James Kettle & John Gallagher
James Chu
Social Networks
8 May 2022

Sociality in Rugby & Rowing

Introduction

Social networks are the backbone of society and are an exciting new field in sociology. Through social network analysis, many unseen truths can be discovered and further analyzed. In this paper we aim to compare and contrast the social structure of two different Columbia University sports teams in an effort to uncover fundamental differences between different extracurricular groups.

In classical sociology, group dynamics are often extracted from interviews or observations; however, by analyzing objective social network data we can see new insights between both groups and how the structures and rules of the groups affect them.

Through a survey, we were able to obtain a complete graph of both teams. Our primary measure was closeness between two players, with the question of "How often do you interact with this person a day?" This question was purposefully vague as to elicit an automatic response about the friendliness level of the two teammates. Touching upon the defining of social relationships by Jimi Adams, Tatiane Santos, and Venice Williams, these relationships "capture particular relationship-based roles that people occupy (friendships, teammates, etc.). These types of ties are frequently thought to exhibit a number of characteristics that enhance our ability to measure them—including that members of the relationship can easily perceive and report about them."[1] We sought to question our respective team's rosters and use their perspective on their inter-team relationships to shed light on the larger picture and interconnectedness of both

[1] Adams, Jimi, Tatiane Santos, and Venice N. Williams. 2019. "Strategies for Collecting Social Network Data: Overview, Assessment and Ethics."

programs. Additionally, lining up with the writings of James Kitts and Diego Leal, we sought to account for features of reciprocity, homophily, and transitivity while interpreting the data collected post survey.[2] Where most of the edges between each player were the same, there were some minor differences in people's perception of friendship. In addition to the adjacency matrix we compiled, we also got personal data on each player to then discover if the separation of the groups fall under any of said personal categories.

Methodologies

For context, both teams are athletic groups at Columbia University in the City of New York, but are starkly different in just about every social detail below the surface. Rugby is a club sport which means that while the team competes in the Ivy League, practice is only 2-3 days a week and is not binding. In addition, the Rugby Club is often seen, realistically, as a social team rather than a “serious” collegiate sports program compared to some D1 varsity organizations at the University. The Rowing Team is a three-time national champion D1 varsity program meaning that team practice is mandatory nearly everyday and is required to remain on the roster. Many athletes on the Rowing Team have been competing in the sport for many years and were recruited for the team back in high school, whereas Rugby has no recruitment program.

The size of the teams are comparable with 28 active members on the Rugby Club and 38 on the Rowing Team. The Rugby Club is solely male, while the Rowing Team is non-gendered.

For our survey, we sought to create a complete directed graph which entailed us interviewing every respondent to fill out a questionnaire which had the entire roster present for both programs. The interview first included 5 personal questions: the sub-team in which they were competing for, their major, their domestic/international status, their school year, and the

[2] Kitts, James A., and Diego F. Leal. 2021. “What is(n’t) a friend? Dimensions of the friendship concept among adolescents."

college which they attended in the University. They were then asked to rank how often they converse with a member of their team on a linear scale of 0-5, with 0 being “never” and 5 being “all the time.”. This question was designed to elicit an authentic reaction while also being quantifiable. After considering options such as “how close are you?” or “how good of a friend you are to them?”, we decided that proximity and number of interactions would be the most conducive route towards garnering meaningful results.

Motivations:

Our primary motivation and interest in this specific study is based on our involvement in both programs and our desire to better understand the nuanced social distinctions between these two teams, amongst different extracurricular groups in general. Furthermore, investigating how different ratios of reciprocity, homophily, and transitivity, as well as common personality traits, impact the social networking of both programs.

Our hypothesis for the Rugby Club is that the most important category is either the A team or B team groups. This is because of the coaching style of the program’s head coach, which emphasizes group cohesion for each subteam. We also suspect that the Lightweight Rowing Team will be, on the whole, much closer because of the amount of time mutually-spent around the foci of rowing.

The results of this study could have broad implications to the field of team management as the two teams have diametrically opposed coaching styles. If both teams are the same, even with different coaching dynamics, then we would have discovered that coaching style is not a principal component to the outcome of the team and should not be emphasized with designing a team structure. However, if our hypothesis is true, that the two teams are different structurally

and that this is related to the way the two teams are coached, then future teams should modify their coaching style to increase player cohesion.

In addition, this study is set to be a platform for future research on other extracurricular activities and even other professional organizations to see how team mores and norms affect the inclusion of people within the group. While we do not discuss this idea in this paper, we suspect that teams with a more inclusive structure have better performances - so this research will discover what in fact makes an inclusive team structure.

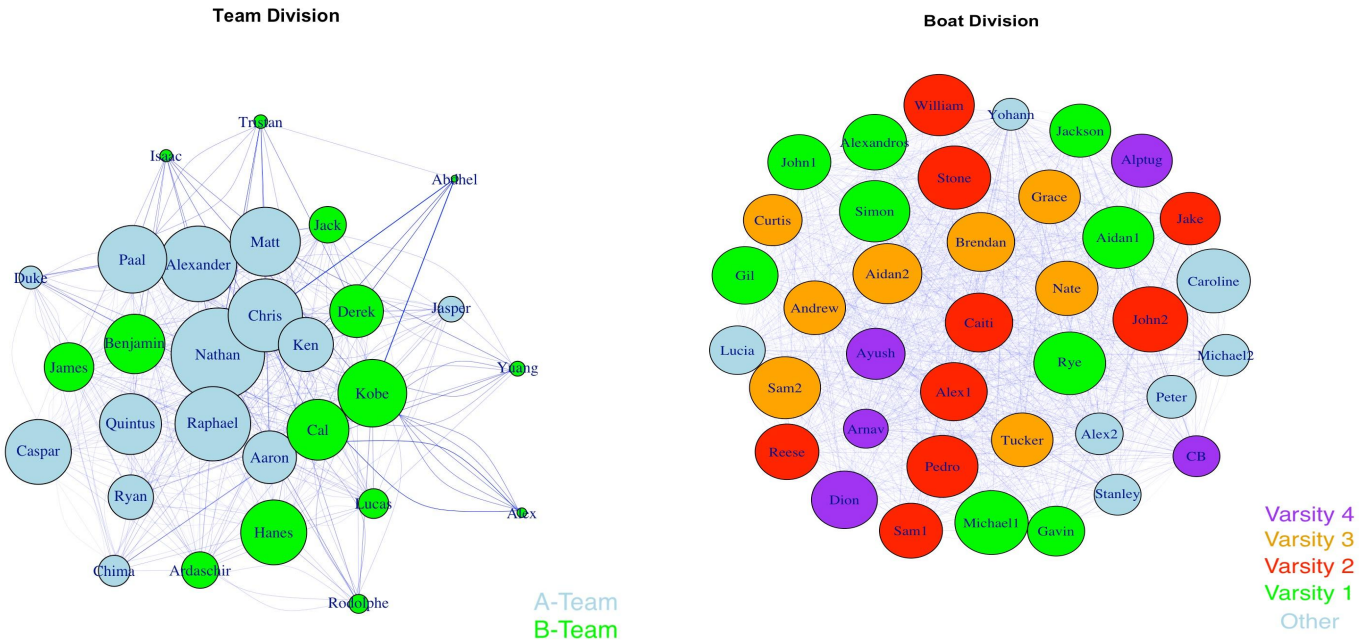
Visualizations, Outcomes, & Findings

For our visualizations we turned our data into an adjacency matrix through Google Sheets, then exported it into R to first graph the connections between the nodes and the characteristics of each node. We ran into some issues with R as a software, such as the inability to link the thickness of the vertices to the number that we provided in the adjacency matrix. This could have been because the scale of interaction was between 0 and 5 and not between 0 and 1. In further research we could normalize the data to perhaps have more easily interacted with the software.

That being said, through our data we have produced extremely informative graphs. Shown above is the team and the boat division of both the Rugby Club and Rowing Team respectively. This iteration of the graph shows three main things about the team. One, the size of each of the nodes represents the indegree value of the node, which in this case is the combined value of the directed edges going into each of the nodes. Then the Fruchterman-Reingold algorithm is used for the placement of the nodes, meaning that most central nodes are placed in the center, lesser connected nodes are placed at the edges, and nodes which are more related are placed closer together. The color of the node represents the characteristic of the node that we

choose to display. For example in the graph below, the team that each player is playing for is shown. The first two characteristics of the graph do not change with every new iteration, however the color does. All of the information gained by the graphs are extremely enlightening. First is the realization that the two teams are fundamentally very different, in structure and player inclusion.

Outcomes & Findings

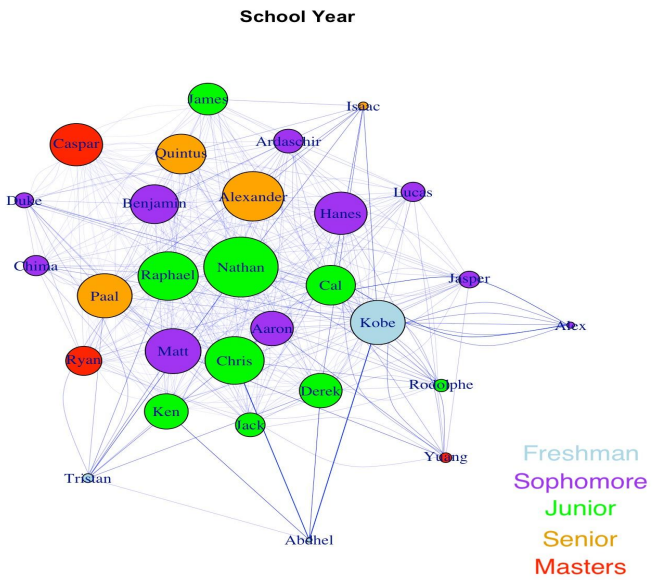


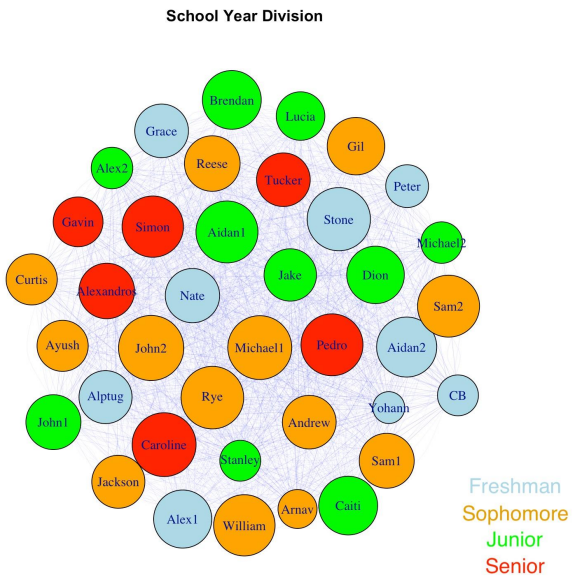
We can first comment on the structure of both teams. While the Rowing Team is almost uniform in nature with only some players being less connected than others, the Rugby Club is highly divided. There seems to be a core circle of players that are all highly connected to each other and on the fringes all the other players that have a remarkably low level of connectedness.

The Columbia Rugby Club is represented by two groups: the A-Team and B-Team and is determined based on skill level and performance. Referencing the Rugby graph above, one can see that there is a loose agglomerate of "A-Team" athletes and another loose connection of "B-Team" athletes. This concurs with our hypothesis that team division within the Rugby Club would be an important factor in determining the strength of ties between specific athletes.

Moving our focus to the rowing graph, our hypothesis seems to be supported again: the entire team is well-connected and fairly uniform in its division amongst the groups.

While school major and college within Columbia University didn't prove useful to divide the team, classes concerning team division, school year, and domestic/international status did prove useful to understand the Rugby Club. However, these classes were not very useful to describe the Rowing Team because the Rowing Team is almost uniform in every category. The Columbia Lightweight Rowing Team is made up of several boats of athletes: there is the Varsity 1, Varsity 2, and Varsity 3 that all feature eight oarsmen and one coxswain (the individual that steers and commands the crew) and the Varsity 4 which includes four oarsmen and one coxswain. Though the athletes spend a disproportionate amount of time within their specific boats, interacting with a specific group of individuals, the entire team shares the same foci of rowing and thus remains a widely connected group as a whole. As discussed in Ronald Breiger's 1974 publication "The Duality of Persons and Groups.", we see the affiliation of team/boat division strengthens the ties between group-mates in Rugby but interestingly not as much with





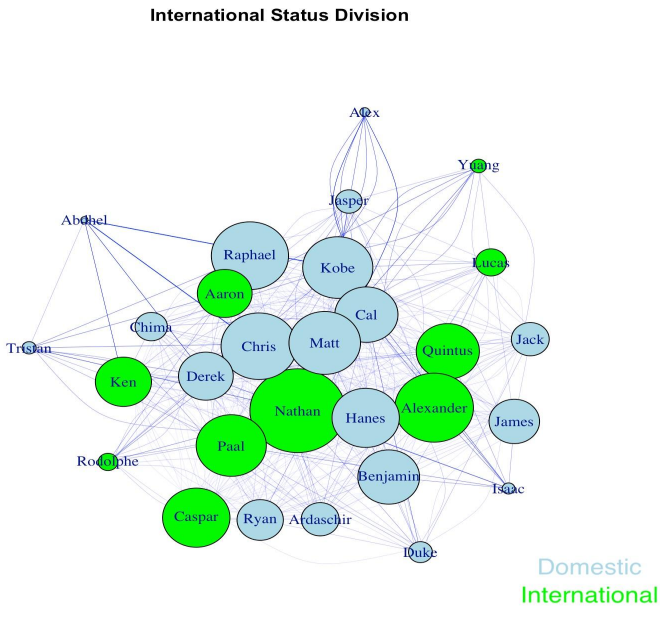
the boatmates of Rowing - a reflection of the significant difference in team dynamic/connectedness.[3]

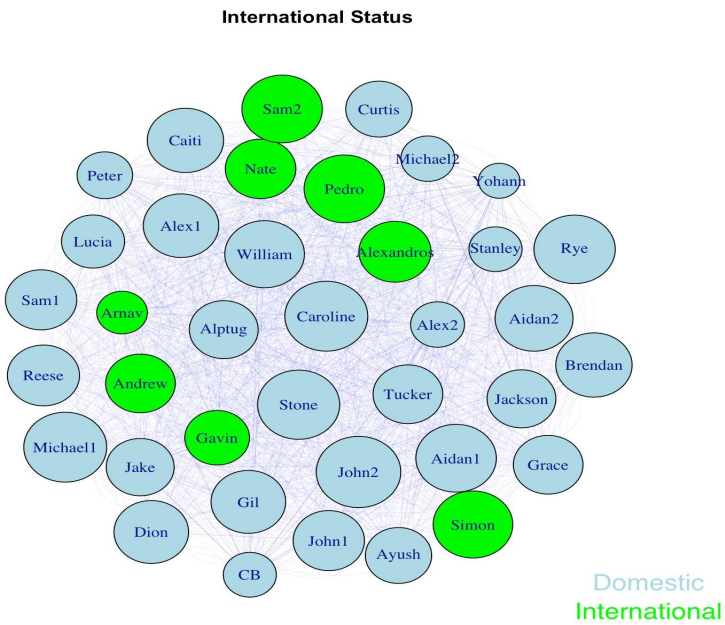
Looking at the School Year Division of the two athletic programs, we see some similarities between both programs in contrast to the stark differences of the Team/Boat Division. There does not seem to be any real loyalty to class within the Rowing Team as athletes from every year distinction are evenly dispersed within the graph. While we are slightly different in age and maturity, obviously, we are all college student-athletes working towards relatively common goals under one team and coaching staff so seeing this class-dispersion is not surprising.

Within the Rugby Club there is preference for junior and senior players to be in the center, where sophomore players seem to be "rising up" the ranks, and freshmen largely seem to be at the outskirts of the graph. While this is just the trend and not the rule, it makes sense given the structure and non-committal nature of the team. Many players first "test out" the Rugby Club in freshman year, but drop out due to lack of skill, bad cultural fit, or interest in other activities. The players who make it in the team all four years have an entrenched position within the team, compared to the new players.

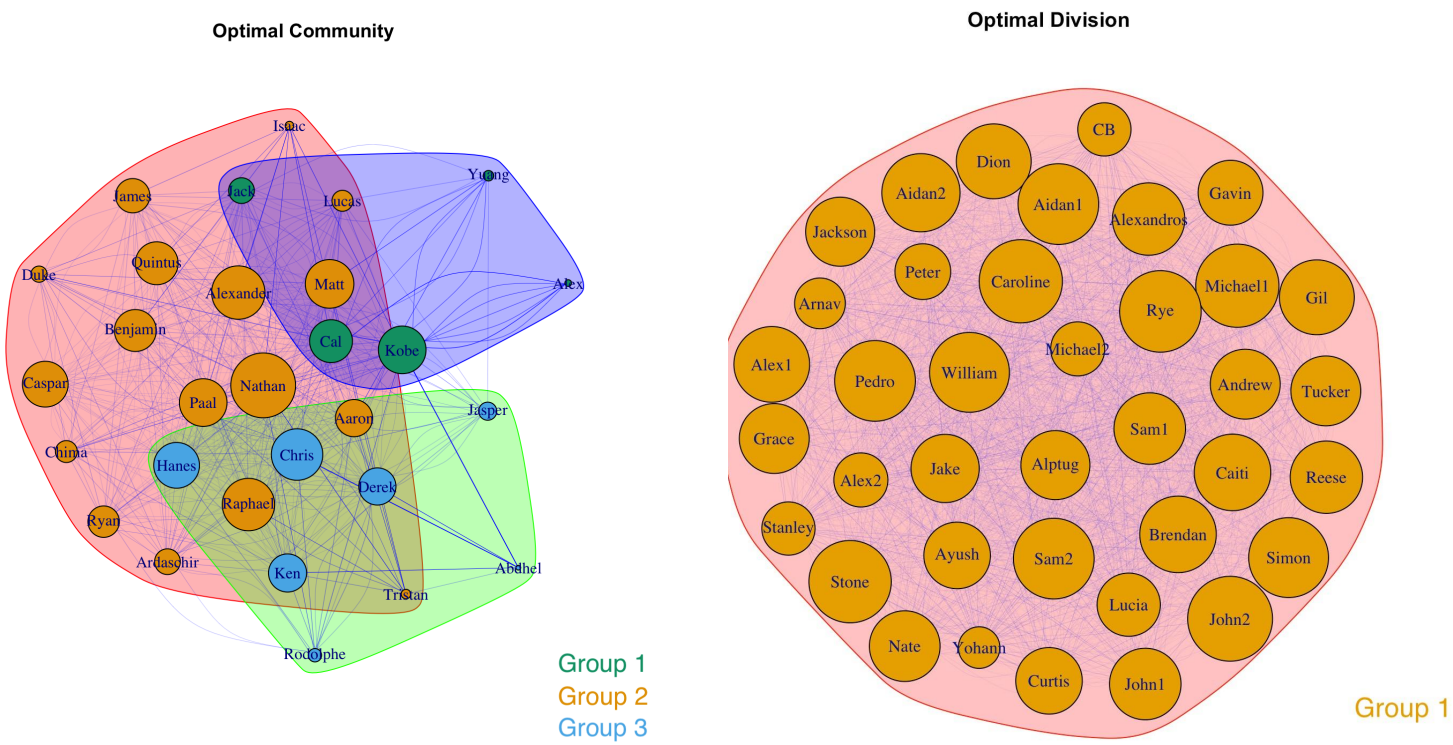
There are some exceptions such as "Kobe" who is a central and well connected node, even though he is a freshman. The reason that he breaks the trend is that he is a very enthusiastic player and built his personality and friend group around the Rugby Club. Another exception is Issac, the reason that he is a small and poorly connected node, even though he is a senior, is that he just joined the team and thus does not have the same level of relationships with the other members as the other seniors. The main property of connectedness is time spent with the team, which is highly correlated with school year but not dependent on it in some edge cases.

[3] Breiger, Ronald L. 1974. "The Duality of Persons and Groups."





Looking at the International/Domestic Status Division of the athletes of the Rowing Team we again see no substantial difference in connections between international and domestic students. Evidently, we are all english-speaking college-aged men competing alongside one another so it would appear that an accent and a slightly different upbringing creates no division within either program. However, on the Rugby Club there are slight trends that show that international students are more connected than domestic students. This makes sense, as we have seen the principle factor of determining connectedness is if a player is on the A or B team, and because rugby is a more international sport, one can draw the conclusion that international students will generally be better at rugby and thus be on the A team and then be more connected. However, it is not the only factor as many of the core members are also domestic students. Meaning that being international increases one's chances of being highly connected, but does not mean that it is a guarantee or a requirement to be highly connected.



Lastly, our final illustrations sought to present the Optimal Division and better understand the modularity of the two athletic programs - we sought to create the optimal divisions within each program by taking all variables into account. As there was a higher modularity within the Rugby Club, we were able to form three distinct groups between athletes (as observed within the illustration on the left). In contrast, on the right we see one large community created within the Rowing Team - all athletes fall under the same umbrella group thanks to the program's notable uniformity and varied ties.

In essence the Rugby Club is more heavily divided. Using Newman's community discovery algorithm[4], we have discovered that there are "three groups" within the team. However, having an understanding of the surface dynamics of the team by participating in it, the groups are not accurate. This could be a result of the structure of the matrix, the numbering system that we used, or the accuracy of the data. Even so, it is clear that there is a large

[4] Newman, Mark E. J. 2006. "Modularity and Community Structure in Networks."

difference between the Rugby Team and the Rowing Team because of the practice structure, player make up, and internal rules within each team.

Discussion & Extensions:

Social network analysis, especially with complete graph data can lead to some stark discoveries, which was the case within our study. It is clear that the Rugby Club and Rowing Team are fundamentally different. On first inspection, one would think that because both teams are sport organizations within Columbia University that they would have some similarities but in fact the two teams are so different that the graphs have almost no similarities.

Our study proved our assumptions about the strong effect of the strength of foci within team structures and that how a team is run deeply affects the outcome of said team. While social networks are based around certain foci [5] it is clear that some foci are stronger than others leading to differences in the real world. The voluntary nature of rugby leads a select few highly talented players to be in an inner circle of highly connected players and an outer circle of disconnected players that are in the sport for many diverse reasons. This way of team organization is fundamentally different from the organization of rowing, which is highly regimented, organized, and uniform leading to a more cohesive and homogeneous team. Additionally, citing a contention of Ronald Burt, individuals within the same group/team share unique opinions and behaviors that make each program's network of athletes a sui generis association that cannot be identically found anywhere else. [6] Each friendship and tie between athletes is strengthened by common foci and a special camaraderie.

One critique of the Rugby Club that we heard while conducting the data collection of this study is that the B team feels left out of practices and that they noticable treated differently than

[5] Feld, Scott L. "The Focused Organization of Social Ties."
[6] Burt, R.S. 2004. "Structural Holes and Good Ideas."

the A team. This is largely due to the coaching methods of the team in which the A team is prioritized in practice. Through our analysis, it is clear that this way of conducting team building is flawed and leads to a more divided team. We suspect that if either the A and B teams were treated equally during practice, if there was not a clear demarcation of the teams during practice or if the Rugby Club practiced more often, the level of division would trend to a more uniform distribution.

In terms of our methodology and how it can be improved for further research, it is clear that the way we collected and structured our data should be modified. If our team had more time, then a longitudinal study would be highly beneficial for discovering true divisions, not solely self-reported ones. With a longitude study we could have incorporated a temporal aspect to our data. If this was possible we would have predicted that the isolated nodes within the Rugby Club would likely be the most probable to leave the team within the semester. In addition, with more long term data we could have more concrete evidence for our analysis.

Within our study, we used a survey to collect data, while this proved to be an effective and time efficient way to obtain the data we sought out for. However, there is no doubt several entries were affected by the semi-sensitive nature of the questions and the fear that one's answers may be leaked. In the future we could use an interview based approach which would have produced more trust and potentially more honest answers and therefore more accurate results.

If we did decide to maintain the survey aspect in future studies, then we could refine our questions to be more clear or more thorough. While our survey question was intentionally vague, we could try to ask a more direct question/set of questions and see if the results of the study changed.

In respect to our numerical data, in future studies there should be an effort to normalize the data as it would be beneficial so that R may respond better to our queries. In addition, we should potentially use Python and Networkx instead of R and Igraph because of the more clear documentation and larger user base. Regardless of the potentially more advanced technical options through our data and plotting, we discovered realities which made the collection process worthwhile.

Further studies could take this idea of a complete graph structure and bring it to other teams and organizations. While we conducted this study within the field of sociology, further studies could be effective in sports or team management to understand which training procedures allow for the best outcomes in terms of team unity and productivity (wins in the case of sports teams). We suspect that likely team structures as shown in the Rowing Team produce the best outcomes. The combination of constant exposure and practice and a unified team mentality causes teams to be extremely unified. This information can also be given to the coaches of rugby and other team sports to demonstrate how the training procedures affect team composition.

One crucial aspect that was missing was a gender component. In future studies, it would be enlightening to see if the same trends exist within male and female teams with the same structure. In addition to the gender component, one aspect of our study that should change is the sample size. If a future study were to take place, then many more teams should be studied with several different teams with the same practice structure and internal rules placed in separate groups. With this dataset, we could discover the true cause of the divisions between teams. Through our sample of two teams, it is clear that exposure and participation are the leading factors, if we have a more diverse sample group, we could deduce underlying or hidden factors at play.

Conclusion

This study examined the differences between the Columbia Men's Rugby Club and the Columbia Lightweight Rowing Team, and proved that the respective teams have extremely different structures. Our hypothesis was true, that the way a team is run, including the number of practices, practice unity, and general team mores and attitudes, greatly affect the structure of the team. We discovered through social network analysis, that while both teams served as foci for the players, some foci are stronger than others and that closeness begets closeness over time. We also discovered that the Rugby Club has a hierarchical team structure which includes the best players at the top and leading them to be the most connected players within the team, with the exceptions of very enthusiastic “B-team” players. We also discover that rowing has a very uniform structure.

We have shown that team structure is a crucial component to team unity. This research lays the groundwork for further studies on the maximization of team unity and its overall effectiveness for team outcomes compared with disunified teams.

Bibliography

Adams, Jimi, Tatiane Santos, and Venice N. Williams. 2019. “Strategies for Collecting Social Network Data: Overview, Assessment and Ethics." SocArXiv

Breiger, Ronald L. 1974. “The Duality of Persons and Groups." Social Forces 53: 181-190.

Burt, R.S. 2004. “Structural Holes and Good Ideas." American Journal of Sociology, 110(2):349-399.

Feld, S.L. 1981. “The focused organization of social ties." American Journal of Sociology 86(5):1015-1035.

Kitts, James A., and Diego F. Leal. 2021. “What is(n’t) a friend? Dimensions of the friendship concept among adolescents." Social Networks 66(1): 161-170.

Newman, Mark E. J. 2006. “Modularity and Community Structure in Networks." Proceedings of the National Academy of Sciences 103 (23): 8577–8582.