People Analytics: Understanding and Enabling the Future of Work

Academy of Management - OCIS Division - 2019

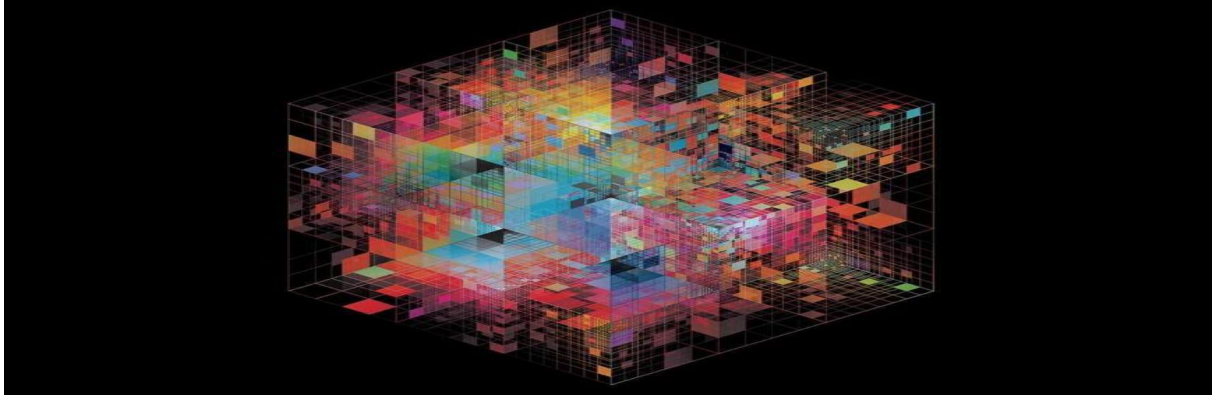Keynote Speaker - **Noshir Contractor**, Northwestern University

Prof. Contractor is a well-known and respected scholar in the field of Management, Organizations and Engineering. His intuition, diligence and passion guided his academic career and allowed him to emerge as a researcher, professor, director and supervisor with outstanding achievements. His current position is Jane S. & William J. White Professor of Behavioral Sciences, Departments of Industrial Engineering and Management Sciences, Communication Studies, and Management, Kellogg School of Management, Northwestern University and devotes his expertise and knowledge to guide and support PhD students during their initial research career.

He has published over 250 research papers on Communication and Organizing, in the field of Network Science, Computational Social Science and Web Science. His research is on the formation management and institution of social and knowledge network in various contexts i.e. communities of practice, engineering communities, public health networks, virtual worlds. Currently he is studying organizational networks, virtual teams, routines, robots and AI at NASA. He serves as Editor of the journal Network Science and at the same time Prof. Contractor has significantly contributed to practice by being the co-founder and the Chairman of the company Syndio (acquired by Edge Analytics) which developed digital platforms for organizations to better understand and leverage networks.

He has received several awards such as *Distinguished Alumnus Award* by the Indian Institute of Technology (2018), *International Communication Association Fellow* (2015), *National Communication Association Distinguished Scholar Award* (2014), *Outstanding Member Award*, Organizational Communication Division (2000), *Institute Gold Medal for Outstanding Overall Achievement* by the Indian Institute of Technology (1983) for his Bachelor's degree. Additionally, Prof. Contractor has received gratitude, admiration and respect from several research communities, which is the highest award a scholar might receive during personal academic career.

During his first semester of the PhD programme, Prof. Janet Fulk and Prof. Peter Monge as his intellectual parents suggested Noshir Contractor work in the field of Organizational Communication. The PhD student immediately went to the library card catalogs as one used to do in the pre-Internet era and found 77 articles on the topic of Organisational Communication. A bit puzzled, his advisers suggested he go back to the library to redo the literature search using "Organizational Communication" with a "*z*" as it is spelled in the US as compared to with an "*s*" in India, where he grew up. A single letter change resulted in him finding more than 2000 articles at that time. Since then, the research interest in the field has continued to expand as witnessed by more than 60 thousand research articles today.

The Future of Changing Nature of Work: People Analytics

After the first literature search, Noshir Contractor devoted his working life to acquire specialized research skills, which brought him to become a distinguished Professor and an expert in Networks for challenging projects such as NASA. The keynote speech opened five windows represented by five research papers about "*The Future of Changing Nature of Work*". which guided the setting of this article.

Prof. Contractor opened the talk with an article recently published in Harvard Business Review about people analytics[1]. This is a technique, which allows companies to analyze and make sense of numbers, data, charts, graphs about employees. Leonardi and Contractor (2018) stated that more than 70% of companies believe that people analytics is a high priority, which is evidence of an increasing interest not only among scholars but also practitioners. Although these topics captures the curiosity in the consultant space, only 9% of companies believe they have a good understanding of what to do with people analytics to drive performance in their organizations, and only 5% of investment in people analytics go to HR department, the division that usually is in charge of managing people analytics.

Leonardi and Contractor (2018) affirmed that there is a tendency to use the data about the *individual* people at the expense of the data at the *interplay among* people, which provides more detailed and complete picture about the people analyzed. This observation, allowed the authors to introduce a new concept: *relational analytics,* which is the science of human social networks (i.e. communication of two people in different departments in a day). Such an approach might better explain employees' workplace performance.
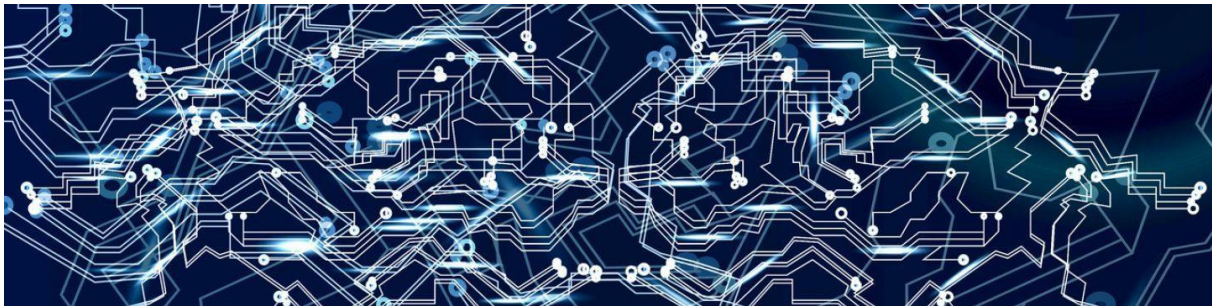
To define the concept of *relational analytics*, authors explained that each employee has two types of data: <u>traits</u> such as ethnicity, gender (attributes that do not change over time in any individual) and <u>state</u> such as age, education level, days absent (attributes that are subject to change over time). Besides this distinction, authors presented an innovative perspective and

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[1] Leonardi, P., & Contractor, N. (2018). Better people analytics. *Harvard Business Review*.

suggest focusing not only on <u>individuals</u> but also on connections between individuas which creates the concept of relational analytics.

The main purpose of this article was to highlight that people analytics is meant to measure who they know not just who they are. People analytics allow a company, interested in improving team performance, to predict how to create effective teams based on the statistical analysis to identify patterns in the data. Such an approach will allow the company to make evidence-based decisions, to select the proper employee for the specific tasks and to identify areas in the organizations that are vulnerable to turnover. Prof. Contractor informed his audience that there is an imperative need to make this area more actionable and he believes that organizational contexts can be made more actionable. The key issues in organizations now are <u>diversity & inclusion</u>, <u>mergers & acquisitions</u>.

Source: MIT Sloan

How do Self-designing Teams Assemble?[2]

Gómez-Zará D. et al

The second window gave the audience a chance to to see the process of team formation. Prof. Contractor and his research team presented research (2019) about the self- designing teams assemblages and performance. Authors stated that team formation is relocated into online spaces such as crowdsourcing, research projects, MOOCs, virtual spaces, startups, hackathons and others. Therefore, HCI researchers proposed several theoretical frameworks to support online team formation. Although there are increased resources and opportunities to augment users' actions in online environments, less is known about the users' behaviors when searching and choosing teammates. The authors conducted a research project to describe how social networks have an impact on the process of team searches, team choices and team composition. The overarching research question that guided this exploration is "*how do self-designing teams assemble?*", which has been decomposed into four intermediate research questions (Figure 1).

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[2] Gómez-Zará, D., Paras, M., Twyman, M., Lane, J. N., DeChurch, L. A., & Contractor, N. S. (2019, April). Who Would You Like to Work With?. In Proceedings of the 2019 *CHI Conference on Human Factors in Computing Systems* (p. 659). ACM.
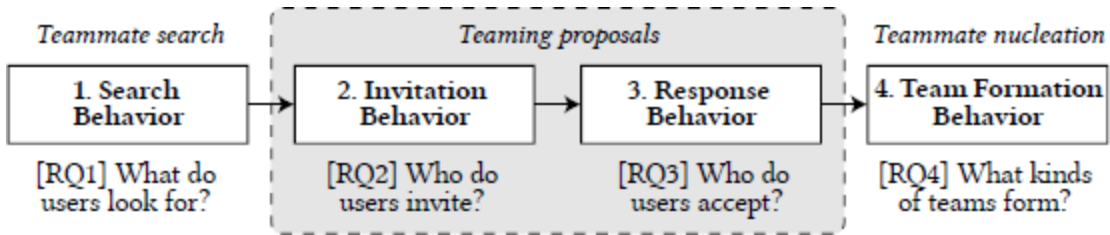
Figure 1: Team formation stages and research questions. Source: Gomez et al, 2019.

A field study was conducted with 530 students who assembled project teams with the support of an online team formation system. Authors analyzed digital trace data and survey data to explore users' agency during the online team formation. The findings showed that (a) initially users search for experts and sociable users, where technology recommendation always improve the chance of being invited to build a team but ultimately they tend to choose their prior social connections. Moreover, (b) teaming up with prior social connections tend to enhance disparities among teams by creating teams with best talent and leaving others disadvantaged. For example, a user with higher number of invitations in building a team have higher power of choice and greater influence in the final team composition.

Source: NASA

Relational Analytics for Predicting Effective Space Crews

Antone B., Lungeanu A., Ng J., Bell S. T., DeChurch L. and Contractor N.

The third window not only updated the audience about effective team formation and predictions for increased performance but also brought them to an interplanetary trip up to Mars. Prof. Contractor first contextualized the research field and explained that this research project has been funded by the National Aeronautics and Space Administration (NASA) to explore team composition, configuration of members attributes and their

relationships. This is part of a bigger project, indeed, NASA is engaged with the preparation of the expedition to Mars. Experts in space crews believe that an effective team working plays an important role in long-duration space exploration (LDSE). Therefore, authors developed the CREWS[3] (Crew Recommender for Effective Work in Space) project funded by NASA to investigate how to optimize crew functioning and performance.

The scholars are conducting multimethod research to develop an agent-based model of team composition for LDSE, to analyze team functioning patterns and create a predictive model of team composition and to conduct an initial validation of the model. The major aims are to identify critical factors of team composition on team functioning in LDSE, to identify particular patterns of this effect, to identify methods for composing teams, to develop a predictive team composition model and to provide recommendations for team composition.

For such an outstanding aim, NASA has to address to some challenges, Prof. Noshir mentioned two key challenges. First, the distance and the time to arrive on Mars. Earth from Mars is about 225 million km/140 million miles this means astronauts will spend 259 days to get to Mars, approximately one year will be spent on Mars to register and collect information about the mechanisms there and almost another year will be necessary to return on Earth. A team strategy is mandatory for such a long time where international astronauts will be involved in this mission. A second challenge refers to the issue of time lag, as the team will get closer to Mars, it will need more time (4 to 21 minutes each way) to receive messages, to reply and to get back answers from Earth before taking any action.

Predictions about the team building for accomplishing specific tasks are necessary for the mission on Mars. NASA CREWS: Crew Recommender for Effective Work in Space guided by Prof. Noshir Contractor addresses these and other challenge by developing agent-based model of team composition for LDSE based on empirical data linking key model inputs. The technique used is a simulation model with computer-based astronauts, which will predict what will happen to specific a team while accomplishing specific tasks. With a multilevel theoretical model, it will predict what will happen to astronauts during the mission to Mars.

Astronauts Job Analysis Reveals: "*Teamwork makes the dream work at NASA*"

The model has been tested with new data and its performance was more than positive. Indeed, the scholars examined the performance of the model on test data, by using 8-fold cross

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[3] https://sonic.northwestern.edu/projects-2/crews/

validation. The performance measures refer to <u>accuracy</u> (percentage of the prediction is correct), <u>precision</u> (percentage of the predicted ties observed), <u>recall</u> (percentage of observed ties predicted) and <u>F1-Score</u> (an aggregate measure of performance, harmonic mean of precision and recall). The prediction accuracy of the multilevel theoretical model is high in terms of work-team composition. However, one relationship that is not well predicted by this model refers to which crew members will be seen as a hindrance in a task. The model until now has been developed to make predictions on who will perform well in a specific activity and how to combine team members to better achieve intended goals. At the moment there is a lack of data about the characteristics of people who are seen as hindrances in specific activities. More data and simulations are needed to include this aspect in the model.

Prior Shared Success Predicts Victory in Team Competitors[4]

Mukherjee, S., Huang, Y., Neidhardt, J., Uzzi, B., & Contractor, N.

After the trip to Mars, some sport activities are necessary to get used to keeping our feet on the ground again. With the fourth window, Prof. Contractor launched his audience to football, cricket, baseball Premium Leagues and to the National Basket Association. Besides Prof. Contractor's interest in networks, there were two other qualifications which made him a suitable scholar for conducting this research with Prof. Mukherjee. The first qualification was his last name: it is the same of a famous former Indian cricket player and team captain Nariman Jamshedji "Nari" Contractor (picture attached). Unfortunately, his professional career finished after a serious injury. The second qualification was his father's cousin, Farokh Engineer who was also a famous Indian cricket player.

In this paper, the scholars conducted a research project about the influence of the team composition and its performance in four sport practices in different countries. In prior studies, sports enthusiasts and scientists often discussed about the impact of team composition on the final outcome with the aim of identifying the proper strategy and mix of resources to win the sport game. On one side, there is a common belief that including superstars in a team, will
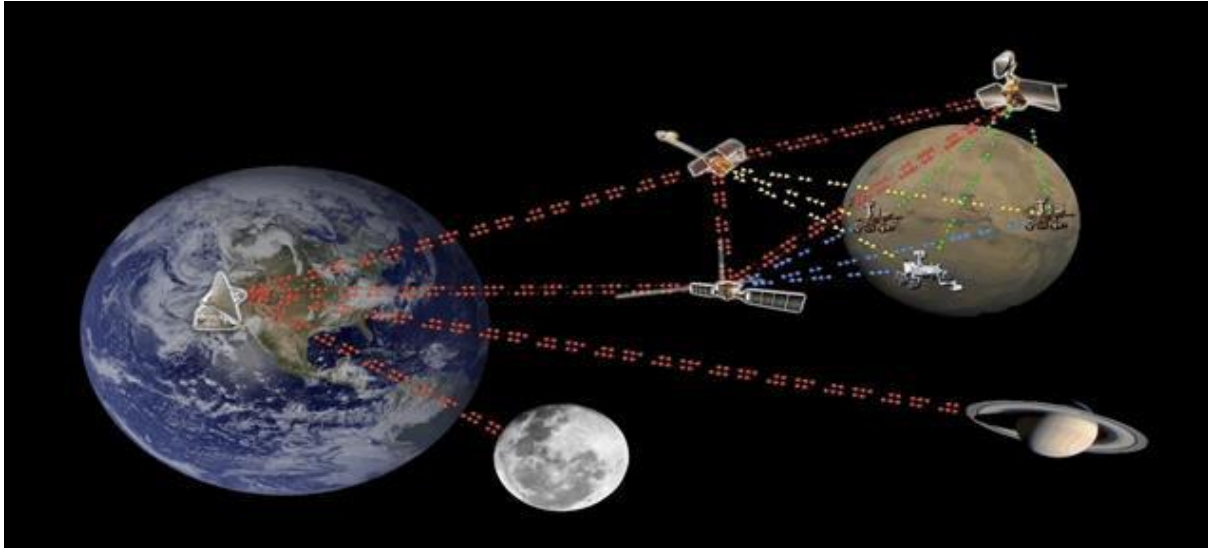
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[4] Mukherjee, S., Huang, Y., Neidhardt, J., Uzzi, B., & Contractor, N. (2019). Prior shared success predicts victory in team competitions. *Nature Human Behaviour*, 3(1), 74.

improve the performance of the team. On the other side, several studies showed that previous relations and shared experiences among team members improve the team coordination and strategy, thus the likelihood of winning. With this perspective, scholars showed that not only highly skilled players but also cooperative teammates impact on the final outcome.

Prof. Contractor, Prof. Mukherjee and the other research members investigated five virtual global teams to explore the impact of within-team relationships on the outcome of competition between sports teams. The data collection involved five sports, including basketball (National Basketball Association), football (English Premier League), cricket (the Indian Premier League), baseball (Major League Baseball) and the multiplayer online battle game (Defense of the Ancients 2). With a qualitative and quantitative approach, the authors identified one consistent result across the five categories of sport disciplines: shared success between team members has a significant impact on the likelihood of the team winning in all sport beyond the individual characteristics of the players.

Prof. Contractor specifically explained that if they would have looked only at individual characteristics of each player to predict the likelihood of winning, the scholars would have never been able to provide an accurate prediction for the final outcome. Instead, when they looked at which teams had players that previously played successfully together for the same team or any other team, then the scholars were able to show that this consistently improved the barriers for predicting which team was going to win. Also in this case, relational analytics play an important role again. Enlarging this perspective and looking at relational dimensions of players, allowed the scholars to identify a consistent result across four sport disciplines.

Communicating Through Space and Over Time[5]

Schultz, M., DeChurch, L., & Contractor, N.

Prof. Contractor concluded the journey with a fifth window into the communication through space. During initial interviews, Prof. Contractor's team noticed that people working together in space need to have similar mental models or shared cognition. One of the challenges astronauts faced during the mission was to try to "read" each other's mind, which is a question of time and mutual understanding regardless of the language they spoke and their country of origin. Prior studies in this field investigated what kind of mental models people have and develop over time. A meta-analysis applied in this research project found that shared cognition was the most powerful predictor of team process and team performance.

They explored this argument using data from Skylab. Skylab was the first experimental space station conducted to prove that humans can live and work in space for long periods and to expand the knowledge about the solar astronomy[6]. The researchers were interested in exploring the ways by which people share mental models with each other. From the network point of view, this refers to individual network, to the network of others with whom the members shared their mental models and to the interpersonal network.

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[5] Schultz, M., DeChurch, L., & Contractor, N. (2018, May). Communicating through space and over time. Paper presented at the 68th Annual *ICA conference*, "Voices," Prague, Czech Republic.
[6] https://www.nasa.gov/mission_pages/skylab/missions/

The scholars analyzed every conversation and information exchanged among the astronauts and with mission control during the Skylab mission. They did text analytics, to recreate the network representing the individual mental model for each crew member and mission control and, from it, the network representing the shared cognition between crew members and mission control. They found some remarkable differences in shared mental models in the network of astronauts in Skylab 3 compared to those who were in Skylab 2 and Skylab 1. Specifically, the mental models shared among astronauts in Skylab 3 were much less than those in Skylab 2 and 1. These dramatic change among the crew members occured 10 days before the mission had an interpersonal crisis resulting in the astronauts in Skylab announcing that they were taking a day off work (popularized by the press as the first "strike in space").

Prof. Contractor brought his audience into an interstellar journey in "*The Future of Changing Nature of Work*". The journey started with the presentation of people analytics impact on team performance in companies, then it moved to virtual environments with self-designing teams. The speaker wanted to surprise and stimulate his audience's imagination with a future mission to Mars by developing predictions about effective space crews. Then he returned back on Earth and trained his audience with five sport disciplines to prepare them for the final trip to the future and suggest that "*People analytics are well positioned to shape the social science research agenda in the next 10 years as we prepare to address grand societal challenges as well as national security, national intelligence and many other fields*".

Cristina Trocin
OCIS Division Student Representative at Large