Review of: "Collaborative Intelligence: A scoping review of current applications"

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Could (and should) we build "collaborative intelligence" with Artificial Agents? A social psychological perspective. A comment to Schleiger et al. (2023) review.

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"Collaborative intelligence" is more than "collaborative capability"

Schleiger's et al. (2023) review tries to assess if Artificial Intelligence (A.I.) can share with humans the relevant methods of "collaborative intelligence" used in real life. Both using virtual reality or cyber-physical form, the applications derived from A.I. should have the capacity of actively cooperating to improve the common performance, sharing aims and outcomes, and entertaining interactions useful for the task. Complementarity and dynamic interaction is required, beyond a simple division of work or a static transactional relationship.

Several different types of agents were involved in the 16 applications reviewed. The fields were: creative, industrial, healthcare, emergency services and knowledge work.

A general conclusion of the review is that working with "collaborative intelligence" applications improved both efficiency and creativity of human problem-solving. Authors "infer that it is technologically feasible to combine a variety of human and AI capabilities and thereby achieve benefits in terms of efficiency, quality, creativity, safety, and human enjoyment" (Schleiger et al., 2023, p.13).

I agree with the Authors that "collaborative intelligence" applications must be differentiated from AI applications with "collaborative capability". Also when using SIRI or a navigator, cooperation between human and artificial agents happens, and obtains outcomes useful for the shared aim: to solve a problem, to find the best way toward the goal. Surely, this capability can be more and more refined and efficient. But from a theoretical perspective the issue addressed in the review is more general than the Authors consider, involving some psycho-social features to consider specifically.

Collaborative intelligence requires synchronic communication

Applications based on A.I. can support, implement, and enhance human intelligence, but real collaborative intelligence requires continuously shared cognitive activities and contents - as in a dyad or group of persons searching for solutions to

a common problem. Therefore, collaborative intelligence need to develop reciprocal (not only instrumental) and synchronic (not only sequential) communication.

The communication should regard aims, methods to reach them, instruments of assessment “in itinere” and criteria of outcome realizing the common goals. This reciprocal (and continuous) communication is different from what happens when the human asks for a solution and the artificial agent gives it or supplies the technical means to reach it, improving creativity, linguistic production, health-related decisions, and so on. Instead, collaborative intelligence – i.e., a new knowledge built together - requires synchronic exchanges: is this met by the reciprocal, iterative, fast, but always sequential, feedback used in the collaborative actions presented in the review?

Collaborative intelligence requires shared motivation

During the cooperation, it is needed to contrast pre-judicial motivations, or the tendency to delegate relevant parts of the work. Otherwise, no true collaborative intelligence is realized. Schleiger et al., (2023, pp. 8-9) say that using *ARMAR-6* “humans can concentrate on the ‘skilled’ part of a job whilst the robot takes on heavy lifting and support roles”; *Bionicworkplace* supports workers “to carry out manufacturing tasks more efficiently, relieving them of tiring or hazardous tasks”.

The purpose of artificial applications remains to help humans realize their motivations, not question or change them (what is called "executive intelligence"). The devices presented in the review do not appear to be designed to change own and humans’ motivation during cooperative work. It does not seem that they can go beyond pre-programmed instrumentality to acquire true collaborative intelligence.

Collaborative intelligence requires adaptive emotions

Human intelligence include not only cognitive domains (e.g., perception, memory, language) but also emotions (fear, anxiety, stress, anger, etc.). “Emotional Intelligence” and “Affective Neuroscience” (Panksepp, 1998) are widely affirmed and represent the basis for recent A.I. applications.

In particular, work is not always a rational activity in which emotion must be repressed to improve efficiency: “emotions are a prominent feature of work” (Riforgiate & Komarova, 2017). Amicality, positive affectivity, assertiveness overcoming aggressiveness, are personality traits requisite to co-work at best (Fineman, 2003).

How the A.I. agent reacts to the wrong behaviors of the human coworker? Or to improper or excessive delegation? If no emotional response is provided, we cannot speak of true collaborative intelligence. We have a human intelligence that uses for its goals an “intelligent” technology capable of cooperative support - which has been happening since the origins of technological support to human life, and is still very useful today.

These social psychological features should be further considered in reviewing the applications of collaborative intelligence, both in virtual and real contexts.

Collaborative intelligence requires beliefs and values for sharing social content

Another aspect should be considered: the recognition of the basic mechanisms shared by the human and artificial coworkers, i.e. the neural networks common to the human brain and artificial connections, useful for cooperative understanding and behavior.

Connectomics developed methods to describe structural and functional neural connectivity, with which neurosciences explain dynamic models of cognitive and affective processes. Brain connectivity is formed by genetics and social development processes; thanks to neuroplasticity it is shaped by life experiences, learning processes, social interactions, and culture (Sporns & Betzel, 2016).

In this sense, from a neuroscientific point of view, beliefs are also defined as the neural product of the perception of objects and events in the external world. They are the product of brain processes that attribute affective meaning to concrete objects and events and of an internal affective state, reflecting personal and collective symbolic meaning (Seitz, Paloutzian, & Angel, 2018).

Thus it is possible that the individual brain re-elaborates cultural contents in a personal way and offers them to semantic, symbolic, and existential interpretations to be shared in turn with the other people of the social group, creating a collective construction of socially active content. Should these models be used to build a true collaborative intelligence among humans and post-human agents and societies?

Some doubts and a wish

Artificial intelligence, to be truly “collaborative intelligence”, should reflect the social-psychological processes reported above, including in the collaboration not only instrumental features but human-like synchronous communication, autonomous motivation, adaptive emotions, shared social beliefs and values.

I doubt that the agents and applications mentioned in the review have these characteristics - which we can find in various movies and literary fictions about intelligent agents and Cyborgs, with the relative risks of being “more intelligent than humans” and therefore dangerous for them.

I doubt that the applications of the A.I., to be useful for humanity, could (and should?) go beyond the “collaborative capability” to exactly reproduce the forms and methods of “collaborative intelligence” in the sense above described. Humans can augment and extend their productive and creative abilities cooperating with intelligent coworkers, without further steps toward obtaining artificial partners too much human-like but not adequately controlled in their “superintelligence” (Bostrom, 2014), or unacceptable to most humans due to the well-known “uncanny valley” phenomenon (Mori, MacDorman, & Kageki, 2012).

I wish an A.I. really collaborative, acceptable, and not potentially dangerous, but surely useful for the future of humanity, as in my opinion are the devices presented in the review, although not definable as true hybrid “collaborative intelligence”. They - as Schleiger et al. (2023, p. 14) conclude quoting Nahavandi (2019) – “can catalyze a new wave of innovation that enables more efficient, safer, sustainable and enjoyable work and lives”.

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