Cascades and Avalanches
in Twitter Communication Networks

Applicants
Eligible proposals must have two (and only two) applicants from different disciplines within the Network Institute.

Supervisor Name	Department/Group	Faculty
1.Iina Hellsten	Organization Sciences/ Network cluster	FSW
2. Ines Lindner	Econometrics & OR	FEWEB

Project description
Provide a brief description of the project (max. 300 words) **263/300 words**

The project *Cascades and Avalanches in Twitter Communication Networks* focuses on the structure and content of communication networks on Twitter, with the aim of identifying mechanisms that lead to sudden information cascades and social avalanches (hypes). We approach hypes as mass synchronization of attention, for example, when specific topics (as identified by shared hashtags) hype on Twitter. In particular, we will test models of preference synchronization in social networks with Twitter data. We will observe the dynamics of the changing communication networks via co-occurring hashtags, targeted users and changing content on Twitter.

 The main research questions are:

1) What kind of network structures emerge under avalanches?
2) Does the network structure follow the preference synchronization or is it the other way around?
3) Can we explain and forecast avalanches by means of models of herding effects?
4) Can we control or at least influence avalanches?

We will build upon the three models of innovation diffusion by Young (2009): Social contagion, social influence and social learning as drivers of preference dynamics in social networks. These models provide a theoretical background to test empirical observation using longitudinal Twitter data. The focus of the analysis is on identifying the mechanisms of synchronization in the structure and content of communication networks.

In the social sciences, media hypes have been expected to result from sudden synchronization of the frames in the debate, where one frame becomes dominant and leads to a hype (Vasterman 1989). We have existing, longitudinal Twitter data on climate change (Dr.Hellsten) that can be used for the pilot case study during the Academy Assistant project.

Project Organization

Each proposal requests two Academy Assistants from different disciplines. Describe their roles and describe the skills and expertise required from them. (max. 300 words) **255/300 words**

This cooperation represents a combination of two expertises.
  (1) The expertise in modelling and social theories of collective dynamics of Dr. Lindner, FEWEB, Econometrics & OR.
  (2) The expertise in social and semantic network analysis of Dr. Hellsten, FSW, Organization Sciences.

The project builds upon the expertise and recent research projects of the two supervisors: Dr. Lindner on *Cascade Dynamics on Interaction Networks* and Dr. Hellsten on *The Dynamics of Social Avalanches in Communication Networks*.

The two student assistants will be recruited from FEWEB and FSW, one each, with skills that complement each other: While the FEWEB student assistant has a basic understanding of mathematical models and use of big data sets, the FSW student has a basic understanding of social network analysis and the social interpretation of the results. We will aim to hire students with an interest in the analysis of big data and network research, an ambition to stay in the academy, and to strive for a PhD project.

The project will have weekly meetings to supervise the understanding of the scientific background and discuss the progress. The Twitter data for the project will be provided by the supervisors. The existing Twitter data set has been crawled since September 2013 until June 2014 and consists of several millions of tweets on climate change (Dr. Hellsten). This provides a unique opportunity to tests mathematical modelling of cascades in interaction networks (Dr. Lindner). The combination of expertise would enable a fruitful supervision of the student assistants and provide a valuable variety of scientific approaches.

Collaboration

Describe how your research improves collaboration and cross-pollination between the disciplines involved (max. 300 words) **293/300 words**

The strength of the proposed collaboration is the shared interest in cascades and avalanches by the project supervisors and the combination of empirical expertise on social hypes of Dr. Hellsten and the expertise of mathematical modelling of collective dynamics of Dr. Lindner.

Iina Hellsten is an associate professor in communication networks at the department of Organization Sciences, Faculty of Social Sciences. She has recently lead two research projects in the field of organizational communication, as a principal investigator in the NWO Open Research Area project *Climate Change as a Complex Social Issue* (https://sites.google.com/site/climatechangeoraproject) in 2011-2014, and in the NWO-Aspasia project focusing on semantic networks in the case of financial crisis (2011-2016). Both projects focus on the dynamics of communication, and combine social and semantic networks. The central research question is how and why some public debates hype instead of others.

Ines Lindner is an associate professor in mathematical economics at the department of Econometrics and Operations Research. Her field of expertise is social and economic networks and game theory. In 2011 she was awarded the NWO MaGW grant *Cascade Dynamics on Interaction Networks* on the research field of collective dynamics. This project aims to improve existing models on mass mobilization by introducing preference contagion. This implies that individual actors influence the other's preferential attachment through their social network position. By including preference dynamics in models of collective action this new branch of research can explain sudden

outbreaks of collective action by synchronization effects based on mutual "charging". The central research question is the impact of the network architecture.

The Academy Assistant project will enhance collaborations between the two supervisors in exploring new ways for cascade / avalanche dynamics and provide a chance to explore the shared research interests with a pilot case study.

Deliverables
Enumerate intended project results: papers, research proposals or otherwise. (max 200 words) **172/200 words**

The project results in new insights into the dynamics and mechanisms of information cascades and social avalanches in online communication networks. The results will also enhance theory building on the three models of social contagion, social influence and social learning when applied to online communication networks. In particular, it will help to identify which of the driving forces of collective dynamics is at stake.
The results of the pilot study will enable the project leaders to develop follow-up research project applications together with the student assistants. In terms of output, the project will lead to 1-2 conference presentations, co-authored by the project supervisors and the two student assistants. The presentation(s) will be revised for an article submission after the project time frame.

The overall goal of the project is to use the pilot study results for working towards PhD project applications for the student assistants to be submitted to the NWO Research Talent subsidy scheme after the Academy Assistant project. The results of the pilot case study will strengthen the PhD applications.

Planning
Provide a breakdown of the project into phases with tentative timing (max 150 words) **149/150 words**

The project is divided into four subsequent phases:
Phase 1: The student assistants will read into literature on the three models (social contagion, social influence and social learning) as well as literature on social network analysis. This material will be provided by and discussed with the project supervisors (months 1-2).
Phase 2: The student assistants will be trained in using software tools for social and semantic network analysis, such as VosViewer and Gephi and identifying and measuring a hype on Twitter (months 3-5).
Phase 3: The project will conduct a pilot case study on testing the three models on hypes identified in phase 2 (months 6-9). The results of this phase will lead to a conference presentation that is co-authored by all team members.
Phase 4: The project will be completed by a reflection on the pilot case study and a planning for the Research Talent applications (month 10).

Please respect the word count limits: proposals that exceed the stated limits will not be eligible.