highly-cited environmental scientists found that lab sizes of scientific elites ranged from two

researchers up to forty people (Parker et al., 2010). What these findings do imply is that scientific collaborations should be kept as small as *necessary*, and that we must find ways to manage size in larger groups. Some of the best ways of doing so include breaking large collaborations into sub-teams with interlocks bridging structural holes between them, increasing organizational leadership capacity, establishing a ‘two-pizza’ rule for meetings, and cross-training on the roles and expertise of other group members (see NRC, 2015).

## References

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