A scientific study characterises our circles of friendships

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People walking through a square with circles around them. Credit: UC3M

On average, there are three to five people in our lives with whom we have a very close relationship (close friends and/or family), around ten with whom we have close friendships, a larger group of about 30-35 people with whom we frequently interact and around one hundred acquaintances we come into contact with every now and then in our daily

lives. In other words, we interact on a regular basis with about 150 people. This number is known as the "Dunbar number" and it indicates the amount of friends that our brain can handle, according to the theory formulated in the 1990's by Robin Dunbar, a professor of anthropology at Oxford University, who also participates in this new scientific study.

"What our theory predicts and what we have now been able to ascertain is that people with a high cognitive capacity could potentially expand their circle of intimate friendships", explains Anxo Sánchez, a professor in UC3M's Department of Mathematics and one of the authors of the study published in *PNAS*. This also happens in small communities, where there are fewer people available with whom to establish a relationship, leading to the broadening of the circle of close friendships among the people available: "It is the first time, as far as we know, that a purely mathematical theory, based on a basic physical principle (that of maximum entropy), predicts a social phenomenon or structure which is subsequently found in the data", says Anxo Sánchez.

Something similar happens in reverse, according to the researchers. "It is impossible to have relationships with 150 people and for them all to be intimate. Therefore, if one has a large number of relationships, it must mean that they are almost all superficial", says another of the authors of the study, Ignacio Tamarit, from UC3M's Interdisciplinary Group of Complex Systems, who is preparing his doctoral thesis on this subject.

When they began the study, carried out with the support of the BBVA Foundation's Programme of Grants to Scientific Research Teams in the area of Digital Society and Economics, the researchers started with the hypothesis that human relationships involve a different degree of effort depending on their emotional intensity and that our ability to manage them is limited. Using standard techniques from statistical physics, they calculated the organisation in circles of friendship and uncovered the possibility of inverted regimes (that in small communities where there

are fewer relationships, their intensity is greater). In order to verify this, data from communities of immigrants which were quite isolated—provided by an anthropologist from the Autonomous University of Barcelona, ??José Luis Molina—were used. After applying the theoretical model, they found the evidence they were looking for: "Our model explains the emergence of the structure in the organisation of personal networks", says another of the researchers, José Cuesta, a professor in UC3M's Department of Mathematics.

More information: Ignacio Tamarit el al., "Cognitive resource allocation determines the organization of personal networks," *PNAS* (2018). www.pnas.org/cgi/doi/10.1073/pnas.1719233115

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