



COLLECTIVE INTELLIGENCE OF HUMAN CONVERSATIONAL TEXT

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Abstract: *Collective intelligence refers to the intelligence that emerges from local interactions among individual people. In the last few decades, web 2.0 technologies have enabled new forms of collective intelligence that allow massive numbers of loosely organized individuals to interact and create high quality intellectual artefacts. Our analysis reveals a set of research gaps in this area including the lack of focus on task oriented environments, the lack of sophisticated methods to analyse the impact of group interaction process on each other, as well as the lack of focus on the study of the impact of group interaction processes on participants over time.*

I. INTRODUCTION

Collective intelligence is shared or group intelligence that emerges from the collaboration, collective efforts, and competition of many individuals and appears in consensus decision making. The term appears in socio-biology, political science and in context of mass peer review and crowd sourcing applications. It may involve consensus, social capital and formalisms such as voting systems, social media and other means of quantifying mass activity. Collective IQ is a measure of collective intelligence, although it is often used interchangeably with the term collective intelligence. Collective intelligence has also been attributed to bacteria and animals

Web-enabled collective intelligence in solving platforms allows crowds to gather and contribute in solving the problems that may be difficult or impossible to solve by even the smartest individuals and fastest computers. Various analytical technique are developed to understand how intelligence emerges from within social interaction and to determine various micro and macro level factors that may positively or negatively influence the collective intelligence phenomenon.

II. LITERATURE REVIEW

A. Collective Intelligence in Humans

A keyword search was performed on the Web of Knowledge and selected papers were reviewed in

order to reveal themes relevant to collective intelligence. Three levels of abstraction were identified in discussion about the phenomenon: the micro-level, the macro-level and the level of emergence. Recurring themes in the literature were categorized under the abovementioned framework and directions for future research were identified.

The selection of literature for this review follows the approach of Zott et al. (2011). A keyword search was conducted on the Web of Knowledge on 7 July 2011 using the keywords, collective intelligence and swarm intelligence. The searches produced 405 and 646 results, respectively. In addition, all issues of the journals Swarm Intelligence and the International Journal of Swarm Intelligence were reviewed for suitable articles. A cursory analysis was performed by reading through the titles and abstracts. The following criteria were used to select the papers for review: 1) the paper discusses collective intelligence in human context; 2) the publication in which the paper is published is listed on the Web of Knowledge and 3) the paper makes a non-trivial contribution to the discussion about collective intelligence (i.e. it involves more than a couple of mentions of the term). The purpose was not to cover everything that has been written about the topic, but to review a representative sample of papers to gain a sufficient understanding of the relevant themes of collective intelligence on humans. The papers were read thoroughly and definitions of collective intelligence and related terms, themes discussed and the main contributions to collective intelligence research were identified. Similar definitions and themes were grouped together and the resulting categories were named as seemed appropriate. The grouping of themes and definitions revealed a pattern in the literature. The discussion about collective intelligence in humans appears to be divided into three levels of abstraction: micro-level, macro-level and level of emergence. The themes identified in the literature are grouped under the three levels of abstraction and examples of papers discussing these themes are given. Next, the characteristics of each level are discussed in more detail.



B. The micro-level: Enabling factors of human beings

At the micro-level, collective intelligence is a combination of psychological, cognitive and behavioural elements. Pentland (2007) argues that humans should firstly be viewed as social animals and only secondarily as individuals. According to his research with the so-called Socio scope, human behaviour is largely predictable, non-linguistic signal response behaviour. The immersion of self in a social network is a typical human condition and our unconscious ability to read and display social signals allows smooth coordination within the network. Pentland suggests that important parts of human intelligence could thus reside in network properties. This might just be the case, as Woolley et al. (2010) found evidence of the existence of a single dominant collective intelligence factor, and underlying group performance. In their experiments, c explained 30-40 % of group performance and was found to depend on the composition of the group (e.g. average intelligence) and emergent factors resulting from interaction of group members, such as conversational turn-taking. Furthermore, c is positively correlated with social sensitivity and the proportion of females in the group, but the influence of females is probably mediated by their better average social sensitivity (Woolley et al. 2010). Many open questions remain regarding the nature of c . Woodley and Bell (2011) suggest that c could actually be largely a manifestation of the General Factor of Personality (Just 2011) at a group level.

III. INTELLIGENCE MACHINES

Problem solving, reducing man's workload and cheaper labour have been the basic reasons why man thought of emulating human intelligence. We have had a certain fascination for inventing intelligent machines since the ancient Greek times. For instance, Greek myths of Hephaestus, the blacksmith who manufactured mechanical servants and the bronze man Talos incorporate the idea of intelligent robots. Till today, we have not been able to achieve a hundred percent artificially intelligent machine which can think and act like humans. In 1956, when John McCarthy coined the term, artificial intelligence, the ultimate objective of this technology was to replicate human-level intelligence, maybe a little more even but, years later the goals are very much the same. To be safe from the unknown, we have collective intelligence. It is a better real-life problem solving alternative. It is not a replacement of a human brain but can outsmart artificial intelligence if applied correctly. It has always been there in the form of families, countries etc. but identified as a concept recently making it relatively new and is more multidisciplinary in nature.

Artificial intelligence is a concept where we are hoping to develop almost a new species whose identity is separate in the universe. We are counting on our incomplete understanding on this subject. On other hand collective intelligence is already present among us. It is being manifested within us. And, relying on the human kind is far safer than depending on something which we are partially knowledgeable about. Also, not to forget, that creating human-life like machines will be going against nature which can be disastrous. In case of collective intelligence, we are simulating the patterns that nature already has provided us with.

IV. COLLECTIVE INTELLIGENCE AND SOCIAL COMPUTING

In recent years the rise of 2.0 applications and platforms, commonly known as "social software", has been promising to provide firms and organizations with new ways of communicating internally and externally. The main characteristics of these solutions are to improve information flows at many levels and between different actors. Its most credited potential lies in the support to team work and project management where people, by exchanging information and knowledge, can act – collectively – more intelligently than the sum of single individuals, producing what is referred to as *collective intelligence*. This emerging concept – as such still under definition – can be described according two different perspectives: at a conceptual level it is the intelligence emerging from the distance collaboration of a multitude of individuals based on on-line software systems and, at the IT level it is the bunch of user-centric applications often addressed as *social computing* that enhance an high degree of community formation and exchange of information. This research paper aims at defining a comprehensive framework of social computing and collective intelligence to draw a coherent and non-redundant picture of this rapidly growing domain. Through a multidisciplinary approach we identified different articles and journals in the fields of information systems, knowledge management, organization science and innovation management.

V. CONCLUSION

A sample of literature discussing the collective intelligence in humans was reviewed and the discovered themes were categorized into micro-level, macro-level and emergence-level phenomena. The framework is similar to the conceptual model of Luo et al. (2009), the gist of which is the question of how macro-level phenomena emerge from micro-level interactions. The framework proposed in this paper emerged from data collected from contemporary literature. Therefore, it is arguable that the scientific community has already implicitly divided collective intelligence to the aforementioned three levels of abstraction. Making this



division explicit hopefully brings some structure to the discussion and helps in fitting the pieces of the puzzle together. The categorization of themes related to collective intelligence provides guidance for selecting topics for further literature reviews and suggests how the results might fit into the big picture of collective intelligence in humans.

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