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Design of Small Multiples Matrix-based Visualisation to Understand E-mail Socio-organisational Relationships

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***Abstract*—One of the fundamental organisational questions is how organisations identify anomalies, monitor and compare E-mail communications between staff-staff or staff-clients or staff-customers relationships on a daily basis. The tenacious and substantial relationships are built by the combination of timely replies, frequent engagement and deep interaction between the individuals. To watchdog this periodically, we need an interactive visualisation tool that can help organisational analysts to re-connect some lost relationships and/or strengthen an existing relationship or in some cases identify inside persons. From our point of view, Social Intelligence (SI) in an organisation is a combination of self-, social- and organisational-awareness that will help in managing complex socio-organisational changes and can be interpreted in terms of socio-organisational communication efficacy (that is, one's confidence in one's ability to deal with social and organisational information). We considered a case study, an Enron E-mail Scandal, to understand the relationships of staff during various parts of the years and we conducted a workshop study with legal experts to gain insights on how they carry out investigation/analysis with respect to E-mail relationships. The outcomes of the workshop helped us develop a novel small multiples matrix-based visualisation in collaboration with the company, Red Sift UK to find anomalies, monitor and compare how email relationships changes over time and how it defines the meaning of socio-organisational communication efficacy.**

***Index Terms*—Email Communication; visualisation; social networks; anomaly detection; temporal features; D3;**

I. Small Multiples Matrix-based Visualisation

Though there are many social and professional networking sites such as Facebook, Twitter and LinkedIn, Organisational email communication is ubiquitous and is used in building business relationships and communication with partners and clients. Socio-organisational networking is rapidly evolving and profoundly changing the way people communicate and interact on a daily basis in an organisation setting. This helps in building a strong business by improving communication between globally dispersed partners, clients and customers, and even measuring scientific impact. Although organisations solely depend on email system for business communication and have formed their own communication networks, email systems and/or web interfaces do not provide effective visualisation to quickly understand relationships between staff-staff or staff-clients or staff-customers. Especially, considering Social Intelligence (SI) in an organisation which is a combination of self-, social- and organisational-awareness that will help in managing complex socio-organisational changes and can be interpreted in terms of socio-organisational communication efficacy (that is, one's confidence in one's ability to deal with social and organisational information) needs watchdogging. So, to find anomalies, monitor and compare various individuals relationships, and to explore characteristics of the socio-organisational communication have become more and more challenging due to inextricable communication with the clients or customers over time. There are few email visualisation tools developed to visualise relationships of staff in an organisation but most do not consider the issue of effectively exploring interpersonal relationships from a single staff perspective.

Small multiples matrix-based diagram are a matrix-based diagrams represented in a small-multiples form. In email communication analysis, individuals relationships changes very quickly over time, resulting in the need for dynamic graph visualisation supporting fast exploration of data. Dense graphs cannot be visualised quickly, especially using node-link diagrams. From the preliminary work, we use matrix-based diagram in small multiples form which facilitates the comparison of relationships/clusters/patterns over time. This helps in finding anomalies and monitoring the "growth of email communication between individuals".

Generally, an email organisation network (aka professional network) is a socio-organisational structure between individuals who are connected by a set of relationships, such as friendship, collaborations, co-working and etc. Based on the case study and the workshop outcomes for finding anomalies, monitoring and comparing individuals email relationships in an organisation over years and months, small multiples matrix-based diagrams were developed by collaborating with the company, Red Sift UK using D3 JavaScript library and Enron email archive to understand the growth of individuals email relationships such that it will help organisations to re-connect some lost relationships and/or strengthen an existing relationship or in some cases identify inside persons. As we know, Social Intelligence (SI) in an organisation can be interpreted in terms of socio-organisational communication efficacy and through our visualisation.

Fig. 1. Small Multiples Matrix-based Diagram representing Enron company's individuals email relationships