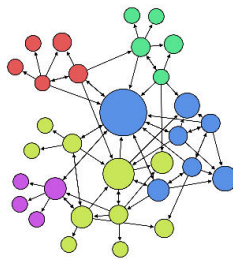Universitat de les
Illes Balears

The Evolutionary dimension of Trust and its effects on cooperation

PhD DISSERTATION

2014

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La presente tesis doctoral se presenta de conformidad con la autora y su director, y para que así conste firman a continuación:

Fdo. Cristina Acedo Carmona   Fdo. Dr. Antoni Gomila Benejam

(Doctoranda)   (Director de tesis)

A mi madre, Francisca Carmona
Perea, y a los ángeles de mi vida: mi padre,
Antonio Acedo Cordero y mi hermana,
Paqui Acedo Carmona, que me acompañan
siempre.

List of Abbreviations in alphabetical order

C: cooperate

D: defect

EH: the Ecological Hypothesis

H1: Hypothesis 1

H2: Hypothesis 2

H3: Hypothesis 3

IPD: iterated prisoner's dilema

NGHA: Northern Ghana

NTC: non-trusting condition

OAX: Oaxaca

PHYSIO: Physiotherapy

PSYCHO: Psychology

P1: participant 1

P2: participant 2

SBH: the Social Brain Hypothesis

TC: trusting condition

UCAM: University of Cambridge

UIB: University of the Balearic Islands

PUBLICATIONS RELATED TO THIS THESIS

Published papers

TITLE: Trust, social capital and the evolution of human sociality.

AUTHORS: Cristina Acedo Carmona, Antoni Gomila Benejam

PARTICIPATION TYPE: Oral presentation in International Conference.

CONFERENCE: *The Asian Conference on Psychology and the Behavioral Sciences 2012*.

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AUTHORS: Cristina Acedo Carmona, Antoni Gomila Benejam

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AUTHORS: Cristina Acedo Carmona, Antoni Gomila Benejam

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Papers under review

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RESUMEN (CASTELLANO)

La vida social humana se sustenta en la cooperación de una forma diferente respecto a otras especies. Sin embargo, siguen sin explicación muchas cuestiones acerca de la evolución de la cooperación. En este trabajo de tesis se analizan la cooperación destacando su relación intrínseca con las relaciones de confianza. ¿Por qué cooperamos? ¿Cuál es la influencia de la confianza en la cooperación y qué papel juega la historia evolutiva en este puzle? Considerando las formas sociales adoptadas por nuestros antepasados humanos es posible pensar en ciertos rasgos cognitivos y psicológicos relevantes para entender las relaciones actuales de cooperación. El objetivo es, en definitiva, identificar los mecanismos sociales adoptados evolutivamente para explicar comportamientos cooperativos que existen en la actualidad.

Esta tesis se basa primero en la relación que existe entre la evolución de la socialidad y la cognición humanas, como hipótesis de partida a contrastar posteriormente. Desde esta perspectiva y, utilizando una metodología multidisciplinar procedente de disciplinas como la Sociología, Psicología y Antropología, se diseña un plan de investigación que trata de profundizar en mayor medida en dichos temas.

Se parte inicialmente de una revisión crítica sobre estudios que tratan de relacionar el comportamiento social en primates y la evolución del neocórtex –la Hipótesis del Cerebro Social de Dunbar. Resulta evidente la necesidad de utilizar un enfoque más matizado para explicar la enorme complejidad de las relaciones sociales humanas. Para ello, ofrece un enorme interés el análisis de la influencia del mecanismo psicológico de la confianza. No obstante, los estudios de Dunbar son continuamente revisados a lo largo de todo este trabajo.

A continuación se crea un marco teórico sobre los factores que influyen en la confianza y su posible configuración en un entorno evolutivo. En base a él, se diseña el posterior trabajo empírico, siempre teniendo en cuenta la hipótesis de que el ser humano tiene un comportamiento social ampliamente influido por un contexto de relaciones dentro de los pequeños grupos en los que ha convivido durante la mayor parte de su historia evolutiva.

El plan empírico consta del diseño de cuestionarios originales para medir el nivel de confianza general y personal en un grupo. Además se usa un juego experimental –dilema del prisionero con algunas variantes– en condiciones de confianza y de no confianza. El estudio piloto se realiza en dos grupos diferentes. Los resultados muestran ya la influencia de las relaciones cercanas de confianza personal en la cooperación.

El siguiente trabajo empírico realizado con distintos grupos confirma lo anterior y cómo la cooperación se relaciona en buena medida con un compromiso afectivo implícito inconscientemente de reciprocidad que proviene de la psicología de la confianza personal, como elemento adaptativo hacia una cooperación más exitosa, incluso en condiciones de anonimato y pese al propio perjuicio a corto plazo. Se incluye

un análisis en profundidad de las redes de confianza para constatar la importancia que ciertas topologías de redes de confianza pueden tener en la cohesión general de un grupo.

En la última parte de la tesis se utiliza una perspectiva más antropológica, mediante la realización de trabajo de campo. Además de la observación, se utilizan entrevistas y redes personales de cooperación en dos zonas caracterizadas por su gran diversidad étnica: norte de Ghana y Oaxaca, en México.

Se concluye la eficacia de la diversificación étnica como forma de crear grupos más resistentes a la hora de enfrentarse a entornos difíciles. El mecanismo de la psicología de la confianza personal, basado en grupos más pequeños y en factores emocionales, se constata tanto a nivel individual como colectivo, extendiéndose a grupos más grandes mediante determinados recursos culturales.

RESUMEN DIVULGATIVO (CASTELLANO)

La vida social humana se sustenta en la cooperación de una forma diferente respecto a otras especies. Los científicos han indagado en la cooperación humana desde distintos puntos de vista pero aún quedan sin explicación muchas cuestiones acerca de la evolución de la cooperación. En este trabajo de tesis se analizan las relaciones cooperativas destacando su relación intrínseca con las relaciones de confianza. ¿Por qué cooperamos? ¿Cuál es la influencia de la confianza en la cooperación y qué papel juega la historia evolutiva en este puzle? Tomando en consideración las formas sociales adoptadas por nuestros antepasados humanos es posible pensar en ciertos rasgos cognitivos y psicológicos específicos relevantes para entender las relaciones actuales de cooperación y, en un sentido más amplio, las relaciones sociales. El objetivo es, en definitiva, enmarcar las relaciones sociales humanas en un entorno evolutivo para explicar comportamientos sociales que existen en la actualidad.

Esta tesis trata de responder a estas cuestiones basándose primero en la relación que existe entre la evolución de la socialidad y la cognición humanas, como hipótesis de partida a contrastar en estudios posteriores. Desde esta perspectiva y, utilizando una metodología multidisciplinar procedente de disciplinas tales como la Sociología, Psicología y Antropología, se diseña un plan de investigación que trata de profundizar en mayor medida en dichos temas.

El trabajo de tesis parte inicialmente de una revisión crítica sobre estudios que tratan de relacionar el comportamiento social en primates y la evolución del neocórtex – la Hipótesis del Cerebro Social de Dunbar. Resulta evidente la necesidad de utilizar un enfoque más matizado para explicar la enorme complejidad de las relaciones sociales humanas. Para ello, ofrece un enorme interés el análisis de la influencia del mecanismo psicológico de la confianza. No obstante, los estudios de Dunbar, especialmente aquellos relacionados con las características propias de los grupos sociales humanos en relación a la capacidad cognitiva, son continuamente revisados a lo largo de todo este trabajo.

A esta revisión le sigue la creación de un marco teórico sobre los factores que influyen en la confianza y su posible configuración en un entorno evolutivo. Sobre la base del marco teórico, se diseña el posterior trabajo empírico, siempre teniendo en cuenta la hipótesis de que el ser humano tiene un comportamiento social ampliamente influenciado por un contexto de relaciones dentro de los pequeños grupos en los que ha convivido durante la mayor parte de su historia evolutiva.

Sobre la base teórica anterior se realizan los trabajos empíricos siguientes. Estos estudios empíricos siguen un plan que consta del diseño original de cuestionarios para medir el nivel de confianza general y personal en un grupo. Además se usa un juego experimental –dilema del prisionero con algunas variantes– en condiciones de confianza y de no confianza.

El estudio piloto se lleva a cabo inicialmente en dos grupos diferentes. Los resultados muestran ya la influencia de las relaciones cercanas de confianza personal en la cooperación.

En un trabajo posterior con otros grupos más numerosos se confirma lo anterior y cómo la cooperación se relaciona en buena medida con un compromiso afectivo implícito inconscientemente de reciprocidad que proviene de la psicología de la confianza personal, como elemento adaptativo hacia una cooperación más exitosa, incluso en condiciones de anonimato y pese a causar un perjuicio propio a corto plazo. Además, el estudio incluye un análisis en profundidad de las redes de confianza de estos grupos para constatar la importancia que ciertas topologías de redes de confianza pueden tener en la cohesión general de un grupo.

En la última parte de la tesis se utiliza una perspectiva más antropológica, mediante el trabajo de campo. Para ello, se utilizan entrevistas y redes personales de cooperación en dos zonas caracterizadas por su gran diversidad étnica: norte de Ghana y Oaxaca, en México.

En el trabajo de Ghana se observa la eficacia de la diversificación étnica para crear pequeños grupos más resistentes a la hora de enfrentarse a entornos difíciles. De este modo, la cultura provee de los mecanismos necesarios para crear fuertes lazos de cohesión basados en elementos emocionales –los mecanismos más primitivos en el ser humano. Se constata así la relevancia de tener en cuenta la configuración de la psicología y cognición social humanas a partir de los contactos más cercanos. En general, los seres humanos se mueven continuamente en relaciones grupales pequeñas a pesar de asentarse en la actualidad en grandes sociedades. A medida que los entornos resultan más difíciles aparece una mayor diversificación de los grupos.

De la comparación de los resultados de Ghana y México, se profundiza en cómo, pese a la universalidad de la existencia del pequeño grupo de confianza y cooperación, el contexto histórico y cultural, y la diferente situación económica de los grupos modela la intensidad de las relaciones de cooperación y confianza.

RESUM DIVULGATIU (CATALÁ)

La vida social humana es basa en la cooperació i la confiança d'una manera diferent de la d'altres espècies. Els científics han investigat la cooperació humana des de diferents punts de vista, però encara hi ha moltes preguntes sobre l'evolució de la cooperació sense explicació. Aquest treball de tesi analitza les relacions cooperatives emfasitzant la seva relació intrínseca amb relacions de confiança. Per què cooperem? Quina és la influència de la confiança en la cooperació i el paper de la història evolutiva en aquest trencaclosques? Tenint en compte les formes socials preses pels avantpassats humans, és possible pensar en certs trets cognitius i psicològics específics que podrien tenir una importància clau per entendre les actuals relacions de cooperació i, en un sentit més ampli, les relacions socials. L'objectiu de la tesi és, en definitiva, emmarcar les relacions socials en un entorn evolutiu per explicar els comportaments socials que existeixen avui en dia.

Aquesta tesi tracta de respondre aquestes preguntes, a partir de la relació entre l'evolució de la sociabilitat i la cognició humà, com hipòtesi inicial per contrastar els estudis posteriors. Des d'aquesta perspectiva i utilitzant una metodologia multidisciplinària de la Psicologia, Antropologia i Sociologia, es va dissenyar un pla de recerca que pretén aprofundir en aquests temes.

Amb aquest objectiu en ment, el treball de tesi es basa inicialment en una revisió crítica d'estudis anteriors que intenten relacionar el comportament social dels primats i l'evolució del neocòrtex –la Hipòtesi del Cervell Social de Dunbar. Aquesta revisió mostra clarament la necessitat d'un enfocament més matisat per explicar aquesta relació a causa de l'enorme complexitat de les relacions socials humanes. Per això, l'estudi de la influència del mecanisme psicològic de la confiança ofereix un interès enorme. No obstant això, els estudis de Dunbar, especialment aquells relacionats amb les característiques dels grups socials humans en relació amb la seva capacitat cognitiva, són contínuament tinguts en compte al llarg de tot aquest treball.

Així, després d'aquesta revisió es proposa un marc teòric sobre els factors que influeixen en la confiança i la seva possible configuració en un entorn evolutiu. En base a aquest marc teòric, es dissenyen els treballs empírics posteriors, sempre tenint en compte la hipòtesi que l'ésser humà té un comportament social àmpliament influenciat per un context de relacions dintre de petits grups. Aquest és el context social en que han viscut els humans durant la major part de la seva història evolutiva.

El marc teòric explica els elements que conformen la confiança, la tipologia i la seva possible configuració al llarg de la història evolutiva. Constitueix el substrat utilitzat per dur a terme l'anàlisi de la confiança i del comportament cooperatiu en els següents treballs empírics. Aquests estudis empírics segueixen un pla basat en un disseny propi, procedent de la revisió de la literatura, amb qüestionaris per mesurar el nivell de confiança personal i general en un grup. També s'utilitza un joc experimental – el dilema del presoner amb algunes variacions– que demostra el comportament

cooperatiu real dels individus. El joc es realitza en condicions de confiança i sense confiança entre els membres d'un mateix grup.

L'estudi pilot inicial es realitza en dos grups diferents. Els resultats ja mostren la influència de les relacions estretes de confiança personal en la cooperació. No obstant això, un treball posterior, amb altres grups més grans, confirma com algunes formes d'altruisme social, la explicació del qual ha estat controvertida, es relaciona en gran mesura amb el compromís afectiu inconscient de la confiança personal, que promou la reciprocitat amb certs individus, com un element adaptatiu cap a una cooperació més efectiva i recíproca. A més, l'estudi inclou una anàlisi en profunditat de les xarxes de confiança d'aquests grups per determinar la importància que poden tenir certes topologies de xarxes de confiança en la cohesió general d'un grup.

En la darrera part de la tesi, s'utilitza una perspectiva més antropològica per mostrar a través d'un estudi de camp, exemples del comportament social dels diferents grups culturals, en relació amb les seves actituds de confiança i cooperació. Per fer-ho, es utilitzen entrevistes i xarxes personals de cooperació en dues zones caracteritzades per la seva gran diversitat ètnica: algunes regions del nord de Ghana i alguns llocs d' Oaxaca, a Mèxic.

En concret, el treball sobre Ghana mostra l'eficàcia de la diversificació ètnica per crear petits grups més resistents quan s'enfronten amb entorns difícils. Així, la cultura proporciona els mecanismes necessaris per a crear uns vincles molt forts de cohesió basats en elements emocionals –els mecanismes més primitius en humans. Així s'observa la importància de tenir en compte la configuració de la psicologia i la cognició social humana des dels contactes més propers. En general, els éssers humans es mouen contínuament en relacions grupals petites fins i tot en el cas de les grans societats actuals. La conclusió de l'estudi mostra que en els entorns més difícils apareix una major diversificació dels grups.

La comparació dels resultats de Ghana i Mèxic, permet aprofundir en la universalitat de l'existència del petit grup de confiança i cooperació i en el paper modulador del context històric i cultural. De la mateixa manera, la diferent situació econòmica dels grups modela també la intensitat de les relacions de cooperació i confiança.

ABSTRACT (ENGLISH)

Human social life is sustained by cooperation and trust in a distinctive way respect to other species. Scientists have investigated human cooperation from different points of view but many questions about the evolution of cooperation remain without explanation. In this dissertation the cooperative relationships are analyzed emphasizing its intrinsic link with trust relationships. Why do we cooperate? What is the influence of trust on cooperation and which role does human evolutionary history play in this puzzle? Considering the social forms our ancestors lived by, it is possible to think in certain cognitive and psychological traits that might have a key importance in order to understand the relationships of cooperation nowadays and, in a wider sense, the social relationships it made possible. The goal is, in short, framing social relationships in an evolutionary framework in order to explain the social behaviors of nowadays.

This work attempts to answer these questions firstly on the basis of the relation between the evolution of human sociality and cognition, as a hypothesis to be tested in the following studies. From this perspective and, using a multidisciplinary methodology including Sociology, Psychology and Anthropology, a research plan was designed in order to further examine these topics.

With this goal in mind, this dissertation starts with a critical review of some previous studies that relate the social behavior in primates to the evolution of the neocortex –Dunbar's Social Brain Hypothesis. This review shows the need for a more nuanced approach in order to explain this dependence because of the enormous complexity of human social relationships. To achieve this goal, the analysis of the psychological mechanism of trust offers a huge interest. However, Dunbar's studies, especially those that relate human social groups to cognitive ability, are continuously in the background throughout all this work.

Next, a theoretical framework is introduced on the factors that influence trust and their possible configuration in an evolutionary environment. On the basis of this theoretical framework the subsequent empirical work is designed, always keeping in mind the assumption that humans have a social behavior widely influenced by a context of relationships within small groups. They are the social configuration humans have lived most of their evolutionary history.

In the theoretical framework the elements that make up trust, its typology and its possible configuration in the evolutionary history are explained. This work is the substrate used to advance in the analysis of trust and cooperative behavior carried out in the following empirical works. These empirical studies follow an original plan, grounded in a literature review, which involves the development of new questionnaires to measure the level of general and personal trust in a group. In addition, an experimental game –a prisoner's dilemma with some variants– is included in order to show the effective cooperative behavior of participants. The game is played in conditions of trust and non-trust among the members of the group.

The pilot study is initially conducted in two different groups. The results already show the influence of close relationships of personal trust in cooperation. However, the next work with larger groups confirms that social altruism, whose explanation is still controversial, is largely related to an unconscious affective commitment coming from personal trust, which promotes reciprocity with certain individuals, as an adaptive behavior. Furthermore, the study includes an in depth analysis of the trust networks of these groups in order to test the importance that certain trust networks topologies might have in promoting a group general cohesion.

In the last part of the dissertation, a more anthropological perspective is included. Field work is carried out to study examples of social behavior of different cultural groups, in relation to their attitudes of trust and cooperation. Interviews and personal networks of cooperation are the methodologies used. The two areas are characterized by a great ethnic diversity: some Northern regions of Ghana and some places of Oaxaca, in Mexico.

Specifically, the work of Ghana shows the effectiveness of ethnic diversification to create small groups because they are more effective to deal with difficult environments. Thus, culture provides the necessary mechanisms to create strong bonds of cohesion based on emotional elements –the most primitive mechanisms in humans. In sum, the importance of taking into account the configuration of the human social psychology and cognition from the closest contacts is highlighted. In general, humans move continuously in relationships within small groups, and this social configuration is at work even in the current settlements in large societies. The conclusion is that in more difficult contexts a greater group diversification will appear.

The comparison of the Ghana and Mexico results allows to deepen in how, despite the universality of small groups of trust and cooperation, the historical and cultural contexts and the different economic situation of groups modulates the intensity of those relationships.

Introduction

In this chapter the ideas that served as inspiration for the content of the dissertation are reviewed. Also the goals and the methodology are introduced. Finally, the structure of the chapters and a summary of them are offered.

1. <u>Motivation</u>

The motivation for this dissertation comes from the interest in exploring the relationship between the brain evolution –at the cognitive and psychological levels– and the evolution of human sociality. The social dimension is the key to how the human brain works. Many mental mechanisms are closely related to social activity, specific cognitive skills make sense to handle complex information about the others' activity such as a high level of empathy, a theory of mind, etc.

Likewise, humans show a complexity in the social lives that stands out from other species and it is closely in line with some traits present in very early aged humans such as imitative predispositions, synchronization, impulses to help others, pro-social attitudes to others and moral values –in a regulatory and ethical sense. The development of language, so prominent in humans, and their conspicuous attitude and aptitude for learning, are also framed in a very developed social context.

Humans need of close relationships for its survival, both in early stages of their individual development as in their maturity to face to different environments. Emotional relationships linked to other individuals are part of the essence of its way of life from birth.

In short, humans are definitely social, in a broad sense of the term. The strong human sociality has become our specialization to the point of constituting the great "maker" of our species with an infinity of cultural forms. At the end, cultural forms are the maximum expressions that come from the complex social interactions.

However, such sociality remains firmly linked to traits acquired during the evolutionary history of the species. The hypothesis that this work aims to demonstrate is

that such evolutionary social features persist in the different social relationships of current societies. The tasks then become one of identifying such past traces and show its adaptive efficiency. At the same time, this analysis permits a better understanding of the mechanisms underlying the groups' cohesion that constitute the pillars of the macro-societies of the present.

In this sense, this dissertation singles out trust as one of the mechanisms of human social psychology where these traces of the past are clearly visible. The analysis of how trust works and its results in natural environments and experimental contexts, that this dissertation contributes, serve as evidences of the connection between evolution, sociality and cognition.

Although these are the motivations for the content, another main motivation is to apply a multidisciplinary approach, which is of great interest for the advancement of science. In this way, along the work methodologies from Sociology and Social Psychology –analysis of networks and questionnaires–, Experimental Economics –games theory– and Anthropology –field work with different cultural groups–, will be used, without losing in any case the evolutionary perspective. The combination of this multiple perspective allows expanding the analysis and contrast additional data in order to increase knowledge and get conclusions that would be difficult to obtain using separately each of these disciplines.

2. <u>Research objectives</u>

The main research objectives are:

- Learn about the mechanisms that underlie trust relationships, how they work and what kind of trust relationships are the most effective to ensure cooperation.
- Identify how trust affects cooperation within groups, both creating relationships with certain individuals and promoting cohesion within a group.
- Identify indicators for a possible measurement of the trust levels.
- Identify possible topologies especially effective of trust networks in order to increase the levels of cooperation and cohesion of the group.
- Determine to what extent such trust-based mechanisms are effective to ensure the individuals' survival.

- Show how the most powerful way of trust arises from the closest social interactions, accompanied by an unconscious emotional load especially needed to overcome the most difficult situations.

- Define which elements of trust underlying any society –universal elements modelled during evolution– and which cultural aspects influence trust.

- Provide an explanation for some forms of social altruism widely observed in human behavior in terms of its adaptive role.

- Understand the structures and social dynamics of the human societies and their relation with the forms of sociality acquired during evolution.

3. <u>Dissertation structure</u>

The work is structured according to the design of a comprehensive plan of research that combines the different above-mentioned methodologies. The content of the different chapters that make up the study, some published and others in process of publication, is included below in its original written language. Their order of appearance follows an analysis of the trust and the cooperation from a micro to a macro perspective: a theoretical framework, an analysis at the individual level, empirical studies at the group level, an analysis within the social and cultural structures that coexist in a common environment, and a comparison between these structures in different contexts. Thus, the structure of the thesis is configured as follows:

Section 1: state of the art and theoretical framework –chapter 2 and 3.

This section is composed by two works: one of them tries to show the interest of adopting the approach followed by this dissertation –chapter 2–, and the other one reviewing the relevant questions considered in the trust analysis in order to be used as a theoretical framework in the next studies –chapter 3. At the same time, both works offer a general view on the state of the art.

- Chapter 2 offers a critical review of Dunbar's Social Brain Hypothesis –a relevant theoretical perspective that relates cognitive capacities with social activity–, from its different approaches: comparison between species and paleo-anthropological and social explanations. The chapter criticizes the simplicity of

Dunbar's explanations of the complexity of the existing social configurations. The need for a trust perspective and a more anthropological insight into the analysis of the relation between sociality and cognition is claimed, especially in humans. However, the Dunbar's studies regarding human sociality and its cognitive limitations are continuously contrasted in the next works contained in this dissertation.

- Chapter 3 summarizes the different aspects implicit in trust relationships – cognitive, emotional, psychological and cultural aspects. Furthermore, a typology of trust is proposed –general, personal, institutional, identity, contextual, weighted and strategic type of trust-, explaining each one of them. Also the trust dynamics are analyzed: its creation, maintenance and its obstacles. Finally, an evolutionary framework in which these types of trust might have aroused is proposed. This review serves as a guide in the configuration of the indicators included in the subsequent questionnaires to measure trust and those used in the fieldwork observation.

Section 2: experimental games and analysis of networks –chapter 4 and 5.

In this section the two empirical studies carried out in experimental contexts are presented. The first one is a pilot study –chapter 4– and it is followed by the second one, which use more people, more appropriate groups, and a deeper analysis in order to confirm the previous results and add more information –chapter 5.

- Chapter 4 shows an empirical pilot study, which uses a combined design of questionnaires –in order to measure the levels of personal and general trust– and an experimental game –prisoner's dilemma– in order to test the participants' cooperative behavior. These participants belong to a same group. General trust refers to the attitude toward strangers and personal trust comes from the previous positive experiences with known people. The experimental game is repeated with each participant in two conditions –played with members of his trust circle in the group or with any other group member. This work compares the same study made in two different groups and relates the trust levels with the

decisions taken at time to cooperate. The study also includes a first approach to the trust networks analysis.

- Chapter 5 is the continuation of the previous empirical study. The previously used tools are improved and the groups are identified with more mature trust relationships and a greater number of individuals. This study confirms the trend, shown in the previous study that individuals cooperate to a greater extent with those people that belong to their closest trust circle, even in situations of anonymity. A greater influence of personal trust than general trust on cooperation is clearly proved. A trust networks analysis is also carried out and a relation between certain networks topologies, certain levels of personal trust and the overall cooperation within the group, even among group members that do not belong to the same circle of trust is identified.

Section 3: Fieldwork –chapters 6 and 7.

In this third part, fieldwork is reported to test the prediction that the role of personal trust, identified in the previous part, can be found at the collective level. Once it is showed the superior influence of personal trust in fostering cooperative behaviors, and the role of the network topologies in modulating such influence, now it is the time to see whether personal trust also plays the same role in natural human societies.

To achieve this goal, this section introduces a change in the methodology. A more anthropological approach, that covers global perspectives of the historical, economic and social contexts, with observation, interviews, personal networks and cross-cultural analysis, is used. The fieldwork is carried out in two areas: the first work shows the results obtained in Ghana –chapter 6– and the second one is the comparison of Ghana and Mexico fieldwork –chapter 7.

- Chapter 6 contains the first field work carried out in some regions of Northern Ghana. The chapter shows the networks of trust and cooperation using this more anthropological methodology. This chapter does not include numerical data, which will be included in subsequent works. It uses a more narrative structure, according with the anthropological methodology. However the text explains the main results obtained. Basically, it notes the real existence in the field of small

networks of trust and cooperation and deepens in the universal and cultural mechanisms that affect trust relationships. The work shows how culture is put at the service of group cohesion, using the previously mentioned emotionality and proximity to ensure mutual support in difficult situations of survival.

- Finally, Chapter 7 shows the comparison between the networks of trust and cooperation in two territories characterized by a great ethnic diversity: the Northern Ghana and Oaxaca (México). In Oaxaca, the same methodology of collecting data than in the previous work of Northern Ghana is applied. The comparison between both areas confirms the universal features of trust and cooperation, and again shows the modulation of these networks with respect to the needs of the environment. The groups that live in harder environments – Northern Ghana– show cultural mechanisms that reinforce and extend its relations of trust and cooperation, while in Oaxaca norm enforcing by the authorities of the group is prevalent.

Section 1: State of the art and theoretical framework

A critical review of Dunbar's Social Brain Hypothesis

Dunbar's Social Brain Hypothesis constitutes an influential position among those that relate the evolution of human cognition and sociality. In this work, we first present the essentials of the theory, and discuss the paleoanthropological and social evidence claimed to support it, in order to point out some shortcomings. They have to do with the general strategy to find linear relations –between group size and relative size of neocortex– when there take in consideration the mental capacities that make possible the human social life, and the diversity of effective social structures.

1. <u>Introduction</u>

Following Humphrey's suggestion in "The social function of the intellect" (Humphrey, 1974), diverse theoretical proposals have developed the hypothesis that a crucial relation exists between human cognition and sociality from an evolutionary point of view. Thus, for example, the Hypothesis of the Machiavellian Intelligence (Byrne & Whiten, 1988), or the Hypothesis of the Vygotskian Intelligence (Moll & Tomasello, 2007), coincide in trying to explain the existence of certain cognitive capacities in humans –such as to detect lies, or to establish cooperative plans–, in terms of their evolutionary function, as adaptive solutions to the selective pressures derived from the increasing complexity which characterizes the social life along the Hominin lineage. It is important to notice the double explanatory link between cognition and sociality involved in these proposals: on the one hand, certain cognitive abilities are required to exhibit the relevant social behaviors; and on the other hand, these cognitive abilities are thought to have evolved because the social behaviors they made possible were adaptive.

This double explanatory link turns out to be even more intricate when we consider one of the most influential programs that relate the cognitive and social evolution of our species: the Social Brain Hypothesis (SBH) of Dunbar (Dunbar, 1992; Dunbar, 1998; Dunbar & Shultz, 2007; Shultz & Dunbar, 2007; Dunbar, 2010). This hypothesis states that our brain is an adaptation to our social life, so that, instead of

singling out the cognitive functions required for our kind of social life, Dunbar focusses on the brain that supports those functions. The idea consists of indicating the interdependence between the type of social life that characterizes humans and the neural requisites necessary to sustain the mental functions that make this type of sociality possible. It is also assumed that this brain evolved, basically increasing its relative size, because of the adaptive advantages derived from the social organization it made possible. It is assumed that this is the right level of explanation, overlooking the fact that the same brain is involved in a diversity of human societies. In other words, social diversity is kept out of the picture; it is just assumed that it must be constrained by the evolved human social brain.

Undoubtedly, there are advantages in the formulation of the evolutionary hypothesis in terms of brain size increase, instead of particular cognitive functions. From the point of view of the hominization process, the increase in relative brain size is an indisputable fact (Cela-Conde & Ayala, 2013). However, from an evolutionary point of view this increase also involved higher metabolic costs –higher energy consumption, risk of overheating, greater demands for the heart in pumping the blood. The SBH stresses the adaptive advantages of this brain enlargement, in terms of the benefits of complex social life, so that they had to be bigger than the biological costs. A diversity of is evidence brought in support of it. Thus, for instance, comparative studies of several species in different evolutionary conditions are required to establish both homologies within our own lineage, and convergences with other taxa, to consider whether or not a relation between larger brains and social complexity can be established. Similarly, paleontological and anthropological data about our ancestors can help establish universal constraints in social complexity among the diversity of human cultures. In particular, the SBH predicts that the human brain sets a limit over the scope and quality of human social relationships.

In this work, we propose to review these different lines of evidence, to assess in which way, and to which extent, Dunbar's SBH is well supported. In our opinion, the weak points of his proposal come from the need to go beyond a too simple initial proposal, as well as from the correlational methodology that he standardly uses, which leads him to look for simple linear relations, overlooking the possibility of complex interactions among multiple factors. These weaknesses are evident precisely in the ambiguity indicated between the assumed original social configuration and his claim

that still holds through the diversity of the human societies. An articulated view about the cognitive mechanisms needed for a human social life, in its diversity, is also required. In our view, it is in this way that social universals can be found, rather than in terms of maximum size of social groups, as Dunbar contends. In fact, it seems that in his more recent work, which focuses on trust-based groups, Dunbar is currently developing the SBH precisely in this direction.

2. <u>The relation between relative brain size and group size</u>

One of the most clear anatomical features of the hominization process is brain size increase relative to body size –a process that started with the primates. In primates, it seems that the relative increase in brain size takes place especially in the telencephalon: the neocortex occupies between 50% and 80% of the entire cerebral volume depending on the species. A great number of authors have emphasized the problems of survival in a new ecological environment as the key to such process. The Ecological Hypothesis (EH) affirms that the selective pressures that our ancestors had to confront, given the available resources in the savanna, and the absence of "arms" (claws, canine teeth, etc.) and brute force, favored a bigger brain, assuming that intelligence depends upon brain (relative) size. The SBH, on the contrary, views this increase primarily as a way of making possible living in bigger groups, which is thought to be advantageous in the new environment. Therefore, both theories relate environmental pressure and bigger brains; the difference between the SBH and the EH lies in that, the EH views such brain increase as an individual strategy, while the SBH views it as making possible a more complex social organization, which in its turn gave rise to new demands. SBH, though, is neutral on whether the new social conditions that come with bigger groups favor more cooperation ("Vygotskian intelligence") or competition ("Machiavellian intelligence"), since it is group size per se, and not the kind of relationships within the group, that is related to such an increase in relative brain size.

As evidence against the EH, Dunbar quotes the McNab & Esinberg (1989) study. It shows that relative brain size in mammals correlates more clearly with their daily routines than with their metabolic ratio –quantity of liberated energy in a unit of time. Dunbar (2003) also checked whether there is a correlation in the primates between the relative volume increase of the neocortex –neocortex volume compared to the total

brain volume– and ecological indicators such as the proportion of consumed fruit in diet and the foraging style (Fig. 1), or the length of daily displacements, but found none.
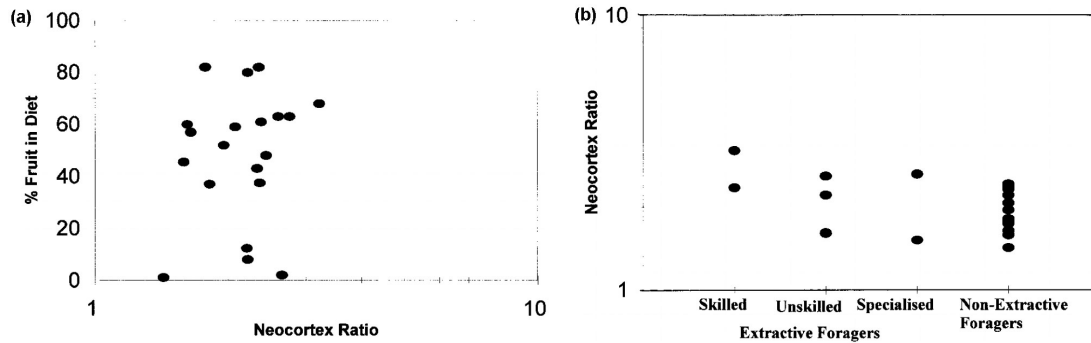
Figure 1. Relative neocortex size in the anthropoid primates compared to (a) percentage of fruit in diet and (b) types of extractive foraging. In none of the two cases a correlation is found (taken from Dunbar, 1998, p.183).

On the contrary, neocortex relative size correlates with group size in anthropoids (Dunbar, 1992; Dunbar, 1995; Kudo & Dunbar, 2001) as predicted by SBH (Fig. 2). When the same variables were compared in other mammals –bats, artiodactyls ungulates and carnivores– and 135 species of birds, though, the pattern turned out to be more nuanced: beyond group size, it is the type of relationships among members of the groups that matters most. Thus, species organized in stable couples have relative bigger brains than those living solitary life or in multi-male groups (Shultz & Dunbar, 2007).
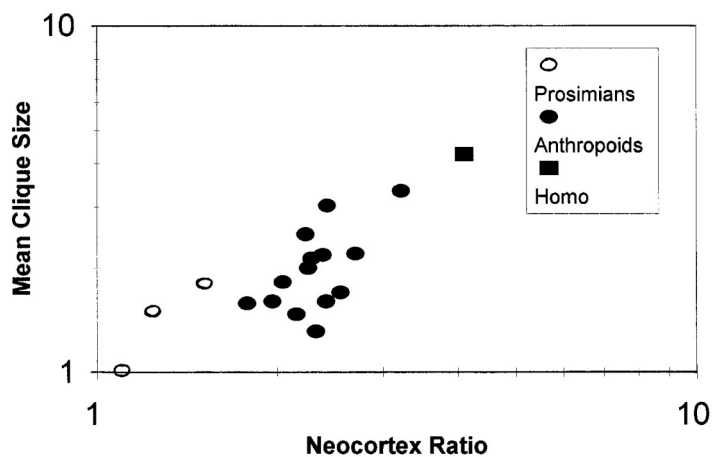
Figure 2. Correlation between the average size of grooming clique compared to neocortex average ratio for primates and anthropoid monkeys such as *L.catta*, *L.fulvus*, *Propithecus*, *Indri*, *S.sciureus*, *C.apella*, *C.torquatus*, *A.geoffroyi*, *A.fusciceps*, *P.badius*, *P.entellus*, *P.pileata*, *P.johnii*, *C.campbelli*, *C.diana*, *C.aethiops*, *C.mitis*, *E.patas*, *M.mulatta*, *M.fuscata*, *M.arctoides*, *M.sylvana*, *M.radiata*, *P.anubis*, *P.ursinus*, *P.cynocephauls*, *P.hamadryas*, *T.gelada*, *P.troglodytes*, *P.paniscus* (Dunbar, 1998, p. 186)

Therefore, the evidence suggests that group size is not all there is to bigger brains: the complexity of the social relationships involved also seems to play a role. The support for the SBH is only modest. An analysis of the characteristics of social life, beyond group size, seems in order. Dunbar, in recent work, has become aware this, as we will see in section 4.

3. <u>Costs and benefits of life in complex groups</u>

Even in the case of primates, where the correlation between bigger group size and higher brain ratio holds the question of why this is so needs to be addressed. Group size might be a mere by-product of developing bigger brains for some other reason. Schaik (1983), Dunbar (1988), and Hill & Dunbar (1998) found support for the idea that the increase in the brain's ratio is the key to bigger groups, which would be advantageous in the new ecological conditions of our ancestors. More specifically, Dunbar (2003) argues that bigger groups cannot be a by-product of bigger brains because of the costs of living in society: group living is so demanding that it constitute an evolutionary pressure per se, so that if advantages were not superior to costs, the group would disperse. In his opinion, the advantages of group living include diminishing depredation risks, improving territory defense, and sharing the breeding of progeny. As for the costs of living in bigger groups, they would involve competition for scarce resources and sexual partners, conflicts among the group members, and, in general, the need to solve coordination problems. Therefore, the larger the group, the higher the costs of keeping the group together, both in terms of time spent and behaviors addressed to avoid conflicts.

From this point of view, for instance, Dunbar (1991) describes the important role of mutual grooming to create ties and to keep the cohesion of the group in primates. This social activity cannot exceed approximately the 20% of daily time so that other vital activities can be attended, although estimation might change among species

according to their different life patterns, habits, social system, predatory pressure, habitat resources, etc. No further precision is provided in this regard.

However, Lehmann et al. (2007) do not find a correlation between group size and mutual grooming in primates: at a certain level, grooming cannot be the only way of keeping cohesion. In addition to mutual grooming, other activities as games, courtship and mating, agonistic interactions, and territorial behavior, also have a role in keeping social cohesion (Dunbar, 1991). All these activities require a great investment of time and effort, as well as specific cognitive capacities, such as remembering who groomed me before, with whom one fought, who is allied with whom, and who helps whom in case of conflict. For this reason, instability and group fission are to be expected when time to invest and cognitive abilities needed to maintain social ties exceed certain limit.

Dunbar's argument can now be formulated this way: brains evolved for social life because group size depends on the cognitive resources in the time available to keep the group together. From this point of view, further relative neocortex increase in the Hominin lineage, and the superior cognitive abilities that followed, made possible to preserve cohesion more effectively in the time available, thereby allowing bigger groups.

Nevertheless, these evidences are not enough to support the SBH idea that group size increase leads to the increase in relative brain size –the neocortex in particular. For the SBH, the benefits of increased social activity puts a premium on neocortex volume increase because superior cognitive skills are needed as a more efficient way to keep social cohesion, manage bigger groups and expand the lineage. However, the SBH comes short to provide a causal explanation of the process: we are not given a clue as to its starting point, nor a reason why other species, which might have also benefited of getting in a complex social life, failed to do so. The SBH is also deficient as a functional account: living in groups as big as the human ones can be achieved without following the "bigger brains" strategy –as long as the relationships among members are kept simple. Therefore, the previous critical remark also applies here: what really matters in this process is not so much as group size per se, but social structure, since the cognitive way of keeping social cohesion concerns in fact the type of relationships among group members that it makes possible. In bigger groups, hierarchies and coalitions, family structure and social roles, become more complex.

4. <u>Neocortex increase and social life</u>

In recent years, Dunbar has increasingly recognized that the question of the type of social relationships deserves greater attention. An effort in this direction is Shultz & Dunbar (2007): they focus on the connection between relative brain size and type of social relationships, by analyzing the different relationships among individuals within the group. Their hypothesis contends that different types of social relationships involve different cognitive demands, which in its turn will require different relative brain sizes. They reason that long-terms bonds, such as couples, require higher cognitive resources, because longer ties involve keeping track of, and managing, the inevitable conflicts that arise regarding access to resources, parental investment and time budget. To keep such a relationship, individuals need skills to solve such conflicts, to influence other's behavior, to remember previous experiences, and a plan to maximize their reproductive success. On the contrary, unstable relationships, such as those of multi-male groups, don't require these cognitive resources are not needed to recognize. Support for the hypothesis is found in a correlational analysis of different groups of animals, in terms of relative brain size and style of social relationship (Fig. 3).
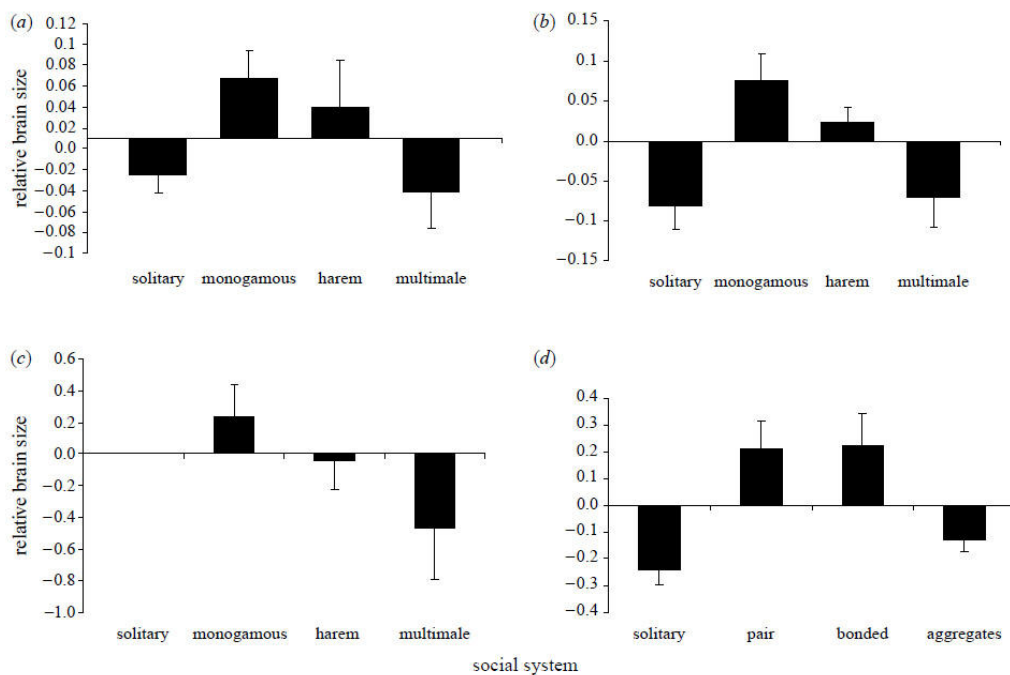
Figure 3. Relative brain size according to parenting system in (a) carnivorous, (b) ungulates, (c) bats, and (d) birds. Stable couples are more likely to be found in species with relatively bigger brains (Shultz & Dunbar, 2007, p. 2432).

In fact, in previous work on ungulates, Shultz & Dunbar (2006) already suggested that the most favorable conditions for brain enlargement are: a highly social way of life, monogamous couplings, and the so-called "mixed environments" –neither closed nor unlimited habitats (Fig. 4).
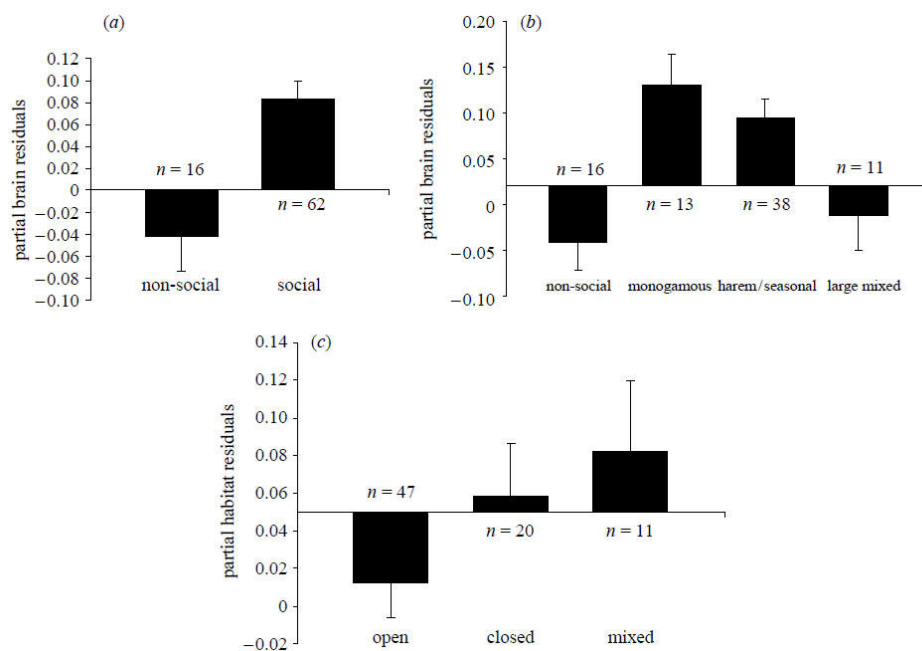
Figure 4. Relation between relative neocortex size and social and ecological factors: (a) sociality, (b) mating strategy, and (c) habitat use (Shultz & Dunbar, 2006, p. 212).

Nevertheless, primates are different. In contrast to other taxa, primates show a clear correlation between group size and relative brain size (specifically neocortex ratio respect to body size). In fact, this is the most important correlation, over other ones such as social system, mating strategy, or habitat use. Primates are also special because they show strong ties among individuals. In particular, anthropoid primates live in large social groups with stable relationships often based on matrilineal or patrilineal kinship, coalitions and affiliated relationships, established and maintained through grooming, between individuals not genetically related. Primates get intense and focused

relationships with other groups' members. In other taxa these relationships just exist between reproductive couples. Also in primates, in contrast to other taxa, the harem and the multi-male social systems also correlate with relative bigger cerebral sizes (Shultz & Dunbar, 2007) (Fig. 5).
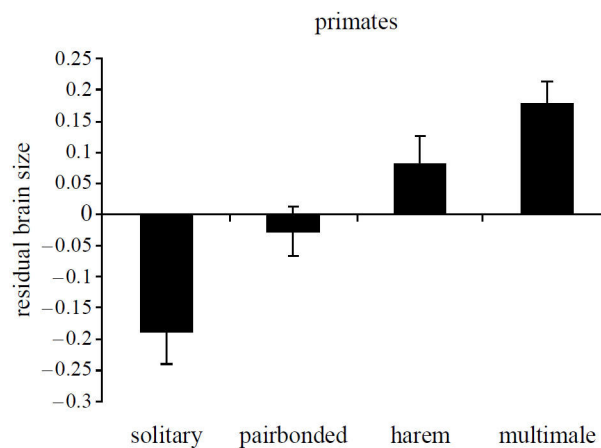
Figure 5. Relative brain size according to the social system in primates (Dunbar, 2007, p. 2432).

These findings suggest the relevance of the neocortex in sustaining the primates' social life, as the SBH predicts. Croney & Newberry (2007)'s results also support the SBH, by suggesting that a longer coexistence among the group members fosters a cognitive development in order to be able to recognize other individuals, coordinate strategies of survival and domination, exchange and transmission of information within the group, improve social attention, use deception tactics, manipulate and compete, etc. This is also in line with Fletcher et al. (1995): they found –using PET imaging– a higher activity in prefrontal areas when primates were to recognize and interpret visual signs and emotional states in other individuals, as well as identify behaviors, manipulate and to process information. Likewise, Byrne (1995) also found that relative neocortex size correlates with frequency of tactical deception in primates.

Even more to the point, recent neuroimaging studies, such as Lewis, Rezaie, Brown, Roberts & Dunbar (2011), have found a positive correlation between volume of gray matter in the average prefrontal cortex and size of an individual's social network. A similar correlation appears again in a new analysis of Powell et al. (2012), in this case between the orbital volume of prefrontal cortex and the social group size. Nevertheless, whereas the neocortex is clearly involved in attentional and behavioral control, it is not

the only brain area involved in social life –think of memory for instance, which is related to tempo-parietal areas, or emotions, which involve the limbic system. Consequently, the evidence concerning neocortex relative size comes short to provide fully support for the SBH, because it fails to account many other mental functions involved in social life.

Another line of research to support the SBH has been to test whether relative neocortex size in primates correlate more with the juvenile period (when social learning is central), than with gestation time (Dunbar, 1998). Again, the evidence links neocortex and learning, but this might be due to brain immaturity at birth as a side-effect of the erect posture. Anyway, evolution drove humans to develop their brains during a long process of social influence and learning, which distinguishes them from other species. Human ontogenesis is the key of the brain plasticity required to learn (Hutchinson et al., 2005).

In summary, we now see how the SBH has to be made more precise again. Taking the kind of social relationships into account, and the different cognitive skills that sustain them, while seem to have to do with relative neocortex size, are not restricted to this part of the brain. More importantly, attention to social learning and brain plasticity during ontogenesis involves realizing its role in cultural diversity. The SBH tries to address this problem by looking for social universals originated in a primitive social structure.

5. <u>Universal constraints in human social life</u>

So, from the connection between cognitive abilities and sociality, the SBH, Dunbar is driven to consider the question of universal constraints in humans' social life. Such constraints are conceived by Dunbar in terms of the required time and limited cognitive resources available to establish and maintain the different types of human social relationships. While socio-economic and marital status, age, education or the familiar configuration are factors known to influence the creation and structure of social networks (McPherson et al., 2006), Dunbar and colleagues suggest the following:

5.1. *Number and type of relationships.*

The first of these constraints is the famous Dunbar's number (Dunbar, 1993), which indicates the maximum number of social relationships humans can keep:

approximately 150. This number comes from observation of different human groups which maintained stable relations along history, in addition to extrapolation from relative neocortex size to group size in different species. Similarly, Hill & Dunbar (2003) suggest a limit in the number of people set by universal cognitive constraints derived of the human way of keeping social cohesion, which requires face to face interaction and individualized pursuit. Nevertheless, soon Dunbar realizes that the point is not the number but the type relationships, as we insisted.

In this regard, Roberts et al. (2009) find a general pattern in the structure of human social networks in contemporary societies. They identify three circles of social relationships: i) the "support clique": it consists of emotionally close individuals, around 5, which get and provide help or advice in hard moments; ii) the "sympathy group": a group of friends, with at least a monthly contact, which includes an average of 12 to 15 people; and iii) the rest of individuals one keeps a sporadic contact. Accordingly, Roberts et al. (2009) view the most sporadic relationships as a form of social capital, as an investment in social relationships from which a future benefit is expected (Lin, 1999). These types of relationships imply different levels of emotionality (Roberts & Dunbar, 2010), which determine different costs of maintenance, both in terms of time and mental resources. In addition to the previous groups mentioned, they also identify groups between 30 and 50 individuals –bands–; those of 500 individuals –mega-bands–, and groups between 1,000 and 2,000 persons –tribes–. Again, they are supposed to be universal patterns across the human social diversity, supposedly derived from the initial hominid structure.

However, this approach overlooks the diversity of human societies. For example, nowadays humans live in wider societies, and many researchers analyze the current globalization phenomenon and the new social configurations it gives rise to. A better way to look for universals in social structure is to try to understand the cognitive resources and emotional motivations for social life, and how they give rise, in different ecological contexts, to different social forms, even if in all of them a "small group" of closely attached individuals can be discerned. From this point of view, Dunbar's number, and this view of universal social circles, of a fixed size (Roberts et al., 2007), remains questionable. Consequently, the previous typology needs better evidence from psychology and social anthropology.

5.2. Cognitive and time requirements to keep social relationships.

Keeping each type of social bond demands different cognitive requisites and time investment. Close ties are those that involve emotional charge, but they can be of different types. According to Roberts et al. (2009), ties with relatives demand lesser dedication in time than other relationships because of the combination of the obligation to help kin and their high level of structural embeddedness. Non-kin close bonds, though, imply more dedication to keep the relationship, through frequent communication in real-time by phone or especially face to face (Mok et al., 2007; Utz, 2007). The longer time required to create and keep these ties limits its number, setting an upper number of non-kin close ties. Accordingly, the other relationships are weaker, less emotionally close, and therefore they also need lesser personal dedication. As a result, this latter kind of relationship can be maintained with a bigger number of individuals, because of the smaller investment in time necessary to keep them.

Zhou et al. (2005) also set, for humans and primates, a fixed numerical sequence in the social relationships types of between 3 to 5 relationships –support group–, 9 to 15 –sympathy group– and 30 to 50 individuals –typical bands of hunters-gatherers, more unstable but a part of the 150 group members–. This sequence coincides with a stable scale, around 3, which increases geometrically and is thought to be universal. According to Dunbar, this sequence in the hierarchy of social closeness is related to the above mentioned cognitive limitations because, when such limitations are exceeded, the relationships stability diminishes and the group divides. In the same sense, Stiller & Dunbar (2007) hypothesize which are the cognitive essentials that limit in number the relationships of each kind supported simultaneously. Thus, they single out theory of mind and memory as the key to the support group size, because of the cognitive limitations they involve. Thus, theory of mind fixes a cognitive limitation in the number of intentionality levels that humans can attribute to others ("John believes that Peter thinks that Mary wants that…") (Kinderman et al., 1998). Stiller & Dunbar (2007) think that humans fail at time of retaining more than 5 intentionality levels and this number corresponds to the support group size. Similarly, short-term memory is limited to 5 –the current value of the famous number 7+/-2 of Miller (1956)–. Memory capacity is needed to retain information about those relationships (Barrett et al., 2003).

On the other hand, Roberts et al. (2008) also analyze personality influences in social relationships but they scarcely find any influence. They only find a small effect of

extroversion in support groups, just at the time of creating new relationships when individual face different life circumstances, or change their place of residence. But they don't find any influence of neuroticism. Therefore, they conclude that it is the cognitive level that matters for social bonding.

Similarly, language supposes a cognitive skill very related to social activity according to Dunbar (1993), which facilitates and multiplies the social complexity and run together to neocortex development. Language serves as a substitute in humans to mutual grooming in primates, multiplying by 2.8 its possibilities of keeping relationships over grooming. Cohen (1971) finds also human cognitive limitations in language when he establishes a maximum number of 5 persons with whom it is possible to keep a conversation at a normal voice level. This affirmation reinforces the idea of Dunbar (1993) on cognitive limitations to keep cohesive groups. When this number is exceeded, the conversation groups fission because the attention and listening capacities descend (Henzi et al., 2007).

The human conversations traits are analyzed to verify if the language origin was related to creation of social bonds (Dunbar et al., 1997). In this respect, Dunbar (1993) concludes that 60% of human conversations treat on social gossips. As well, other experiments on social information transmission find that social gossips are transmitted more frequently than other social topics or any other issues (Mesoudi et al., 2006) (Fig . 6).
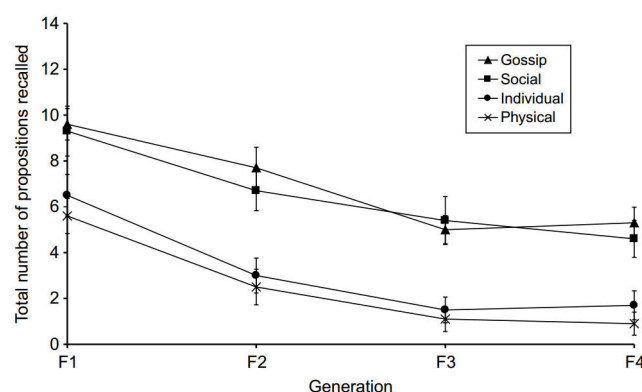
Figure 6. Total number of propositions remembered in every transmission, independently of their precision (Mesoudi et al., 2006, p. 416).

Dunbar et al. (1997) also suggest that the most informal conversations are related to oneself as others and they are merely social activities. From these works they try to support the SBH emphasizing the social influence in a cognitive skill such as language, which needs, according to Dunbar (2009), at least the level 4 in capacity of others' intentional attribution. Nevertheless, the previous gossips percentage constitutes a weak argument to extrapolate the social origin of human language coming from a study based on a limited number of participants who live together in a very concrete social context. This is another example of the simple linear relations used by Dunbar to support the SBH. In fact, recently Freeberg et al. (2012) begin to speak on the Social Complexity Hypothesis to explain the communication to language step in more complex social contexts. In a similar sense, Henzi et al. (2007) have tried to link meta-representational capacity with social group size. Nevertheless, all these arguments trying to identify cognitive mechanisms as possible limiters to certain social practices are insufficient to support the SBH.

Although the Dunbar's classification on relationships types are interesting, he does not reflect on whether the human social networks structure is limited by cognitive skills or by the same social practices. In this sense, an anthropological perspective on social practices and culture is in order to understand how social networks get configured by means of cultural resources as identities, symbology, beliefs, norms and technology. Dunbar concentrates exclusively on interpersonal relationships, but the SBH should consider also other forms of social relationships (intra-group vs. inter-group, for example, or other phenomena of the social psychology), which suppose the individual's identification with a generic group. This type of considerations leads us to consider with some skepticism the recent line of development of the SBH on internet influence in social relationships. Dunbar and collaborators have tried to show the same type of social groups in the new virtual social networks (Dunbar, 2012), but using analogies not according to the different nature of virtual relationships.

In other words, the typology of social networks put forward by Roberts et al. (2009) might be explained, not in terms of cognitive limitations to create and keep the relationships, but as a way to answer the human need for affiliation. From this point of view, the support group might be enough to cover the most basic human needs for help, cooperation, affectivity and safety especially in hard moments. These bonds are reinforced by a stronger emotional load which promotes a greater involvement. Also,

the creation of wider and less emotional networks might serve to another type of social needs that require a lower implication, possible for weaker relationships. Thus, the attribution to cognitive limitations to the different number of social relationships turns questionable. On the other hand, these different groups need of a wide empirical support to be contrasted. Nothing prevents, for example, to find a society with support groups of 10 individuals; in fact, the extensive families of traditional societies are out of Dunbar's typology. Equally, the strict compartmentalization of relationships types, their components and the psychological mechanisms and conditions to keep the bonds are also questionable. These questions need deeper anthropological and psychological evidence.

In this respect, it is clear that Dunbar and his groups begin to recognize the necessity of adding other perspectives from psychology to their initial evolutionary perspective, in the line to include the role of trust in social cooperation, for example (Sutcliffe et al., 2011). This helps to recognize the simplicity of the cognitive explanations used previously. In the same sense, Dunbar (2012) begins to use other elements in his explanation of the SBH, as the relevance of laugh and its relation to endorphins, as a possible mechanism useful to share social activity.

6. <u>Reconstruction of human phylogenesis</u>

Another goal of the SBH is to offer the grounds for a reconstruction of the hominization process. To this extent, it tries to interpolate the social characteristics of the fossil species of our hominin lineage, from consideration of living species: anthropoid monkeys and modern humans. The proposal has moved from a first phase, grounded on group size and neocortex relative size, which, as we have already indicated repeatedly, turns out to be too simplistic, to a more recent and complex proposal.

Thus, in a first attempt, Aiello & Dunbar (1993) used the relation between neocortex volume and group size. They make an estimation of neocortex volume of different fossil species from their cranial volume using the scale identified by Finlay & Darlington (1995). From the estimation of neocortical volumes they inferred the group size of these species, assuming that the correlation initially found between both parameters held as well. As result, *Homo erectus* was singled out as the beginning of the key transition towards the greater increase of cerebral volume and group size with respect to the great apes (Fig.7).
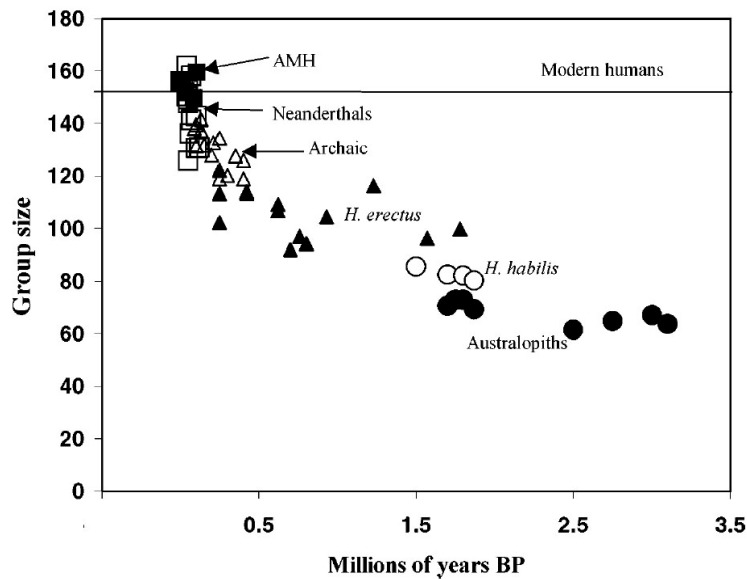
Figure 7. Social group size predicted for populations of hominids, including modern humans, using the regression equation for the group size on the neocortex ratio (Dunbar, 2003, p. 173).

From previous estimations of group size of different species, they inferred the time spent on social activities needed to maintain the group cohesion. Assuming that individuals cannot dedicate more than 30% of its daily time to social activity to have time to attend to the rest of their needs –this percentage might change if more selective pressures are considered–, they calculate the maximum number of individuals that can interact. Thus, knowing the group size of different fossil species and the maximum percentage of time to social dedication, they calculate the time when language appeared. They conclude that language did appear 0.5 million years ago. This period coincides with appearance of archaic humans hence the Neanderthal might already have possessed a social speech according Dunbar (2003).

In a new reconsideration of the question, Dunbar (2003) infers that only the modern humans and Neanderthals are capable of the level 4 of intentionality (Fig. 8), comparing intentionality levels of "catarrhine primates" and its cranial volume. The level 4 is especially important because supposedly it is needed for religion or appearance of the symbolic culture. This estimation coincides with the available archaeological evidence that places the language appearance with the archaic *Homo sapiens*.
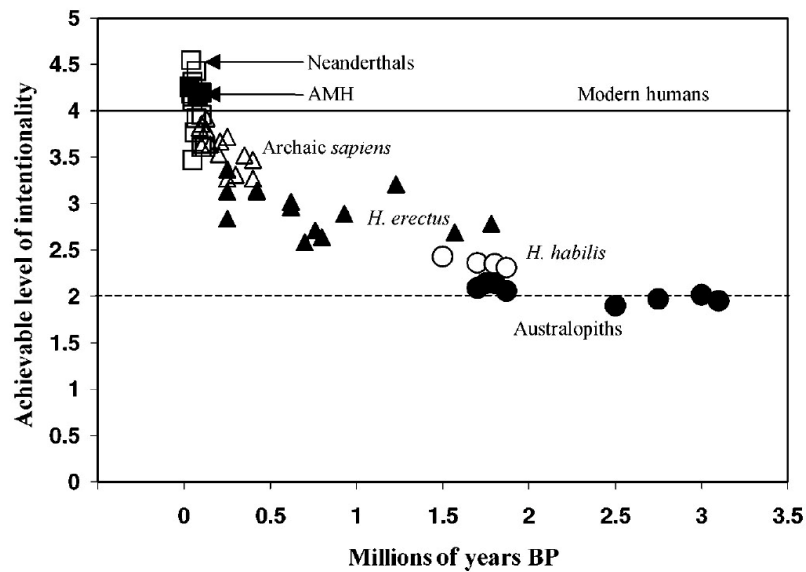
Figure 8. Level of attainable intentionality (or theory of the advanced mind) for hominines populations respect to time (Dunbar 2003, p. 178).

Nevertheless, basing the whole explanation of the hominine evolutionary process on a simplified and not entirely validated hypothesis supposes some risks that imply the same weakness of its conclusions. Although fossils evidence the relation between cerebral growth and a superior cognitive complexity by the technical changes in material culture, the SBH is not the only possible hypothesis to account it.

Recently, Schultz et al. (2012), after admitting that group size is not enough to explain the hominids' brain evolution, test its previous works and try to add other factors in their statistical analysis. They add elements such as climate, predatory pressures, sociality and language evolution. The analysis tries again to reject the EH in favor of the SBH, although looking for a slightly more complex social explanation. They conclude different forces in the brain evolutionary process, with periods of gradual cerebral growth and moments of prominent evolutionary jumps which not coincide with important climate changes and neither coincide in Africa and Europe. Undoubtedly, they admit that group size hardly might depend on just a variable, and the ecological factors (available resources, competition level, climate, etc.), interactive factors (fertility, sexual ratio, etc.) or even social factors (language or norms on reproduction and familiar organization) might have something to do with this. But the

coherent thing, after this recognition, would be to leave the pretension to find a linear relation in this regard.

7. Conclusion

The Dunbar's evidences to support the SBH face a paradoxical situation. Its original formulation, when consider only the relative proportion of neocortex and not the implied cognitive capacities or the group size and neither the types of social networks, turns to be threatened (as Dunbar recognizes, 2007). The human social group size has, for example, a big dispersion of effective group values, a great changeability of sizes.

Certainly, the Dunbar's last works go in the line of recognizing this complexity and go beyond the simple correlations. Accordingly, for example, we find some neurobiological analyses on brain areas involved in certain social aptitudes (Dunbar, 2010; Lewis et al., 2011) and reviews on their implied neurochemical bases (Machin & Dunbar, 2011). Similarly, he is also interested in social networks topology, and not just in group size (Dunbar & Shultz, 2007). This confirms the simplicity of the previously used arguments to support the SBH based merely on neocortex size. Nevertheless, the greater complexity in the SBH formulation implies questioning some of its nuclear assumptions, as the relevance attributed to the neocortex relative increase over other cerebral structures, since the cognitive capacities involved in human sociality do not depend exclusively on neocortex. In the same way, having displaced the focus from group size to the social relationships type and its implied networks structure, the central nucleus of his primitive hypothesis is questionable. In effect, the biggest difficulty of the SBH is forgetting the vast diversity of current human configurations, trying to find its "magic numbers" (5-15-50-150) in effective social configurations. The explanatory power of a hypothesis to link mind and society, hardly will find social universals in the real social diversity without considering psychological mechanisms behind human social life with its diversity, changeability and its sensibility to context and history.

Principally, the SBH limitations come from its preference by correlational analysis to look for linear relations. But the last Dunbar's works reveal the intention of using more complex analyses and including new methodologies. In our opinion, the most promising route goes for the increasing interest in universal psychological mechanisms, as trust and a more sophisticated analysis of effective social networks. In

this sense, Dunbar (2012), Curry & Dunbar (2011), and David-Barrett & Dunbar (2012) indicate the interest of using the social networks analysis, although they have again the pretension to find "group constants". The trust networks study might also show more on the cognitive skills to get group cohesion.

On the other hand, although the SBH provides interesting elements on which to go on working, it becomes unsatisfactory because it doesn't make distinction between its functionalist explanation of the brain relative size increase (getting selective advantage of living in bigger groups) and a causal explanation on how it did happen. Similarly, the hominine adaptive biological solution remains unexplained: many other species, with a similar situation, chose other adaptive routes different to this cerebral increase. Examples of this erroneous pretension are still present in recent works: "*the big brains have increased along the evolution as answer to the social and ecological conflicts inherent to the life in group*" (Shultz & Dunbar, 2007). O: "*primates developed big brains to handle its unusually complicated social system*" (Dunbar, 2009). These statements do not consider other highly social species that have not developed such cerebral and cognitive development levels. In other words, even when the route of a greater telencephalization could be beneficial for many species, they did not follow it. There are species that support hard environmental pressures and must to move long distances to get food, as ungulates, but these pressures did not force them to create more complex social systems to face these environmental challenges, assure reproduction or even protect the descent.

In summary, from the analysis and review of Dunbar's works, we can conclude that, although the SBH doesn't remain robustly established, its works on the human sociality evolution and cognitive mechanisms that did make it possible help to open an interesting route to be explored more thoroughly. In fact, other authors have theoretical approaches in this sense (Rubí-Barceló, 2013). In particular, we highlight of the Dunbar's work the relevance of examining the small-scale human societies to compare them with the large current human agglomerations. Maybe the basement to keep structure and social relationships within big societies are similar to those of the small-scale societies which were the human ancestors' context. In other words, just as Dunbar tried to find evolutionary footprints to current social relationships, it would be interesting to verify whether social networks exist working as small-scale societies

inside current societies, or whether social cohesion in such contexts depends on other mechanisms.

Trust, social capital and the evolution of human sociality

In this contribution we want to integrate conceptual developments in Theoretical Biology, Sociology and Anthropology into an Evolutionary Psychology approach. Evolutionary Game Theory tries to model the evolution of human social behavior, of cooperation in particular. "Strong altruism" has been recently defended as the best model of such a process. According to this view, non-kin cooperate because they are afraid of retaliation by all group members, rather than just the exploited individual; in other words, altruistic punishment is the way to make sure nobody free-rides. This approach, though, is defective in two ways: at the theoretical level, it opens up the possibility of free-riders that get the benefit of general punishment, but avoid the costs of punishment. At the empirical level, the evidence that human groups effectively implement "strong altruism" is missing.

What we find at the empirical level is that cooperation is made possible by trust-building practices. In the anthropological literature, Mauss' classical "Essay on the gift" remains a milestone, but much work from "Social Network" theory also shows how trust is build, maintained and restored, so that delayed exchanges can continue. In Sociology, the notion of "Social Capital", despite its variety of meanings and uses, can also be understood as the resources an individual may have available through the valuable social relationships he develops through trust. Against this background, we will articulate our view of trust, as a complex attitude, that presupposes affective links, cognitive tracking and moral emotions. We will argue that the complexity of human sociality, when compared to other species, has to do with the way Hominids developed the psychological scaffolding that made trust possible.

1. <u>Introduction</u>

Cooperation and the possible altruistic or selfish nature of social behavior have been approached from an evolutionary perspective of human sociality. Historically, the analysis of cooperation, at an individual level, started by looking into cooperation among related members –selection by kinship. This was called "biological altruism" (Trivers, 1971; Dawkins, 1976; Axelrod & Hamilton, 1981), or "inclusive fitness", and showed a purely biological view of survival of "selfish" genes, over the individuals which carry them.

However, human social behavior extends beyond relatives. In general, it seems to be driven by relations of "reciprocity", not just with relatives, and distinguishing

between "direct" and "indirect" reciprocity. Direct reciprocity involves a cooperative answer from the same helped subject in a period of time that can vary, giving rise to reciprocal altruism (Trivers, 1971). Its most famous expression, "tit-for-tat", was evident in simulations with experimental games carried out by Axelrod (1984), where it was noted that the strategy followed when subjects interacted repeatedly in these games was imitation of game partner's behavior.

In indirect reciprocity, though, assistance to a subject does not imply a direct compensation from the same helped subject to the helper, but to somebody else, thus generating a chain of cooperative interactions. One approach to make sense of indirect reciprocity has been "group selection" (Boyd and Richerson, 1990; Wilson and Sober, 1994; Bergstrom, 2002). A greater degree of collaboration among members of a group ready to cooperate is expected, as a strategy that guarantees group survival and its evolutionary continuity.

On the other hand, a purely rationalist vision (Caporael et al., 1989), driven by a stream of economists and sociologists, considers that human beings are eminently rational, optimizers that take efficient decisions and look for the maximization of benefits at minimal costs. Following this idea, individuals would cooperate as little as possible and they would benefit as much as possible of others' help.

Against these set of views, "strong altruism" (Fehr & Gachter, 2002; Bowles, Gintis, Boyd & Richerson, 2003) proposes an alternative account of the evolution of cooperation. This proposal contends that cooperation (as indirect reciprocity) is made possible due to existence of individuals willing to cooperate in so called "third party games", willing to punish non-cooperative others, even if this amounts to incur in a cost.

Nevertheless, this view has to face criticism. In particular, about the real existence of individuals who practice strong altruism (Guala, 2012). The experimental works used to demonstrate such attitudes, carried out under conditions of laboratory, has been questioned because it is hardly transposable to real social contexts. On the other hand, the ethnographic evidence provides scant examples of this kind of punishment at level of collective practices. The scarce examples identified rather suggest that "altruistic punishment", when it appears, does not involve a great effort at individual level.

In general, the "evolutionary game theory" approaches reviewed above seem to be too simplified, not taking into account the complexity of human cognitive functioning and the influence of cultural contexts in social activity. In order to go beyond this stage, trust could be a useful mediator element in the explanation of social cooperation. Trust offers a promising way to integrate psychological, sociological and anthropological notions in an evolutionary approach.

Thus, for instance, trust relates to the sociological notion of "social capital". "Social capital" (Coleman, 1988; Putnam, 1993) is a notion eminently economic, which

is defined as "the investment in social connections of interest, with a view to future results". It emphasizes the idea that humans collaborate with each other, looking for some kind of support, exchange or reciprocity. However, authors using this term have based their analysis on very different notions and ways to measure it, in their attempts at explaining human social interactions, the elements that influence them, as well as its structure and dynamics through social networks. In addition, they have disregarded the evolutionary and psychological constraints that this notion has to satisfy.

To overcome this situation, this paper focusses on the mutual influence between cognitive skills and social behaviors. In this regard, it follows the path of Dunbar. Dunbar has worked in the search of this connection through his controversial hypothesis of social brain (Dunbar, 1998), carrying out comparative studies of sociality between species and its cognitive traits (Dunbar, 2007) and analyzing possible cognitive limitations that reflect different types of interaction in human social networks (Dunbar, 2003). These works support the idea that socialization in small groups played a key role during most of human evolution. We want to go beyond this conclusion, arguing that this important footprint shows up in trust relationships in current human social relationships.

Hence, from this point of view, cooperation and altruism in human social interaction is mediated by variable trust relationships among the agents. This in turn implies an analysis in which subject are inevitably immersed in a context full of nuances related to a cultural and regulatory context of the society to which the individual belongs, and inside which structures and dynamics of trust are immersed, but keeping traces of the environment in which trust relationships emerged and developed during the greater part of evolutionary process.

2. **The concept of trust**

The concept of trust has been considered from many points of view. Multiple disciplines, such as psychology or the social sciences have tried to give a definition of it based on their own perspectives. We propose to analyze trust from an anthropological and evolutionary perspective, because it provides the grounds to integrate different aspects of this concept. Emotional, cognitive, psychological and cultural components in trust can be distinguished, taking the before-mentioned disciplines into account, in order to get a more integrative understanding.

Trust seems to answer the necessity to promote social action in risky contexts of creation of new relationships. Parsons' concept (1970) defines literally trust as "... the attitudinal ground –in affectively motivated loyalty– for acceptance of solidary relationships". This concept highlights the idea of relevance of the emotional component which replaces the complex rational inversion in social relationships. From a purely rationalist perspective would be very difficult to process all necessary information from other's intention to make judgments about people's behavior and take

action accordingly. Lewis and Weigert (2001) claimed that it was not possible to develop plans of action which took into account all possible contingent futures. These cognitive biases were also pointed out by Yamagishi (2001). Consequently, from these points of view trust could emerge like an emotional predisposition based on limited cognitive abilities where emotions and cognitive mechanisms are constantly feeding back each other, to promote joint actions.

In this concept we can find some of the relevant aspects of trust. First the word "attitudinal" refers to a tendency to act of a certain way. This tendency could be supported by psychological and cultural aspects, reflecting the specific environment where trust arises and develops, as well as cognitive aspects involved in trust. The word "affectively" refers to the emotional aspect mentioned above. Finally, "solidarity relationships" refers to the result of trust, that is, cooperative relationships.

The predispositions that Uslaner (2002) called the "moral foundations of trust", involved a positive faithful attitude toward others when there is no information on which to build an action, which requires a collective context to emerge, providing a security sense, based on familiarity. But the psychological, cultural, emotional and cognitive elements pointed out would be implicit in this attitude. These elements could interact in several ways, resulting in different kinds of trust.

In its turn, different sorts of social relationships could emerge from these different types of trust. Therefore, it would be interesting to look for possible changes in trust types, to find out whether they go with simpler to more complex societies where there are more diverse social relationships.

In any case, it is important to distinguish the concept so far introduced, which refers to expectations of other subject's intentions, of trust generated through competency expectations (Barber, 1983), which have a clear understanding of its origin and it is closely related to specific individuals.

2.1. Emotional aspect

The emotional element is closely linked to the origin and dynamics of trust. This aspect as such motivates action to maintain or withdraw decision of trust towards others.

Regarding the origin of trust, this emotional aspect could be pertinent because trust arises as a way to face fear that creation and maintenance of risky social relations might cause by avoiding fear of uncertainty, and thus, providing a feeling of greater security.

Furthermore, there are relationships of trust with a great deal of affection implied. Normally, the level of affectivity is different in closer relationships of trust than in the weakest. Sometimes the level of affection could even be by itself a reason

for the emergence of trust without considering another argument, as in case of love relationships, in which otherwise, not mediating this feeling, the same subject might be an unreliable individual.

In highly affective close relationships, betrayal can produce high doses of pain and resentment, while in case of weaker trust relationships, treason can provoke just anger.

On the other hand, the feeling of being reliable is used to promote satisfaction in the trustee, sometimes even pride. Especially the feeling that comes from being trustworthy –a sense of approval– is a strong motivator for actions that contribute to trust maintenance, helping to keep a trusting personality.

There are studies that have analyzed more deeply the influence that emotions have to push or pull trust. For instance, according to work of Dunn & Schweitzer (2005), misattributions in judgments of others, that can elicit incidental emotions, may affect future chances of trust. In this kind of case, misattributions influence more the relation with unfamiliar trustees, which truster had less information on, than familiar ones. This is just an example of deep connection between emotions and trust relationships, and hence, to social relationships.

2.2. Cognitive aspect

Humans need some specific cognitive abilities to get possible their trust relationships, which make of trust in humans something so complex compared to other species.

The emergence of self-awareness is a necessary first step (Humphrey, 1976; Crook, 1980). Also, in the process of emergence of trust an expectation is generated about the trustee's attitude and conduct. This expectation is based first on attribution of a mental state to the trustee (theory of mind), expecting a pattern of behavior based on an analysis carried out by his context. But this expectation also involves getting relevant information by truster about trustee to take the decision to trust him, which is an analysis of multiple variables on which to infer a conclusion –a reasoning process which ends up formulating an appropriate judgment of the situation. In addition, the information collected also depends on how reality is perceived and interpreted by truster. The way we perceive what surrounds us is also part of the cognitive process implicit in trust (Good 1988).

This complex process could further include the use of schemas and stereotypes – as social categories– which sometimes support trust, as well as interpersonal attributions might be also important, about which roles people can influence the way of attributing certain characteristics in others. Also occasionally trust requires a long or medium term vision, sometimes about intentions, that may require even a future planning and also

certain complex memory capabilities that enable the collection and processing of all this information.

2.3. Psychological and cultural aspects

The psychological aspect attempts to identify what psychological traits acquired during the development of the individual, from both genetics and family, inside the social context in the early years of life, could have influenced his general tendency to trust others. This aspect may refer to an individual's attitude towards others, sometimes strangers.

Many studies have attempted to identify psychological attitudes related to trust. Rotter (1980) found that the more trustful individuals usually were also the more trustworthy and more liked by friends. They are also less likely to lie, cheat or steal, to be unhappy or maladjusted. So, Uslaner (2002) claimed too that positive self-assessment was one of the strongest predictors of trust, and Freitag & Traunmüller (2009) thought that predisposition to general trust was closely related to psychological traits such as optimistic attitude.

In this regard, Wrightsman (1966) concluded that altruistic, honest and independent people were more trusting that people with hostile attitudes toward human nature. Moreover, being a trustworthy person implied according to Hardin (2006) a strong psychological motivation to maintain this attitude of approval.

As regards the cultural aspect, by culture we mean all those intangible constructs created by a society that are recognized, shared and internalized by its members, and which influence both their collective organization and individual action. This includes norms, beliefs, customs, practices, habits, values, experiences, etc…

Consequently, it is important to consider the cultural aspect as a factor affecting trust because the whole context of beliefs, norms and values shared by a social group can modulate trust interactions in a characteristic way. Thus, for example, Yamagishi (1998) appeals to differences in forms of trust between Japanese and American people.

Within this cultural aspect, there could be included, therefore, education systems which help to individual's development; the rules formally established by governmental institutions to create a collective atmosphere of greater or lesser trust and security; as well as the implicit rules culturally transmitted between individuals of a society that are internalized as a set of exemplar trust behaviors, which are shared and supported by all members of a community, and that are based on values transmitted by generations and consolidated by habits and daily routines of their cultural practices.

Religious beliefs can also be included under this dimension. They can also encourage or limit certain trust behaviors, and the proper set of legitimate recipients.

Certain historical events that could have influenced dramatically the consolidation of certain attitudes of trust on the individuals of a population belong also to this category.

3. <u>Types of trust</u>

Interest on trust analysis comes from studies about social capital (Coleman, 1990; Fukuyama, 1995; Glaeser et al., 1999; Uslaner, 2002). The most extended trust classification considers two types: the denominated particularized trust and generalized trust (Yamagishi & Yamagishi, 1994; Uslaner, 2002). Origins of both of these two types of trust seem to be different. The former appears as a product of the more or less positive trustworthy experiences of an individual, while the later seems to be based on innate predispositions or psychological mechanisms learned in early ages of individual.

Particularized trust, called "knowledge-based trust" by Yamagishi (1998) and "thick trust" by Putnam (2000), refers to trust created between closer relationships, normally relatives, friends and acquaintances. This type seems to arise in a familiarity context of reiterated interactions where experience of daily practices can maintain or break the trust degree between people.

Generalized trust, "general trust" (Yamagishi 1998), or "thin trust" (Putnam 2000), rather refers to the "trust moral sense" of Uslaner, which is used with weaker and more distant relationships, even with strangers, and depends upon certain natural predispositions, based on faith acts towards the kind behavior of others. According to Uslaner (1999), this type of trust would be more stable and more difficult to change due to every day experiences, a contention which is controversial.

Many have attempted to explain which elements have more influence on generalized trust. For example, Glanville & Paxton (2007) suggest that generalized trust is more influenced by the context than by psychological factors; in particular, they underline the remarkable influence of neighbors and people with whom individual interacts in shops. Other studies (Bjørnskov, 2006; Delhey & Newton, 2010) also corroborate the influence of communitarian factors in generalized trust. Thus Delhey & Newton (2001) concluded that the elements that can influence the widespread of generalized trust vary depending on the specific circumstances of each country. According to Bjørnskov (2006) monarchy countries seem to show higher levels of generalized trust, and post-communist countries show higher levels of distrust. These same works, which use a sociological perspective based on statistical analysis of regressions correlating certain social indicators with trust generation, could be confusing because such indicators used to measure trust can rather be a reflection of its consequence. Also the categories chosen as explanatory variables could be implicitly interconnected, in which case they don't provide a clear argument to explain creation of trust.

From an evolutionary point of view, it could be more understandable the integration of both collective experiences and individual predispositions, admitting their interrelationship and constant feedback, to create a spectrum of trust forms, which would be linked to particular contexts.

Within these trust forms, different spheres could be distinguished that can contribute to a more sophisticated trust typology. This typology distinguishes different stages in trust formation, both throughout individual development in a given context, and also along the evolutionary process:

• The **"generalized trust"**: corresponding to the generalized trust influenced by innate and learned elements in environments of close relationships in early ages and generating a general trust attitude toward others, that could be affected by other experiences in individual's life.

• The **"personalized trust"**: corresponding to the particularized trust based on reiterated experiences with individuals forging el circle of closest relationships.

• The **"institutional trust"**: influenced by institutional agencies, which establish policies that create a framework of norms and values as socialization mechanisms, that may affect to trust in the members of the society. Authors like Luhmann (1979) studied this influence.

• The **"identity trust"**: that creates a tendency to rely on individuals with whom traits are shared, forming groups of trust. According to this view, Foddy, Platow & Yamagishi (2009) claim that "group-based trust" operates in the presence of mutual recognition of shared group membership, traits of identity, attribution of more favorable characteristics to in-group members, and the expectation of altruistic and fair behavior from them.

• The **"contextual trust"**: acquired through purely contextual features that may refer to the individual's age, sex, place of residence, origin, education, income level, etc., circumstances that could influence individual trust degree.

• The **"weighted trust"**: refers to the issue that raises the trust relationship. The truster may trust the trustee in relation to an issue but not equally in relation to another because the level of risk involved maybe differently pondered.

• The **"strategic trust"**: refers to trust based in interests, that could be mutual or not, trusting others to obtain a goal. Even if it is not based on a real sense of trust, to take this risk could be considered necessary to reach a goal. Sometimes this type is based on knowledge that the trustee will respond according to expectations because he is also interested in the trust relationship – "encapsulated interest" of Hardin (2002). In addition, this kind of trust creates the necessary environment where social capital can emerge, increasing the chances of positive response from trustee. Accordingly, this type of trust, more

than being based on real feelings of trust, would be based on a conscious intention of using this mechanism to obtain social capital.

These spheres of trust seem not be isolated, but interconnected, and influencing each other in shaping, not only a trusting personality, but also a trustworthy one.

Regarding interaction between spheres of trust, an example could be made with generalized trust. First, generalized trust can be influenced by personalized trust since the very close relationships left their mark on the social interactions during the first years of life. It may also be influenced by institutional trust since values disseminated by institutional agencies can be transmitted also in those early years, or by identity trust which can also be inculcated in behaviors during the earliest moments of life. Generalized trust could also feed itself in positive terms according to authors as Freitag & Traunmüller (2009), who claim that trust is influenced by positive experiences with strangers but not by negative experiences. Even generalized trust could be influenced by contextual, strategic, or weighted trust.

Another example of interaction with respect to weighted trust could be the work of Jones & George (1998) who distinguished between conditional and unconditional trust. The difference relates to attitudes of trust that do not involve a significant cost for truster from those trust attitudes that could require self-sacrifice at the limit, respectively. This study seems relevant because sometimes trust levels differ not just accordingly to trust objects but also because of attitudes and values promoted in certain environments to create relationships with more or less personal involvement. This case could be an example of institutional influences on weighted trust.

4. Dynamics of trust

4.1. Creation and maintenance of trust

The most primary human needs –affectivity, help, support, company and security– can be seen as the primary urges towards sociality, and therefore, as prompting the need for trust.

Among the affective motivations to trust, there are those that come from family or friends relationships, people in love (Yamagishi, 1998), or trust coming from strangers with friendly traits. The "friendly traits", include certain facial features, gestures and attitudes can contribute to a sense of trust between strangers (Scharlemann et al., 2001; Tingley, 2010).

But trust not always comes accompanied of a sentiment of affection. There may be other reasons for trust emergence separated from affective context, as we have seen above. This can be the case for "strategic trust" in the pursuit of different goals –what Hardin (2002) calls "encapsulated interest", and Yamagishi (1998), "assurance of security".

Among the motivations for strategic trust there can be the creation and maintenance of a reputation (Coleman, 1990; Cook & Hardin, 2001), the pursuit of mutual interests or shared goals (Conviser, 1973), the establishment and expansion of social networks, the obtaining of help to cope with changes, etc... Trust can be purely based on moral influences from the context in which truster operates, and not on its genuine expectations; it may also be imposed by certain commitments (Hardin, 2006). In these cases, trust does not imply a real feeling of positive expectation from the subject of trust.

Maintenance of trust could depend on kind of trust, being required in particularized trust a constant demonstration of trust in everyday experiences, building trust step by step and person to person. In a context of close intimacy between subjects, where emotions get more intensity, trust can be more vulnerable. Consequently, repetition of positive actions and experiences is required.

For generalized trust, on the other hand, a positive attitude towards others might be a more stable quality to maintain trust, although some authors consider that positive experiences might positively feedback this attitude.

And of course, as it has already been mentioned, cultural, institutional and contextual individual's environment may be other external influences in trust creation and maintenance.

4.2. Obstacles to trust

Trust is often difficult to create and maintain due to multiple factors. One among them deserves special attention: the degree of asymmetry implicit in trust (Hardin, 2002; Six, 2005), which requires a few negative experiences to reduce it, and a set of reiterated positive experiences to keep it, which constitutes a constraint to its easy expansion.

Trust is also based on perceptions and predictions about the other's behavior (Six, 2005), which suppose a weak base for the creation and maintenance of trust, being very vulnerable to purely speculative factors at the time of taking trust decisions and sometimes may be too highly malleable by policy decisions, media, educational environments, etc.

A trusting decision involves a high risk, requires great deal of openness to others, and sometimes to be exposed to behavior from subjects whose acts can produce a very intense emotional burden in truster. Trusting someone does not guarantee the certainty of that such person will respond to expectations. All these elements may cause reluctance in individuals to take such risks.

With regard to the resolution of potential conflicts of trust, the lack of a clear understanding of what trust is and how it works, as well as the multiple factors that can affect it, may make difficult its resolution.

5. Environments of emergence and evolution

5.1. Environment of emergence

Once identified the several aspects that have to be taken into account in modelling trust, it may be easier to recreate an environment in which this feature could have emerged and evolved.

In evolutionary terms, it seems reasonable to think about the emergence of trust at the closest relationships between relatives and in a family environment. These are personal relationships, created through the strong ties of basic emotions, when the individual is in a situation of dependency towards his parents during the long period of human maturation. In this period, attitudes are shaped, just as expectations about others, on the grounds of their compliance through experience. This type of relationships, which are shared by many others species, are transformed in the hominid lineage because of the new cognitive and cultural dimensions.

Thus, in more complex social environments, where trust relationships extend not just to kinship members, such behaviors require more complex cognitive capabilities, appearing as a result groups with dominant individuals, coalitions, hierarchies. These new type of relationships involve a higher social risk and consequently the need to track other's behavior to establish closer contacts with some individuals than with others. To succeed at power struggles, domination or simply survival, the cognitive capacity to generate trust could be developed as a beneficial strategy. Trust recreates the sense of familiarity that provides security in insecure contexts and this familiarity can been used to facilitate action in more complex social contexts. Primates use grooming as a means of socialization (Dunbar, 1998) creating closer relationships between group members to get certain aims –social capital. These could seem very primitive signals of trust relationships, generating that sense of familiarity.

In the human case, trust has adopted more complex features, consistent with the broader possibilities of human cognitive processing, diversifying forms of trust and gaining broader meanings. Survival in difficult environments where humans needed to acquire adaptive advantages, social bonding and cooperation made trust indispensable.

Instances of trust could help to create and improve ties; as Yamagishi (1998) claimed, "under high social uncertainty and high opportunity cost, high trusters will have a better chance to make more profits than low trusters" (pp. 56). Accordingly, individuals creating stronger and more diversified bonds of trust could be more likely to survive than those that limited trust to few people. This need to link with others for common purposes might have constituted the evolutionary pressure which encouraged

the tendency to trust as a means to reduce anxiety caused by the need of taking large risks, sometimes leaving own life in hands of others. This new scenario of socialization in small groups during most of human evolution could have been the environment of emergence of other types of trust, for example, strategic or identity trust.

According to Uslaner (2002), creation of an environment based on trust could promote cohesion and a greater tendency to help others, solidarity and union. In the early days of human evolution, in which human groups were small and where initially there could not have existed large differences of power between individuals, a more or less egalitarian social organization could have encouraged trust, benefiting of all its members.

5.2. Evolution of trust

When members of group grew in number, trust relationships could change and adapt to social relations in more complex and diverse contexts. However, personal trust with closest subjects with whom individuals interacted was maintained, in relationships with a greater emotional charge, but also was needed a more flexible typology of trust to enable actions in common with lesser-known subjects. Being cognitively too costly to maintain a strong bond with an unlimited number of subjects, which could require long time and commitment in frequent meetings (Dunbar, 2003), as well as treatment of excessive information, more flexibility in trust could be driven using other cultural resources in which humans had specialized.

In this way, in culturally and organizationally more complex societies, trust could have evolved in the forms of generalized, institutional, contextual and weighted trust, using in this process a range of emotions more complex too. Thus, for instance, generalized trust could have emerged, less based on interpersonal experience, which are impossible to extend to all known subjects, and more on a learned attitude toward others in general. In these cases, the emotional component lost intensity in affectivity but it was possible to extend the number of interactions and social capital contacts. Evolution of sociality involved the evolution of trust in a typology of more nuances and gradations.

Section 2: Network analysis and experimental games

Trust and cooperation: a new experimental approach

Several theories within different disciplines emphasize the role of trust in fostering cooperation in human social life. Despite differences, the core of these notions of trust is affectively motivated loyalty, which makes the individuals feel mutually committed and willing to accept vulnerability because of positive expectations about each other's behavior. In evolutionary game theory and experimental economics, the notion of trust is much simpler: it is an expectation about another's behavior, a kind of wager, in which the sense of mutual commitment and vulnerability is completely absent. In order to extend the paradigm of trust games typical in those fields to explore the fuller sense of trust relationships, we have developed a new experimental design, in which an iterated prisoner dilemma is played by participants who do or do not hold a trusting personal relationship, while anonymity is preserved. We present here the results of our two pilot studies, which indicate the relevance of personal trust in fostering cooperation and suggest the influence of the structure of social networks on the degree of cooperation achieved.

1. <u>Introduction</u>

Since Mauss' *Essay on the Gift* (Mauss, 1925) and Arrow's *The Limits of Organization* (Arrow, 1974) the notion that trust fosters human cooperation has become a kind of truism. However, it is a truism that has not been easily accommodated within the framework of rational decision theory of collective action. Several proposals from different disciplines have underlined the role of trust in social life as a missed dimension in the mainstream approach to the social sciences. From the theory of social capital in sociology (Coleman, 1988, 1990; Fukuyama, 1995; Putnam, 2000), to Ostrom's theory of social self-regulation in institutional economics and political science (Ostrom, 1990; Poteete et al., 2010), trust has received much attention as a key social factor that cements social groups, fosters cooperation, deters free-riding, and averts social dilemmas (Rothstein, 2005; Ostrom, 2009).

All these theories share an understanding of trust as an extra familiar, affective relationship that grounds mutual normative expectations and reciprocal commitments. These norms may be explicitly formulated, but are often just implicitly assumed. In any case, they are as different from contracts as they are from rational calculations. When engaging in a relationship of this kind, one puts oneself at risk of being exploited while

believing that this risk is minimal or nonexistent, and one is aware that the partner runs a risk but expects not to be exploited, because of an affective binding relationship. Social psychologists have studied these kinds of relationships and tried to understand how trust is built, kept, and restored in case of a breach (Lount et al., 2008). Social psychology also distinguishes between this central phenomenon of particular or personal trust (Conviser, 1973), and generalized or impersonal trust, that is, a general disposition regardless of effective relationships of trust related to personality differences, contextual and institutional factors, and previous experience (Bjørnskov, 2006; Freitag & Traunmüller, 2009). Generalized trust, for instance, has been shown to be sensitive to the in-group/out-group dimension: people naturally trust members of the same social group more than members of other groups (Eckel & Grossman, 2005; Chen & Li, 2009; Chen & Yan Chen, 2011; Brañas-Garza et al., 2012). There has also been interest in studying the means by which individuals identify others as being trustworthy (Janssen, 2008).

This trend in the social sciences contrasts with the way trust has been dealt with by game theory, where approaches that use it as the basic tool, such as experimental economics and evolutionary theory, take for granted a self-interested view of the participating agents (Camerer, 2002; Ostrom & Walker, 2003). Within this framework, the notion of trust is rather different: it is seen as a sort of prediction, an expectation about others' behavior, which can be viewed as a proxy for the social psychological notion of generalized trust (Deutsch, 1958, 1973). So called trust games, in which any contribution to the common pool generates further resources that are equally distributed, do not, in fact, involve relationships of personal trust among agents, but rather a kind of bet on what others will do. Therefore, the normative and affective dimensions of trust, and the reciprocal commitments, are absent in such games.

Trust games have shown that agents exhibit a disposition to cooperate, which is contrary to the predictions of rational decision theory. Between 40% and 60% of subjects contribute assets to the provision of the public good in a one-shot public good game (Davis & Holt, 1993; Offerman, 1997), and about the same percentage of participants contribute to the common pool in the first round of a finitely repeated prisoner's dilemma. The rate of contribution decays over time, but never reaches the predicted zero level (Isaac & Walker, 1988). Of course, personal trust may develop out of a series of mutually benefiting interactions, so that what could begin as a tit-for-tat strategy that is reciprocated may end up fostering real trust (Yamagishi et al., 2005; Poteete, 2010). However, given the anonymous way such games are played, this possibility is, in fact, excluded in principle from consideration.

To experimentally study the role of the core, personal notion of trust in cooperation, we have tried to develop a new experimental design to test the influence of personal, particular trust relationships in social cooperation. We also want to investigate whether the structure of trust relationships within a group has an influence on the level of cooperation achieved (Curry & Dunbar, 2011; Kovářík et al., 2012).

In this report, we present this experimental design and the result of two pilot studies in which it has been implemented. In our procedure, we ask each participant belonging to the same group to play an iterated prisoner's dilemma with either an anonymous individual from within her network of trust within the group or with someone from the group but outside of her network of trust. This second condition amounts to a control condition, where cooperation is expected to be similar to standard levels found in public goods/trust games. In addition, we manipulate whether the participants know how many rounds of the game they are to play. In the first study, participants knew how many iterations the game was going to have (a finite supergame), whereas in the second they did not, to approximate an infinite supergame (Dal Bó & Fréchette, 2011). In this manner, we may distinguish between cases where cooperation is the outcome of a self-interested strategy that has reached the cooperation equilibrium, and cases where cooperation is, in fact, the outcome of trust. Although agents initially deciding to cooperate on the grounds of a rational strategy, such as tit-for-tat, can keep cooperating in an infinite supergame (if that equilibrium is reached, even if cooperation may decrease due to the discount rate of the players), they are expected to defect at least on the last round of the game, if they know that it is the final round (Murnighan, 1981; Rubenstein, 1982), while trusting agents will keep cooperating.

To measure the influence of personal trust on cooperation, we developed four indicators of cooperation: (1) the proportion of participants selecting cooperation as their first choice; (2) the proportion of fully cooperative participants; (3) the proportion of full mutual cooperation along the game; and (4) the difference in cooperation choices between the first and third rounds of the game. The results indicate that more cooperation, in any way that it could be measured, took place in the personal trusting condition (TC) than in the non-trusting condition (NTC). The results reached statistical significance in just one of the pilot studies, the one in which the participants knew how many rounds of the game they would be playing. As expected, it was also the group with a significantly higher measure of personal versus generalized trust. Interestingly, this higher degree of personal trust correlates with a different structure of trust relationships within the group.

2. Method

2.1. Participants

Two studies were conducted: one with PhD students and post docs from a research center at the University of Cambridge (UCAM); and another study with first-year education students from the University of the Balearic Islands (UIB). In both studies, a whole group was recruited.

Study 1: UCAM. This group comprised 13 participants, seven males and six females, aged 24–41 years old (M = 30.46, SD = 5.06), of different nationalities; four

were Catholics, one was Buddhist, and eight were of no religious affiliation. Most were unmarried and monthly income was variable: three below €500, four between €500 and €1,000, and six between €1,000 and €3,000 euros. Their participation was completely voluntary.

Study 2: UIB. This group comprised 31 participants, 9 males and 22 females, aged 18–38 years old (M = 20.35, SD = 5.03), of Spanish nationality, 41% Catholics and 59% declared nonbelievers; mostly students, unmarried, and with monthly expenses below €500; just 23% of them declared spending €500–1,000 per month. They participated in exchange for course credit and an additional prize depending on how many points they gained. At the time of participation they did not know either what the prizes were or how many points they would need to obtain them. It was later revealed to them what they had gained: from drinks to a memory stick.

2.2. Procedure

2.2.1. Questionnaires

In both studies, participants first filled in two questionnaires prepared by us. One questionnaire explored generalized trust (Annex 1), to control for the possible influence of this factor, involving several subscales, including institutional trust, personality traits (openness, extraversion, responsibility, neuroticism, and agreeableness), previous experiences of disappointment, etc., that may influence whether the individual would cooperate or defect (Acedo & Gomila, 2012; Lejarraga, Dutt & González, 2012). The second questionnaire gauged personal trust (Annex 2): each participant had to write the names of three people in the group they trusted, and answer a set of questions about each relationship. From these questionnaires, we obtained measures of generalized and personal trust for each group. Participants were asked not to discuss their answers to the questionnaires. The questionnaires allowed us to give each participant scores of personal and generalized trust on a scale from 0 to 100.

Based on their responses to the second questionnaire, we assigned each of the participants to a different partner, for each condition, and appointed them for a second session, a couple of weeks later, in which there were to play the iterated prisoner's dilemma.

2.2.2. Iterated prisoner's dilemma

Each participant twice performed an iterated prisoner's dilemma, with three repetitions. In the first condition, each participant played with one person she said she trusted, without knowing which one in particular, to maintain anonymity ("trust circle" condition: TC); in the second condition, each participant played with someone from the

same group, but who was not mentioned as particularly trusted (NTC). Both conditions were presented in a counterbalanced order, and all participants did both.

In the UCAM study, participants knew that the game would be repeated three times. In the UIB study, they did not know how many rounds would be played. In both studies, the participants played at the same time but in different places, communicating through the researchers, to maintain anonymity.

The prisoner's dilemma was presented first to participants in a training phase, where they had to make five choices in a row as practice, to make sure they understood the pay-off matrix (Fig. 9).

P1	P1	P2	P2
C	3	3	C
D	6		C
C		6	D
D	1	1	D

Figure 9. The prisoner's dilemma payoff matrix: C means cooperate and D means deceive. P1 is participant 1 and P2 is participant 2.

After that, they were informed of the assigned condition (TC or NTC), and depending on the group, the number of rounds to play; then they were asked to decide whether to cooperate or deceive, without knowing the partner's decision. In the second and third rounds, the participants were informed of the partner's choice in the previous round, and the points obtained. Both participants had the same information and were under the same conditions.

At the end, the points obtained in each decision were added. This concluded the UCAM study. In the UIB study, the points obtained were converted to corresponding prizes a week later.

3. Results

3.1. The influence of personal trust on cooperation

To measure the level of cooperation, we have developed four indicators: (1) the proportion of cooperation choices; (2) the proportion of participants who cooperate in the three decisions; (3) the proportion of mutuality, that is, when both players always cooperate; and finally, (4) the contrast between the cooperative decisions in the first

decision and in the third. We compared these data in both studies and under both conditions.

Study 1: UCAM. The results for the UCAM group are shown in Figure 10.
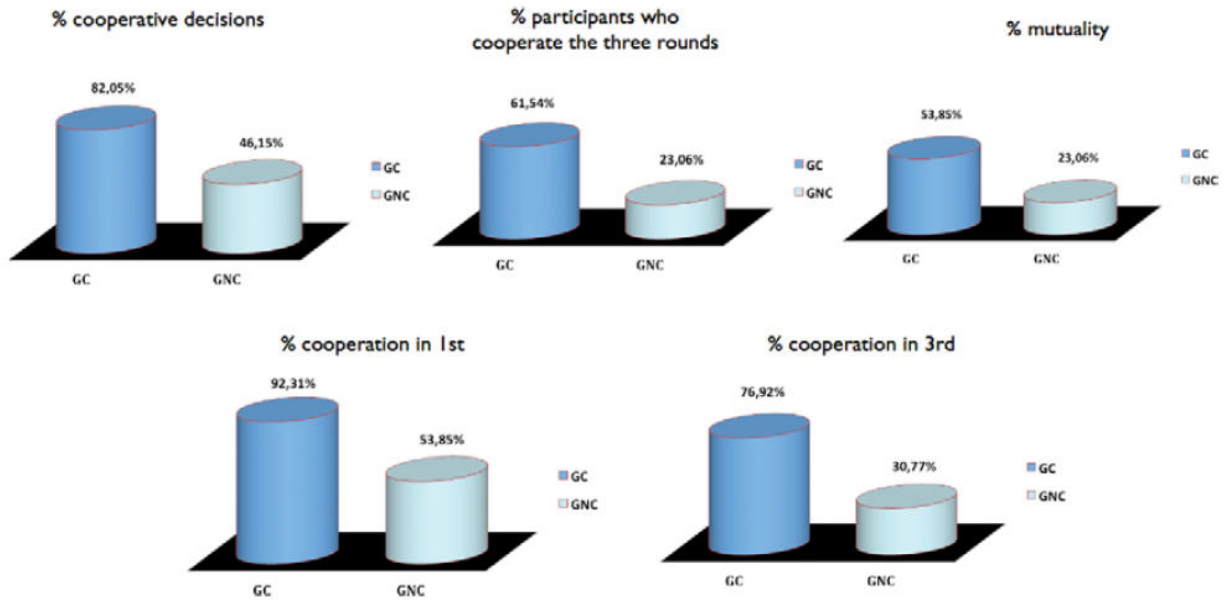
Figure 10. The results of the UCAM study.

One-tailed McNemar tests demonstrated that there was a significantly higher proportion of cooperation in the trust condition than in the other condition, for each dependent variable. Thus, the percentage of cooperation was 82.05% in TC, and 46.15% in NTC ((1, n = 13) = 4, P < 0.02); the percentage of participants who always cooperated was 61.54% in TC and 23.06% in NTC ((1, n = 13) = 5, P < 0.05); the instances of mutuality were 53.85% in TC and 23.06% in NTC ((1, n = 13) = 4, P < 0.05); and in the TC cooperation shifted from 92.31% in the first round to 76.92% in the third, while in the NTC, cooperation shifted from 53.85% to 30.77% (for the first round, (1, n = 13) = 5, P < 0.05; for the third, (1, n = 13) = 4.5, P < 0.05). Note that this group was told that they would play the IPD three times, and there were no prizes delivered at the end.

The UCAM group scored 61.5 in the generalized trust questionnaire, and 81.3 in the personal trust questionnaire, which indicates a significantly higher level of personal trust among its members.

Study 2: UIB. The results for the UIB group are shown in Figure 11.
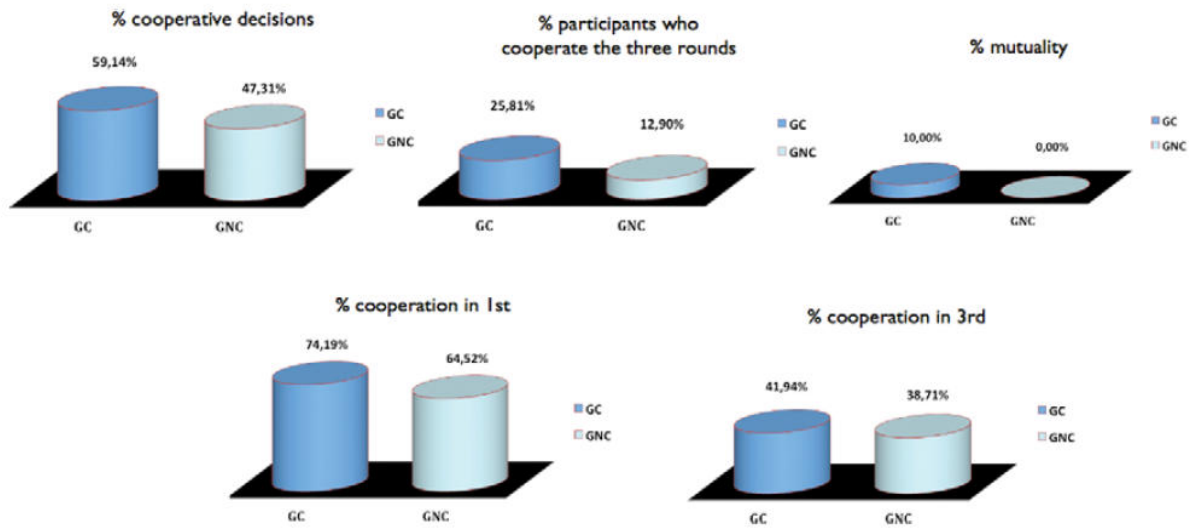
Figure 11. The results of the UIB study.

One-tailed McNemar tests demonstrated that there was not a significantly higher proportion of cooperation in the trust condition than in the other condition, for each dependent variable in this group. Thus, the percentage of cooperation was 59.14% in TC and 47.31% in NTC ((1, n = 31) = 0.305, P < 0.25); the percentage of participants who always cooperated was 25.81% in TC and 12.9% in NTC ((1, n = 31) = 2.66, P < 0.2); the instances of mutuality were 10% in TC and 0 in NTC ((1, n = 31) = 3, P < 0.1); and in the TC cooperation shifted from 74.19% in the first round to 41.94% in the third, while in the NTC cooperation shifted from 64.52% to 38.71% (first round, (1, n = 31) = 0.692, P < 0.5; third round, (1, n = 31) = 0.066, P < 0.5). In this case, the participants were not told how many times they would play, and received prices in exchange for the points obtained in the game.

This group scored 71 in the generalized trust questionnaire, and 69.04 in the personal trust questionnaire, which is not a statistically significant difference.

3.2. The structure of the group

Given the procedure, we were also able to represent the trust relationships within the groups in each study (Fig. 12).
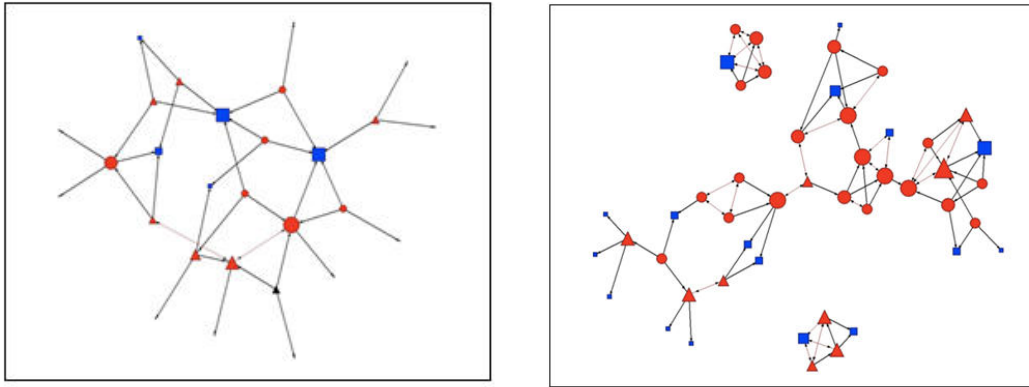
Figure 12. The group networks of both studies. UCAM group on the left and UIB group on the right. Circular nodes represent female participants and triangular nodes represent male participants. Red nodes refer to the study participants and square and blue nodes refer to mentioned trustee individuals not involved in the study. Size node refers to nodal degree.

Each member is represented as a node in a social network, and the size of the node represents social relevance (the number of people that trust this person). In these networks, the groups exhibit different patterns: while the UCAM network has a spider web form, revealing a high degree of cohesion and integration dependent upon close-knit groups of central individuals, the UIB network exhibits a more scattered distribution of trust. There are even isolated subgroups (cliques). The network appears weakly integrated, crucially dependent upon a reduced number of individuals. In this network, we find greater number of coupled relationships but less cohesion.

4. <u>Discussion and conclusion</u>

The pilot studies provide support to the notion that personal trust fosters cooperation, and offer a promising new experimental methodology to study it. As expected, the different measures developed clearly indicate a greater degree of cooperation when playing with a trusted partner than when playing with somebody else (even if from the same group). In the latter case, we found levels of cooperation similar to those found in standard trust/public goods games, those which block the possibility of personal relationships playing a role in the interaction. Personal trust fosters higher levels of cooperation and reciprocity: the results suggest that the higher the strength of the trust bond, the greater the cooperative attitude.

Cooperation was also higher in the trust condition in the UIB study, but the differences failed to reach statistical significance, probably because of the lower degree of personal trust, in comparison with the Cambridge group, while their respective measures of generalized trust were similar. The fact that the UIB group that volunteered to participate was one of first-year undergraduates may explain their lower level of personal trust, and hence a smaller difference between personal and generalized trust.

Interestingly, this difference in particular trust between the groups seems to be connected to the different topologies of their respective social networks, but in a way that has yet to be explored.

Equally, as expected, trust helps overcome the well-documented trend of declining cooperation as the end of the game approaches (or because of applying a discount rate). In the Cambridge group, where personal trust is high, mutuality was also remarkably high, over 50%, even when the number of iterations was known, and during the last round of the game. The UIB group, with lower personal trust, showed the standard decline in cooperation, reaching a similar level in both conditions.

However, these studies are not enough to prove the point, even if one of the studies reached statistical significance: the procedure is now being applied to bigger groups, better chosen in terms of group level of personal trust. But these studies have been useful in devising the procedure, and finding ways to improve it. Personal trust measurement also needs more stringent criteria. On the other hand, it might be that playing for just pretend incentives, as in the Cambridge study, makes cooperation easier.

In this regard, the most intriguing result of these pilot studies concerns the role of the topology of the social network in fostering cooperation, beyond the personal relationships between each pair of members (Cook & Hardin, 2001). Personal trust, in addition to reputation, might account for the emergence of indirect reciprocity in a group (Nowak & Sigmun, 2005), through the impact it may have upon social cohesion and integration. This raises the possibility that the higher levels of cooperation in the UCAM group reflect not only a higher degree of personal trust but also to the structure of the social network. Group size (13 vs. 31) may also play a role in this regard, as well as the number of nominated trustees in the questionnaire. This is something that deserves further investigation, by means of an agent-based evolutionary model.

Overall, we found few people defecting all the time, and few people cooperating no matter what. The most common strategy was conditional cooperation, where trust increases the possibilities to cooperate, and cooperation, in turn, reinforces trust (Six, 2005). But there also appears to be two types of conditional cooperators in anonymous interactions: collaborators, who cooperate if their partner also cooperates, and deceivers, who cooperate to first, encourage partner cooperation and then cheat on them. Finding ways to better infer agents' strategies from their behavioral choices is needed, just as experimental research needs to be combined with anthropological fieldwork (Henrich et al., 2004), to further our understanding of trust in the real world.

Personal trust increases cooperation beyond general trust

In this paper we present a new methodology which, while allowing for anonymous interaction, it also makes possible to compare decisions of cooperating or defecting when playing games within a group, according to whether or not players personally trust each other. The design thus goes beyond standard approaches to the role of trust in fostering cooperation, which is restricted to general trust. It also allows considering the role of the topology of the social network involved may play in the level of cooperation found. The results of this work support the idea that personal trust promotes cooperation beyond the level of general trust. We also found that this effect carries over to the whole group, making it more cohesive, but that higher levels of cohesion rely on a particular topology. As a conclusion, we hypothesize that personal trust is a psychological mechanism evolved to make human social life possible in the small groups our ancestors lived in, and that this mechanism persists and plays a role in sustaining cooperation and social cohesion.

1. <u>Introduction</u>

Current approaches to the evolution of cooperation share the notion that any viable account must assume that cooperation is in the interest of the cooperator. All these models take it for granted that agents are self-interested, and that the only way to account for the evolution of cooperation is to show that it is in the interest of the agents. This can be due to the fact that reciprocity can be beneficial to both parties, at different times, and can be reinforced either directly (Trivers, 1971), or indirectly (Nowak & Sigmund, 1998; Wang et al., 2012); or to the fact that defectors are somehow punished (Gintis, 2000; Boyd et al., 2003; Gintis et al., 2003; Wang et al., 2013). Thus, a rational agent is expected to cooperate in an iterated prisoner's dilemma (IPD) just when it is in its own interest and in addition is able to resist the discount of the future.

This standard model of the rational agent, though, does not fare well with the evidence, which rather reveals the existence of genuine pro-social preferences in humans: an interest in another's welfare, even if this may involve a cost to oneself (Tomasello & Vaish, 2013). Therefore, these social preferences should be included in the explanation of the evolution of cooperation (Bowles & Gintis, 2011; Fehrler & Przepiorka, 2013; Rosas, 2013). This requires providing an account of how these social preferences evolved in the first place, and how they sustain the forms of cooperation

that can be found across societies. However, social preferences are still regarded with skepticism by some researchers (Binmore & Shaked, 2010), and have not yet found a proper treatment in evolutionary games models. In part, this is due to the conditional strategies followed by agents, which may cooperate or defect depending on the partner's decisions. This conditionality may be interpreted as suggesting that agents are not guided by social preferences in general, always and everywhere, which may also invite a self-interested account –social preferences as a form of hypocrisy.

In this paper, we want to contribute to the defense of social preferences by focusing on personal trust, a powerful psychological mechanism that can be seen, from an evolutionary point of view, as a way to solve social dilemmas by making one feel certain that our counterpart will be loyal and choose to cooperate and hence, making one feel committed to cooperate. This is achieved, neither by an external threat of punishment, nor by some sort of rule enforcing authority, but by an affectively grounded, benevolent attitude towards the trusted person that is derived from previous interactions (Tanghe et al., 2010; Lee et al., 2011). In other words, personal trust puts one in a situation of risk of being exploited, while believing that one will not be exploited, because of the feeling that binds one with the counterpart. Therefore, it is a complex psychological state, which relates two people, with a previous story of positive interactions, and which involves both a cognitive and an affective dimension, and which gives rise to a pro-social attitude between them.

Many proposals have underlined the role of trust in our social life. Trust is of great interest in the social (Lewis & Weigert, 2001; Delhey & Newton, 2003), political (Almond & Verba, 1963; Luhmann, 1979; Inglehart, 1988; Tilly, 2005), and economic sciences (Ostrom & Walker, 2003; Murphy, 2006; Bouma et al., 2008), that consider cooperation to be a fundamental aspect of the organization and maintenance of cohesion in the large societies of nowadays. These disciplines are interested in which factors increase the level of trust and cooperation within and between societies. The factors that have received more attention are the creation of rules, institutions, ideologies, and the promotion of social habits that increase and support social networking for practical purposes –under the notion of ''social capital'' (Coleman, 1988; Putnam, 1994; Fukuyama, 1995; Cozzolino, 2011). Similarly, social psychology has explored the differences between intra- and inter-group behavior, as regards cooperative behavior (Smith & Postmes, 2009; Böhm & Rockenbach, 2012).

It's arguable, however, that these approaches have mostly relied on the notion of general, rather than personal trust (Putman, 1994, 2000; Stolle, 1998; Yamagishi, 1998; Glaeser et al., 2000). General trust is an attitude towards any other person. It is clear that this general attitude fosters cooperation (Rothstein, 2005) and provides conditions concerning communication, reputation, etc. (Poteete et al., 2010). As a matter of fact, general trust can be viewed as the psychological factor in play in so-called ''trust games'' in experimental economics, where ''trust'' is just taken to mean an expectation about how the partner will choose (Deutsch, 1958, 1973). General trust can help explain the robust fact that in games played anonymously, cooperation is found about 50% of

the times in the first round and then decays (Dawes & Thaler, 1988; Ledyard, 1995; Fehr & Schmidt, 1999; Ostrom & Walker, 2003). But typical game playing is incompatible with personal trust because it is designed to keep anonymity. Therefore, even though general trust may contribute to cooperation, what remains to be shown is whether personal trust may also have a role –one that may be even more important (Arrow, 1974; Balliet & Van Lange, 2013).

In fact, personal trust can help explain the pro-social attitudes observed in many cooperative behaviors. It proceeds through the tendency, often unconscious, to cooperate more with those people one trusts, because this affective bond involves an implicit expectation of reciprocity. In addition, an evolutionary perspective clearly suggests that human social life finds its roots in small groups, where everybody can interact with everybody else, and is known by everybody in the group. This suggests that it is personal trust that matters in these small-scale groups (Marlowe, 2005). Even if it were possible to develop global measures of social cohesion (such as social capital theory suggests), the particular bonding pattern of particular members –as suggested by personal trust–, seems to be the central factor in fostering cooperation, the one upon which any other relies, even in large societies.

Interestingly, recent work on evolutionary games provides indirect theoretical support to this approach. Several models introduce as a new factor some sort of heterogeneity among the individuals, so that individuals in a social network are not equally likely to interact with each other (Perc & Wang, 2010; Tang et al., 2013; Zhua et al., 2014). Personal trust may be ''the missing link'' in these models, the psychological mechanism by which the network topology is structured. The critical point is that the network topology fosters cooperation by itself. From this point of view, this theoretical work can be interpreted as a way to account for the evolution of social preferences. Our empirical study will also consider this implication.

Therefore, we hypothesize firstly that personal trust has a greater weight than general trust in fostering cooperation (H1). Furthermore, we also hypothesize that personal trust among group members is the key to the cohesion of the social group, so that the higher the level of personal trust, the greater the group cohesion (H2). In other words, personal trust fuels cooperation even with non-personally trusted agents, just because it structures social networks. Consequently, we also hypothesize that personal trust generates a characteristic social network of cliques, which is the structure through which cooperation spreads beyond the trust circle (H3).

To test these hypotheses, this work integrates several methodologies: questionnaires, an experimental game –an iterated prisoner's dilemma–, and social network analysis. The questionnaires allow us to measure both general and personal trust, in a group of people. The experimental game allows us to organize participants in such a way that, while keeping anonymity, they can play with one of their trusted members within the group. It also allows, by letting the participants know that it will be played three times, to check whether cooperation is conditional on strategic calculation

(of reciprocity or backwards induction), or it is based on personal trust. We also pay attention to the social network structure (Radcliffe-Brown, 1940; Barnes, 1954; Milgram, 1967; Mitchell, 1969; Wasserman & Faust, 1994; Molina, J.L., 2001; White & Harary, 2001; Newman et al., 2003; Freeman, 2004) and cooperative behaviors (Eguíluz et al., 2005; Fowler & Christakis, 2010), to ascertain whether social network topology has a role of its own in fostering cooperation (Curry & Dunbar, 2011; Gracia-Lazaro et al. 2012).

This study builds on a previous pilot study (Acedo-Carmona & Gomila, 2013), which already showed an effect of personal trust on cooperation. This work tries to overcome the limitations of the previous one, regarding the number of participants and the time of previous interaction within the group. We have also improved our questionnaires to measure general and particular trust. In addition, we have developed an in depth analysis of the structure of the trust networks involved.

2. Methods

2.1. Ethics statement

This study was approved by the Ethics Committee of the University of the Balearic Islands. Written informed consent was obtained from each participant prior to participation, as approved by the Ethics Committee.

2.2. Participants

Participants in this study were two groups of 54 third-year undergraduate students: a group of 40 Psychology (PSYCHO) students, and a group of 14 Physiotherapy (PHYSIO) students, from the University of the Balearic Islands. Their global characteristics are: 26% males and 74% females; aged between 20 and 49 years old (Mean6 SE = 22.4360.67, N= 54); mostly of Spanish nationality; 41% Catholics, 57% declared non-believers, and 2% Orthodox; in their vast majority just students 280%–, while the rest carry out other activities: 9% part-time employees, 2% liberal professionals and 2% government workers; 93% are unmarried. About their economic possibilities, 80% has monthly expenses below 500 euros, 15% are consumers of between 500 and 1,000 monthly euros and 5% has expenses of more than 1,000 monthly euros.

2.3. Procedure

2.3.1. Trust measures through questionnaires

Different scales have been developed to measure trust, aimed at different goals (Fey, 1955; Rosenberg, 1957; Wrightsman, 1964, 1974; Rotter, 1967; Survey Research

Center, 1969; Christie & Geis, 1970; Johnson-George & Swap, 1982), including occasionally the analysis of close relationships (Rempel et al., 1985). For our study, we have chosen the most well-established items in the literature to prepare our own questionnaires: one for general trust and one for personal trust. Whereas personal and general trusts are different notions, they are somehow related; that's why some items are repeated in both questionnaires.

The general trust questionnaire (Annex 3) involves 5 questions widely used in literature concerning attitudes towards other people in general: one on perceived fairness (World Values Survey Association, 2009); one on relational trust (Yamagishi, 1998), and three questions on what trust is about: money, secret information, and care of beloved ones (Johnson-George & Swap, 1982), with answers ranging on a 5-point Likert scale.

To obtain a measure of personal trust, we first asked our participants to name 5 people they trusted in their classroom group, and then they had to answer our second questionnaire, about particular trust, for 3 of them (Annex 4). Six questions concern the participants' expectations about their trustees on lending and borrowing money, caring for the beloved ones and sharing secrets –similar to some questions used in the general trust questionnaire, but now related to the particular individuals they say they trust–, and two more questions to get one more accurate measure of the level of personal trust according to each particular trustee such as: getting help if moving, or being defended by the trustees at their own expense or personal effort. All of them are to be rated on a 5-point Likert scale as well.

Each measure is then expressed as a percentage, with 100% meaning maximal trust (either general or personal).

2.3.2. Iterated prisoner's dilemma

Several days after filling in the questionnaires, each participant played an iterated prisoner's dilemma, with 3 repeated decisions, paired with another member of the group, in two experimental conditions. In one condition –trust circle condition (TC)–, each participant played with somebody from their trust circle without knowing which one in particular. In the other condition –non-trust circle condition (NTC)–, the iterated prisoner's dilemma was played anonymously with somebody also from the classroom, but not mentioned as a trusted one. Players were placed in different rooms, and their respective decisions were communicated after each round of the game. Half the participants played first in the TC, half played first in the NTC. Both participants had the same information and were under the same conditions.

In each round, participants were asked to decide whether cooperate with, or defect to, their partner, before knowing the other player's decision, in order to obtain a number of points which depended on the decisions of both players, with the possibility

of obtaining a maximum of 6 points or a minimum of 0 points in a round, as specified in the pay-off table (Fig. 13).

P1	P1	P2	P2
C	3	3	C
D	6		C
C		6	D
D	1	1	D

Figure 13. The prisoner's dilemma pay-off matrix: (C) means cooperate and (D) means defect, (P1) is participant 1 and (P2) is participant 2.

Most importantly, they knew in advance they would be playing the game three times in each condition, as the way to tell apart self- interested cooperation from trust-inspired cooperation. The decline in cooperation as the game proceeds is only expected when cooperation is driven by self-interest (Dawes & Thaler, 1988; Ledyard, 1995; Fehr & Schmidt, 1999).

According to the number of points obtained after going through both conditions, participants got different awards. The higher the score, the bigger the prize won. The prizes ranged from a ticket for a snack to a pack of CDs. However, participants were ignorant of the prizes until all of them completed the study –in order to make them play under the same conditions.

3. Results

3.1. Particular and general questionnaires

Global personal and general trust scores are represented in Fig. 14.
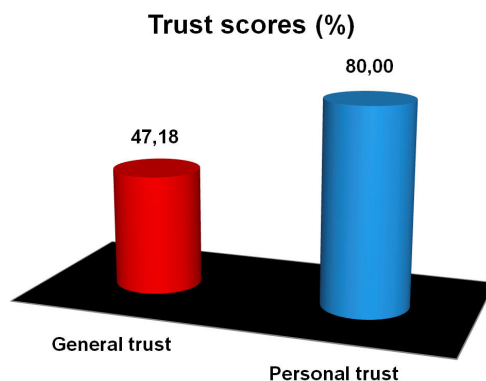
Trust scores (%)

Figure 14. Global scores of general and personal trust.

Personal trust scores are higher than general trust scores. We obtained a significant difference –Wilcoxon text– (z = - 6.393, N = 54, p < 0.001, r = - 0.86) between means of personal trust scores (Mean ± SE = 7.99 ± 0.13, SD = 0.96, N = 54) and general trust scores (Mean ± SE = 4.71 ± 0.12, SD = 0.91, N = 54).

Personal and general trust scores were also calculated separately for the PSYCHO (General trust score: Mean ± SE = 46.8 ± 1.80, SD = 6.73, N = 14; Personal trust score: Mean ± SE = 85.6 ± 2.60, SD = 9.73, N = 14) and PHYSIO (General trust score: Mean ± SE = 47.3 ± 1.56, SD = 9.87, N = 40; Personal trust score: Mean ± SE = 77.9 ± 1.40, SD = 8.85, N = 40) groups. We found that, while the differences in general trust score were not significant –Mann- Whitney test– (U = 270.5, z = - 0.19, N = 54, p < 0.9, r = - 0.02), the differences in personal trust score were significant (U = 158, z = - 2.41, N = 54, p < 0.02, r = - 0.32) (Fig. 15).
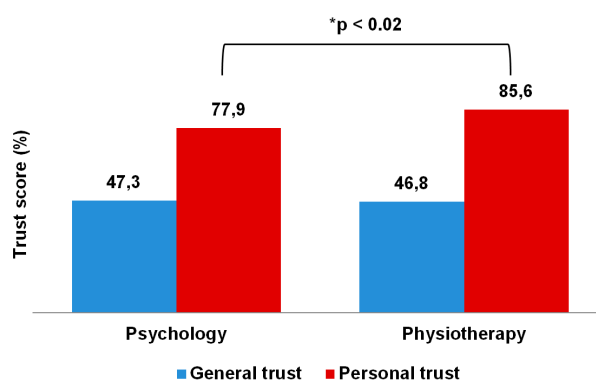
Figure 15. General and personal questionnaires scores by groups. (*) Significant difference in personal trust score between PSYCHO and PHYSIO groups –Mann-Whitney test.

Detailed means and standard deviations obtained for each item of the questionnaires appears in Tab. 1 for general trust and Tab. 2 for personal trust.

Scales and items	Mean	PSYCHO mean	PHYSIO mean
General trust scale	2.36 (0.60)	2.38 (0.61)	2.34 (0.61)
Do you think most people would try to take advantage of you if they got a chance or would try to be fair?	3.24 (0.97)	3.20 (1.01)	3.35 (0.84)
Generally, a person with whom you have had a longer relationship is likely to help you when you need it.	2.22 (1.16)	2.27 (1.26)	2.07 (0.82)
Would you lend some of your property to an unknown person?	2.50 (1.01)	2.51 (1.04)	2.50 (0.94)
Would you leave the care of someone important to you to a stranger person?	1.57 (0.71)	1.47 (0.64)	1.85 (0.86)
Would you share personal information with stranger people?	2.29 (0.86)	2.42 (0.84)	1.92 (0.82)

Table 1. Results of the general trust questionnaire by items and groups**.**

Scales and items	Mean	PSYCHO mean	PHYSIO mean
Personal trust scale	4.00 (0.40)	3.89 (0.41)	4.28 (0.36)
Do you think that XX would you lend you a large sum of money if he/she had so much?	3.71 (1.00)	3.59 (1.03)	4.07 (0.83)
Do you think that XX would return you a loan of a large sum of money?	4.50 (0.75)	4.43 (0.74)	4.71 (0.74)
Would you leave to XX the care of something very valuable for you?	4.30 (0.80)	4.17 (0.85)	4.66 (0.52)
If you had a secret that could be very harmful for you if it did become public, would you feel safe to share it with XX?	3.85 (1.09)	3.71 (1.13)	4.23 (0.87)
Do you think that XX would provide help to you in a move?	4.18 (0.94)	4.15 (0.91)	4.26 (1.03)
If XX had to defend you hurting himself, do you think he/she would do?	3.43 (0.89)	3.33 (0.90)	3.73 (0.79)

Table 2. Results of the personal trust questionnaire by items and groups.

Personal and general trust scores may be partially connected (Acedo-Carmona & Gomila, 2012), although they are different measures. In fact, we found that personal trust score correlates –one-tailed Kendall's tau measure– with general trust score ($r = 0.256$, $N = 54$, $p < 0.01$).

3.2. Cooperative behavior in prisoner's dilemma

To measure the level of cooperation, we developed four indicators: a) proportion of cooperative choices; b) proportion of participants who cooperate in the 3 decisions; c) proportion of mutuality, i.e., when both players always cooperate; and, d) the contrast between the first and in the third rounds. We compared these data in both conditions. Results appear in Fig.16.
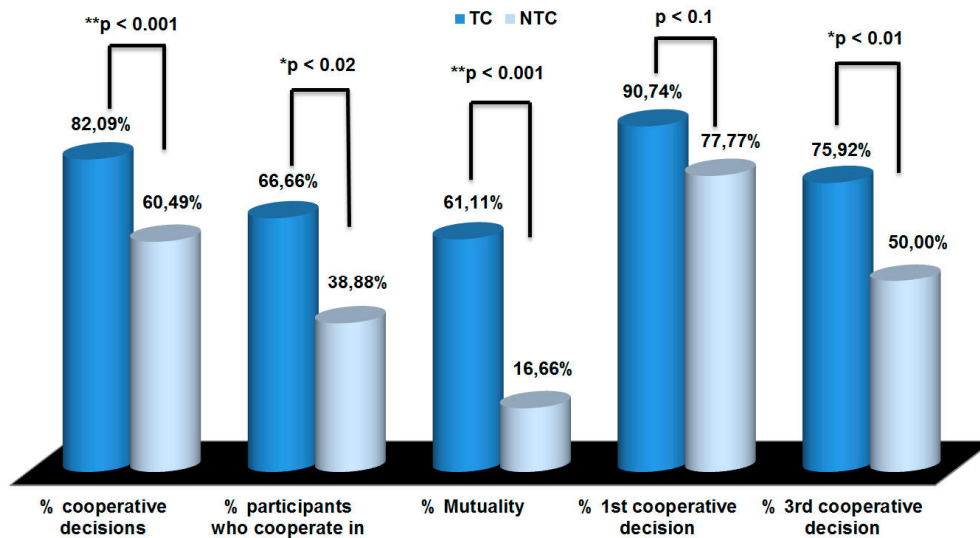
Figure 16. Level of cooperation in the IPD. (*) Significant and (**) very significant differences –One-tailed McNemar tests.

One-tailed McNemar tests demonstrated that there was a significant higher proportion of cooperation for each of the dependent variables in the TC than in the NTC, except as regards the first decision, whose differences failed to reach significance. Thus, the percentage of cooperation was 82.09% in the TC, and 60.49% in the NTC ($X2$ (1, n = 54) = 11, p < 0.001); the percentage of participants who always cooperate was 66.66% in the TC and 38.88% in the NTC ($X2$ (1, n = 54) = 6.53, p < 0.02); the percentage of mutuality was 61.11% in the TC and 16.66% in the NTC ($X2$ (1, n = 54) = 16.94, p < 0.001); and in the TC cooperation shifted from 90.74% in the first round to 75.92% in the third one, while in the NTC, cooperation shifted from 77.77% to 50.00%: for the first round, ($X2$ (1, n = 54) = 3.26, p < 0.10); for the third round, ($X2$ (1, n = 54) = 7, p < 0.01).

We also found the general tendency to defect on the final round, but the decline in cooperation from the first to the final decision was higher in the NTC ($X2$ (1, n = 54) = 9.03, p < 0.01) than in the TC ($X2$ (1, n = 54) = 4.26, p < 0.05), according to a Pearson chi-square measure.

3.3. Analysis of trust networks

Given the significant differences found in personal trust between the two groups, we decided to analyze whether they were related to differences in group cohesion, as hypothesized (H2). We built the trust networks of the two groups –PSYCHO and PHYSIO–, on the grounds of the group members info supplied in the personal trust questionnaire by each participant, using the Gephi software (Bastian et al., 2009). Given the different number of participants in each group, we also compared the structure of each network to an equivalent random one (one of identical number of nodes and links), which represents the null hypothesis. In this way, we could also examine our hypothesis concerning the role of network topology to cooperation (H3).

The network structure of the 2 groups –PSYCHO and PHYSIO– appears in Fig. 17.
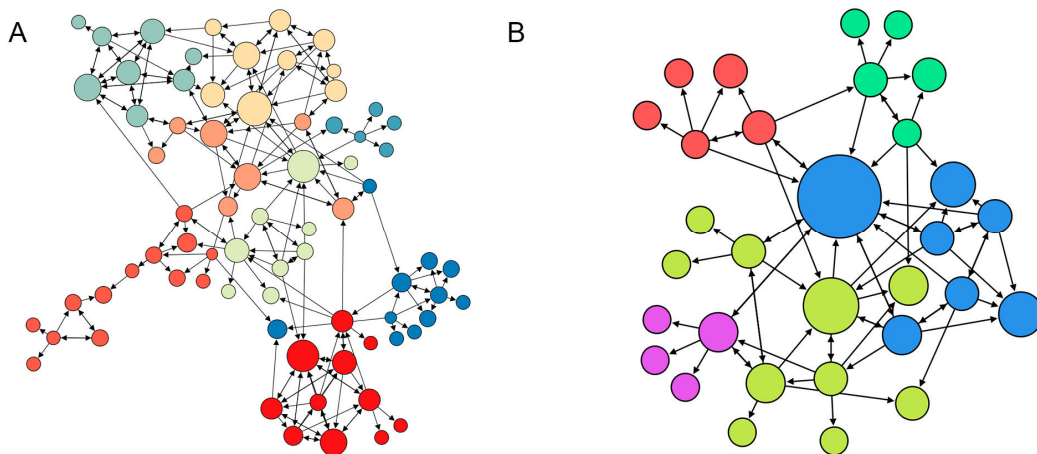
Figure 17. The PSYCHO trust network (A) and the PHYSIO trust network (B). The nodal size represents the in-degree level and the nodes colors represent the communities –modularity.

Each participant and each mentioned trustee are represented as nodes, while links represent the trust relationships; therefore, they represent who trusts whom in the group. The size of the node indicates how many times a participant was mentioned as someone trusted by the other members of the group –in-degree level.

Several network measures were used to determine the level of network cohesion:

– Clustering coefficient (Holland & Leinhardt, 1971; Watts & Strogatz, 1998): indicates how the nodes are embedded between its neighboring nodes. The average gives a general indication of the clustering into the network.

– Modularity (Blondel et al., 2008): it is a detection algorithm of communities. A result of 0.4 or greater value is considered generally significant. Social cohesion runs against modularity.

– % of reciprocity: percentage of mutual edges with respect to the total edges of the network, that is, couples that name each other as trustees in the personal trust questionnaire. The greater reciprocity in a group, the less cohesive it is because when the number of people to trust is smaller –a less cohesive group–, people tend to rely on mutuality.

– Average path length (Brandes & Faster, 2001): graph average distance between all pairs of nodes. Connected nodes have distance 1. A shorter average path length indicates greater cohesion of the network.

– Diameter (Brandes & Faster, 2001): it is the longest graph distance between any 2 nodes of the network –how far are the 2 nodes further away. The meaning of this measure is very similar to the previous one.

Fig. 18 represents the results for each group.
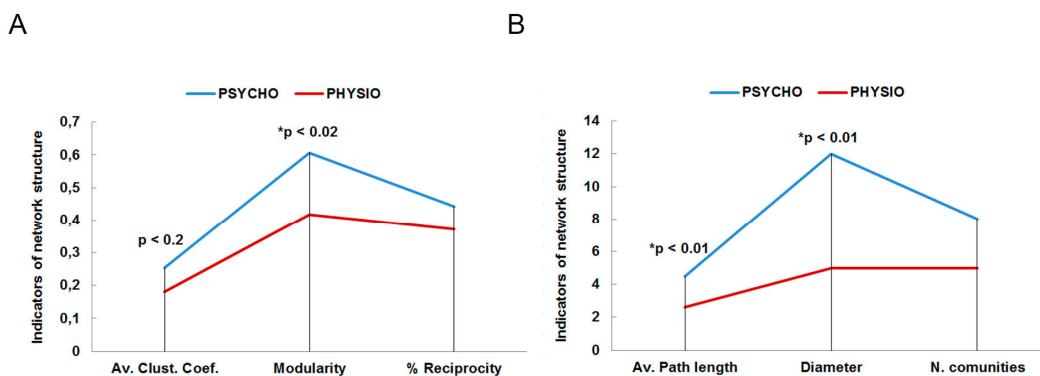
Figure 18. It shows the comparison of the indicators of network structure between the PSYCHO (A) and PHYSIO (B) groups. (*) Significant differences respect to their equivalent individual measures (clustering, modularity, closeness, eccentricity) –Man-Whitney tests.

We found that in the PSYCHO group there were more, and more intensively related, internal communities –as indicated by the clustering coefficient and modularity– than in the PHYSIO group. In addition, the distances among nodes – average path length and diameter– are also longer in the PSYCHO group than in the PHYSIO group. These results indicate a higher level of cohesion for the PHYSIO than in the PSYCHO network.

To examine if these differences between the structures of the two networks are significant, we proceeded to an individual analysis on the set of nodes of the networks.

In this case, we looked at measures equivalent to the above ones at an individual level: clustering coefficient; modularity; and average path length and diameter that can be measured at an individual level by closeness centrality and eccentricity respectively. Thus, closeness centrality refers to the average distance from an initial node to all other nodes in the network, and eccentricity refers to the distance from a node to the most far off one from it in the network. A Mann-Whitney test found significant differences between PSYCHO and PHYSIO network structure in modularity (U = 780.5, z = - 2.521, N = 104, p < 0.02, r = - 0.24), eccentricity (U = 740, z = - 2.935, N = 104, p < 0.01, r = - 0.28), and closeness centrality (U = 739.5, z = - 2.934, N = 104, p < 0.01, r = - 0.28) but not in clustering coefficient (U = 935.5, z = - 1.421, N = 104, p < 0.2, r = - 0.13).

On the other hand, the results of cooperation in the iterated prisoner's dilemma for each group separately exhibited non-significant differences in the TC by means of Pearson Chi-square tests: mutuality ($X2$ (1, n = 54) = 0.84, p < 0.4); cooperation in the three decisions ($X2$ (1, n = 54) = 1.20, p < 0.3); total of cooperative decisions ($X2$ (1, n = 54) = 1.38, p < 0.3); cooperation in the first decision ($X2$ (1, n = 54) = 1.92, p < 0.2); cooperation in the third decision ($X2$ (1, n = 54) = 0.991, p < 0.4); and barely significant differences in some measures of cooperation in the NTC, such as cooperation in the three decisions ($X2$ (1, n = 54) = 5.129, p < 0.03); and total of cooperative decisions ($X2$ (1, n = 54) = 5.84, p < 0.02). The other measures in the NTC –mutuality ($X2$ (1, n = 54) = 0.07, p < 0.8); cooperation in the first decision ($X2$ (1, n = 54) = 0.007, p < 0.95); and cooperation in the third decision ($X2$ (1, n = 54) = 3.47, p < 0.07) showed non-significant differences (Fig.19).
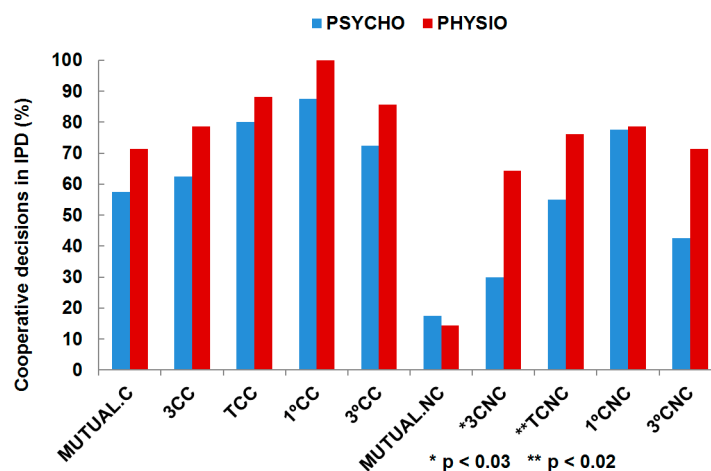
Figure 19. Cooperation results in the Prisoner's Dilemma by groups. MUTUAL refers to the proportion of mutuality, when both players always cooperate; 3C refers to the proportion of participants who cooperate in the 3 decisions; TC refers to the total proportion of cooperative decisions; and 16C and 36C refers to the contrast between the cooperative decisions in the first and in the third rounds. The following C or NC refers to trust circle or non-trust circle conditions. (*) (**) Significant differences –Pearson Chi-square tests.

In order to take into account the different sizes of these networks, we also compared them to their respective random networks (Erdös & Rényi, 1959), that is to say, networks with the same number of nodes and links but randomly connected (Fig.20).
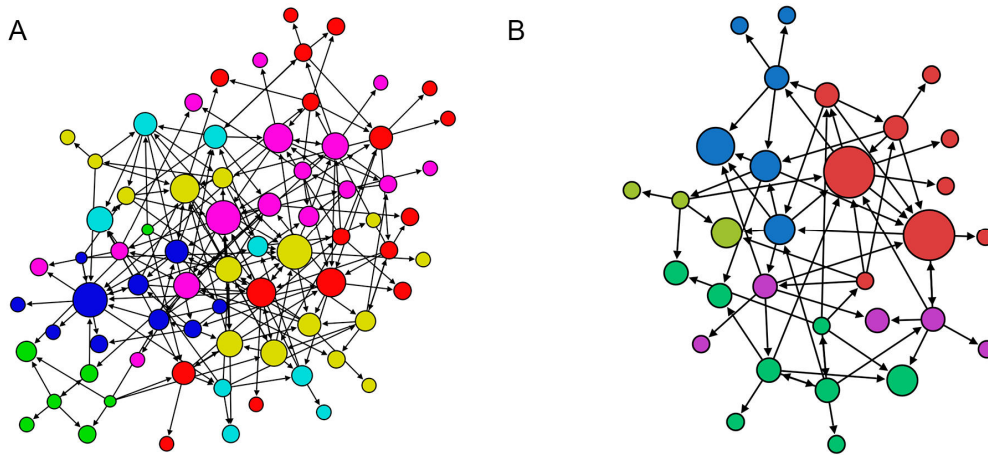
Figure 20. The random trust network of PSYCHO (A) and the random trust network of PHYSIO (B). The nodes size represents the in-degree level and the nodes color represents the communities – modularity.

Network measures comparing real and random trust networks are shown in Figure 21 for PSYCHO and Figure 22 for PHYSIO networks.
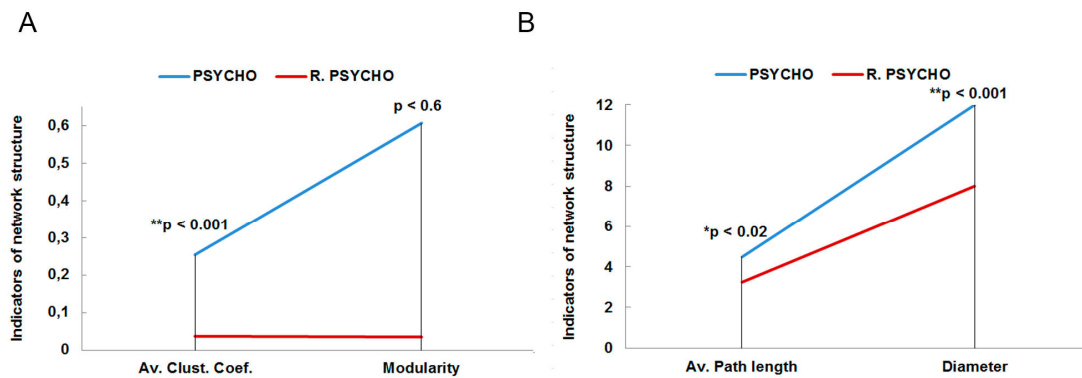
Figure 21. It shows the comparison of network structure indicators between the real (A) and random (B) trust networks of PSYCHO group. (*) Significant and (**) very significant differences respect to their equivalent individual measures (clustering, modularity, closeness, eccentricity) – Man-Whitney tests.

Significant differences between the PSYCHO network and its corresponding random network, both in their clustering coefficient and in the measures of distance between nodes at the individual level –eccentricity and closeness–, were found using the Mann-Whitney test: clustering coefficient (U = 1375.5, z = - 5.25, N = 146, p < 0.001, r = - 0.43); eccentricity (U = 2042.5, z = - 5.25, N = 146, p < 0.001, r = - 0.20); closeness (U = 2042.5, z = - 2.53, N = 146, p < 0.02, r = - 0.20). Differences in modularity were not significant (U = 2513.5, z = - 0.59, N = 146, p < 0.6, r = - 0.04).
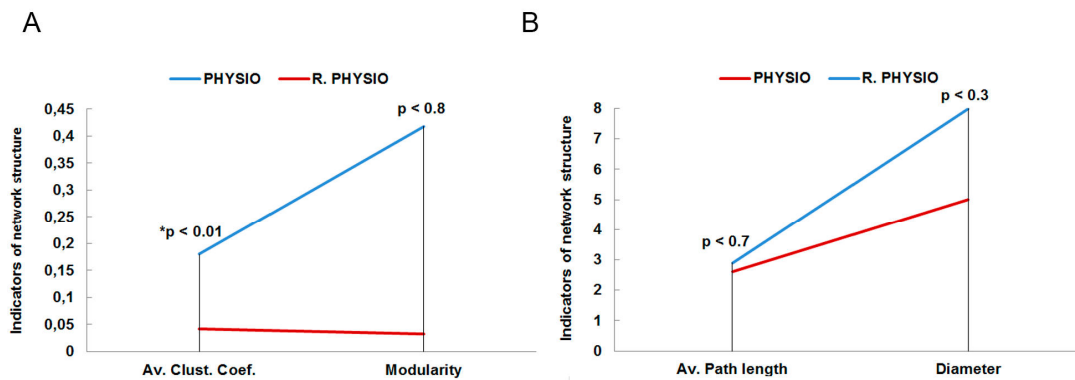
Figure 22. It shows the comparison of network structure indicators between the real (A) and random (B) trust networks of PHYSIO group. (*) Significant difference respect to their equivalent individual measures (clustering, modularity, closeness, eccentricity) –Man-Whitney tests.

Regarding the measures of PHYSIO and its random counterpart, differences in their clustering coefficients were significant, but differences in the distances among nodes and in modularity were not (Mann-Whitney test): clustering coefficient (U = 293, z = - 2.84, N = 62, p < 0.01, r = - 0.36); eccentricity (U = 401.5, z = - 1.22, N = 62, p < 0.3, r = - 0.15); closeness (U = 447.5, z = -0.50, N = 62, p < 0.7, r = - 0.06); and modularity (U = 454.5, z = - 0.37, N = 62, p < 0.8, r = - 0.04).

4. <u>Discussion and conclusions</u>

This study, with bigger groups and longer-lasting relationships among their members than those of our previous study (Acedo-Carmona & Gomila, 2013), provides robust support to the hypothesis that personal trust boosts higher levels of cooperation than general trust (H1). The highly significant differences found in cooperation between the two experimental conditions –trust and non-trust circle conditions– clearly show that personal trust increases cooperation beyond the baseline level commonly found even in one-shot anonymously played games. The most significant difference between the two experimental conditions was found in mutuality, which is in turn the most demanding

measure of cooperation –it requires both participants to cooperate with each other in the three rounds. The fact that 75.92% of the decisions in the third round were cooperative in the TC, despite it was known by players that it was the last round of the game, clearly indicates that cooperation is driven by pro-social preferences, derived from personal trust, rather than by strategic calculation. The only non-significant difference found between the two conditions concerns the total amount of cooperative behaviors in the first decision, which may be attributed to the effect of general trust, and is coherent with the trend found in experimental games. In both conditions, cooperation in the first round is very high (90.74% in the TC and 77.77% in the NTC).

Our results also confirm that the way personal and general trusts were measured is well-grounded, even if there may be multiple ways to operationalize these notions. The average personal trust score (80%) –higher than the general trust score (47%)–, seems to be the critical factor giving rise to the high level of cooperation in social dilemmas found when the game is played anonymously among members of a trust circle, even if both measures are somehow correlated.

We also found support for our second hypothesis: that personal trust is the key to group cohesion, thus fostering cooperation even with non-members of the trust circle. Remember that the personal trust score is the group average of the trust level for each trust circle in the group. A group with a high level of personal trust will therefore foster higher levels of cooperation for the whole group: the fact that some people in the group are highly trusted by other members facilitates cooperation at the global level, thus reinforcing the cohesion of the network (Zhua et al., 2014). Support for H2 also comes from the comparative analyses of the networks of the PSYCHO and PHYSIO groups. There we found a significantly higher level of personal trust in the latter than in the former, which is congruent with the consistently higher scores for any of the measures of group cohesion. Remarkably, as expected, we found significant differences between both groups in total cooperation in the NTC: group cohesion is made apparent in that cooperation is easier with people outside the trust circle. Aware that the small and different size of both groups is a weakness, we compared each of them to a corresponding random network –with same number of nodes and edges–, as the way to clearly show that group cohesion has to do with personal trust.

Furthermore, comparative network analysis also makes possible to find evidence for our third hypothesis, that trust-based cooperation is better supported by a specific network topology: that of a small-world (Watts & Strogatz, 1998), in which the hubs correspond to cliques (Rigdon et al., 2007). Several results support this idea: on the one hand, the structure of the PHYSIO network clearly exhibits this topology, while the PSYCHO network is not so well integrated. Consequently, the percentage of reciprocity –of pairs of participants that name each other as trustees– is higher in the PSYCHO than in the PHYSIO network (Fig.5), which is in line with the lower degree of cohesion of the PSYCHO network.

If this interpretation is correct, it calls for a modification of the ''social circles'' hypothesis (Hill & Dunbar, 2003; Zhou et al., 2005; Roberts et al., 2009), which distinguishes three kinds of social networks: the ''support groups'' –more or less 5 persons–, the ''group of sympathy'' –between 12 and 15 persons–, and the groups of other people with whom individuals establish sporadic relationships. The ''social circles'' hypothesis overlooks the potential of personal trust among non-kin to bind people together, in any sphere of activity of an individual. Similarly, network experiments that ignore the role of trust in social relationships do not find that network topology matters for cooperation (Grujic et al., 2010; Gracia-Lazaro et al., 2012) –a result that indirectly suggests that trust-based network topology it's the factor that makes the difference. In fact, it seems to us that personal trust may be a central factor is giving rise to heterogeneity in social interactions, and therefore, in giving rise to a topology that may foster cooperation by itself (Szolnoki & Szabó, 2007; Fletcher & Doebeli, 2009; Curry & Dunbar, 2011; Zhua et al., 2014).

In summary, our multi-method study supports the view that personal trust is a crucial factor in cementing society. It is not the only factor: there may be other ways to foster cooperation and to make groups cohesive. However, personal trust creates robust and long-lasting bonds, which give rise to greater levels of social cohesion. We contend that these findings provide support for the view that small, trust-based groups are a basic social structure in non-kin groups. They were the evolutionarily original forms of social organization and can still be found across human societies, even in the large, developed ones. Personal trust drives psychological altruism towards non-kin, in a way that goes beyond the effect of general trust. It turns people into a kind of conditional cooperator: depending, not on whether there is the possibility to punish her if she defects; not on an authority that can require norm following; not on a strategic calculation about chances of reciprocation; but on an affectively mediated commitment derived from past experience of interaction. Further support for this view requires a cross-cultural anthropological approach.

Section 3: Field work

Diversidad étnica, clanes y familias en Ghana: plataforma económica, social y cultural.

El presente trabajo, realizado en algunos distritos del norte de Ghana como Bawku-este, Garu-Tampane y Bunkpurugu-Yunguo, trata de servir de ejemplo de cómo a través del emprendimiento social los sujetos organizan las redes sociales que resultan más eficaces para adaptarse a su entorno a través de la cultura. En Ghana conviven alrededor de 100 grupos lingüísticos y étnicos, con claras diferencias culturales, ideológicas y socioeconómicas. Concretamente en el norte del país, donde las condiciones de subsistencia son bastante duras, la configuración social basada en la familia, el clan y el grupo étnico resulta muy eficaz para asegurarse la cooperación de los miembros del grupo.

Este trabajo se basa en el análisis de la confianza como elemento clave que configura las redes sociales, la cultura implícita en ellas y la economía del entorno. Se explicarán los elementos que intervienen en la confianza, el papel que juega la cultura en los mismos y cómo la confianza se refuerza en torno a la creación de grupos más pequeños, como en este caso es la familia, el clan y, en último término, el grupo étnico. Este análisis servirá también para dar cuenta de la existencia de la gran diversidad étnica repartida en diversas zonas del continente africano.

En definitiva, por medio de la obtención de las redes personales de cooperación y la realización de entrevistas a los participantes de este estudio, se confirma la eficiencia de generar grupos más pequeños y cohesionados para enfrentarse a las condiciones más difíciles del entorno, fenómeno que también se observa en grandes sociedades en periodos de crisis económica. Además se mostrará que la cultura juega un relevante papel como generador de la confianza necesaria para asegurar la reciprocidad en la cooperación y la cohesión de los grupos. No obstante, el mecanismo de la confianza va más allá de lo meramente cultural y asienta sus bases en la evolución humana.

1. <u>Introducción</u>

Ante los fenómenos que hoy en día se están produciendo debido a la situación de crisis económica generalizada en gran número de países desarrollados, van surgiendo diversas formas sociales, que espontáneamente o no, intentan paliar las duras

consecuencias para los ciudadanos. Muchas de estas reacciones se sustentan, en muchas ocasiones, en la mayor cohesión con los grupos con los que se tiene una vinculación más estrecha o, en otros casos, se intentan crear asociaciones con distinto anclaje emocional para asegurar una mutualidad más auténtica. Estas formas de emprendimiento social, a través de los micro-grupos fuertemente vinculados, originan redes de apoyo mutuo más fáciles de gestionar y más flexibles a la hora de adecuarse a situaciones de vida difíciles. Pero recurrentemente en la historia en estas formas de emprendimiento social, se han usado diversas fórmulas culturales para crear esa mayor vinculación. Parece además que dichas estructuras micro-sociales están muy en consonancia con la psicología social del ser humano. Este es el caso del continente africano, en el que ha existido una diversidad cultural extraordinariamente amplia.

A lo largo de la historia africana, no siempre muy conocida, se observa la amplia diversidad cultural de pequeños grupos que han subsistido aprovechando los recursos naturales, lo que les han llevado a realizar numerosos movimientos migratorios (Cleveland, 1991). Las difíciles condiciones del entorno y la escasez de recursos, son el trasfondo en el que las interacciones migratorias no han hecho desaparecer sino que, al contrario, han impulsado la existencia de innumerables grupos con rasgos culturales propios, los cuales han mantenido su identidad incluso compartiendo el territorio con otros grupos. Esto ha creado situaciones como la que existe en Ghana, donde pese a la aparición de instituciones estatales que tratan de crear una identidad "nacional" (Benedict, 1983), se conserva una gran diversidad étnica, sobre todo en las zonas con condiciones económicas más duras. Tal diferenciación cultural se observa también en la diferenciación lingüística (Bemile, 2000).

Los autores atribuyen muy diversas motivaciones para explicar por qué tal diversidad cultural se crea y se mantiene (Barth, 1969, 1994; Lentz, 1997; Lentz y Nugent, 2000; Schlottner, 2000; Schlee, 2002). Autores como Lentz (2000) atribuyen la diversidad cultural de Ghana no a su pasado histórico sino a creaciones artificiales motivadas por influencias coloniales, políticas y a la influencia de la terminología adquirida en las clasificaciones aportadas por los mismos antropólogos. De cualquier modo, resulta patente que la sociedad ghanesa aparece fragmentada a través de los linajes, los clanes y los grupos étnicos, tanto si las apropiaciones culturales puedan considerarse totalmente diferenciadas o no (Southall, 1970; Schildkrout, 1979; Ranger, 1983, 1993). Tal fragmentación cultural se mantiene en el imaginario común y en la afiliación real de los individuos.

Existe una larga tradición de teorías antropológicas que han intentado explicar la influencia del entorno ecológico y la economía en la cultura. Algunas de ellas, basadas en una corriente de evolucionismo materialista, como el evolucionismo cultural de White (1943, 1949) y la ecología cultural de Steward (1955), ofrecen explicaciones que utilizan el contexto ecológico como causa para una pretendida evolución de la cultura. Frente a estas perspectivas, otras en vez de fijarse en una causa ecológica concreta, proporcionan visiones más sistémicas del papel del contexto ecológico dentro de

determinadas configuraciones culturales. Este es el caso del funcionalismo ecológico de Rappaport (1967, 1979) y el materialismo cultural de Harris (1966, 1968), entre otras.

Efectivamente, la diversidad cultural de grupos que interaccionan en un mismo territorio plantea la cuestión de cuáles son las posibles motivaciones de su mantenimiento en el tiempo. Parece lógico pensar que la existencia de tal variedad cultural y social resulta eficaz para adaptarse a un entorno no sólo ecológico, sino también económico, político e histórico, en sociedades más complejas.

Este trabajo pretende dar cuenta de la eficacia de la creación de grupos pequeños con rasgos culturales específicos para sobrevivir sobre todo en las situaciones más difíciles. El surgimiento del pequeño grupo de cooperación también se observa en sociedades más complejas cuando se enfrentan a dificultades económicas. La especificidad cultural ayuda a la cohesión del pequeño grupo, el cual resulta más flexible ante retos complicados. Este podría ser uno de los factores explicativos del mantenimiento de la diferenciación étnica en diversas zonas del continente africano. Se tratará de profundizar en tales cuestiones apoyándolas mediante el ejemplo de Ghana. Se mostrará cómo los papeles asignados a los diferentes grupos culturalmente creados del linaje, clan y grupo étnico en Ghana garantizan diferentes tipos de cooperación y niveles de confianza. Se explicarán los elementos que intervienen en la creación y mantenimiento de las relaciones de confianza y su eficacia a la hora de crear las redes de cooperación y de adoptar tal sistema de organización social. Se mostrará, así pues, cómo las diferentes estructuras y dinámicas sociales que crean los humanos, modeladas por la cultura, aparecen fuertemente relacionadas con factores económicos, y cómo la confianza juega un papel relevante en ellas.

2. <u>Contexto histórico y cultural</u>

En Ghana (Fig. 23), la amplia diversidad de grupos lingüísticos y étnicos existentes ofrece un marco idóneo para profundizar en la búsqueda de los elementos universales utilizados en el acercamiento social y la cooperación, pese a tanta diversidad cultural.

Ghana cuenta con una población de algo más de 24 millones de habitantes, repartidos en 10 regiones administrativas, entre ellas, las regiones del Norte y del Alto-Este (Fig. 24) donde se realizó el estudio, concretamente, en las poblaciones de Bawku y Garu de la región del Alto-Este, y Bende de la región Norte (Fig. 25).

Figure 23. Situación geográfica de Ghana

(missions.awana.org/site/News2?id=6343)

Figure 24. Regiones administrativas de Ghana.

(commons.wikimedia.org/wiki/File:Regions_of_Ghana_en.svg)
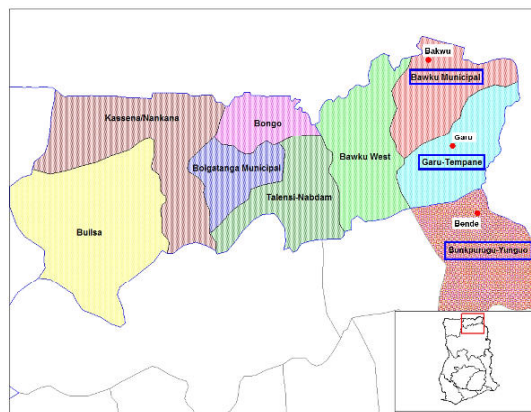
Figure 25. Situación geográfica de las poblaciones visitadas.

(en.wikipedia.org/wiki/File:Upper_East_Ghana_districts.png)

Figura modificada por Cristina Acedo

En estas regiones áridas del noreste del país situadas en la cuenca del Volta Blanco, predomina la sabana, con zonas de pastos, baobabs y acacias. En ellas viven mayormente de la agricultura de tala y quema y de la ganadería.

Bawku es la mayor población, capital del distrito Bawku Municipal (Fig. 3), con una población de unos 56.000 habitantes. Es un núcleo urbano en el que confluyen diversos grupos étnicos, de entre los cuales, participaron en este estudio grupos asentados en la zona como los Kusasis (Syme, 1932; Hilton, 1962; Awedoba, 1989, 2001), Frafras (Hart, 1971), Bissas y Mossis (Zahan, 1967); y otros procedentes de otras

regiones del país como los Asante (Rattray, 1931, 1932), de la región Ashanti, y los Sissala y los Waala (Wilks, 1989), de la región Alto-Oeste (Fig. 24).

En la región de Garu, capital del distrito Garu-Tempane (Fig. 25), se visitaron principalmente a los Kusasi, los cuales habitan dispersos en ámbitos rurales.

En Bende, pequeña población situada en el distrito de Bunkpurugu-Yunguo (Fig. 3), se visitaron varios grupos étnicos que conviven en la zona como los Mamprusis (Drucker-Brown, 1975, 1992; Schlottner, 2000), Bimobas (Fussy, 1979; Laari, 1987; Assimeng, 1990), Konkombas (Tait, 1961) y Fulanis (Oppong, 2002; Tonah, 2005).

Los participantes de Bawku habitan un entorno urbano y los participantes de las zonas de Garu y Bende viven en zonas rurales.

Las diferentes lenguas de todos estos grupos étnicos forman parte del conjunto de lenguas Nigero-Congoleñas, entre las que se incluyen las lenguas Kwa (Asantes), Gur (Bimobas, Mamprusis, Mossis, Kusasis, Sissalas, Waalas, Frafras, Konkombas), Mande (Bissas) y Fulbe (Fulanis) (Fig. 26). Sin embargo, cada una de estas ramas ha derivado en lenguas y dialectos diferentes para cada uno de estos grupos.
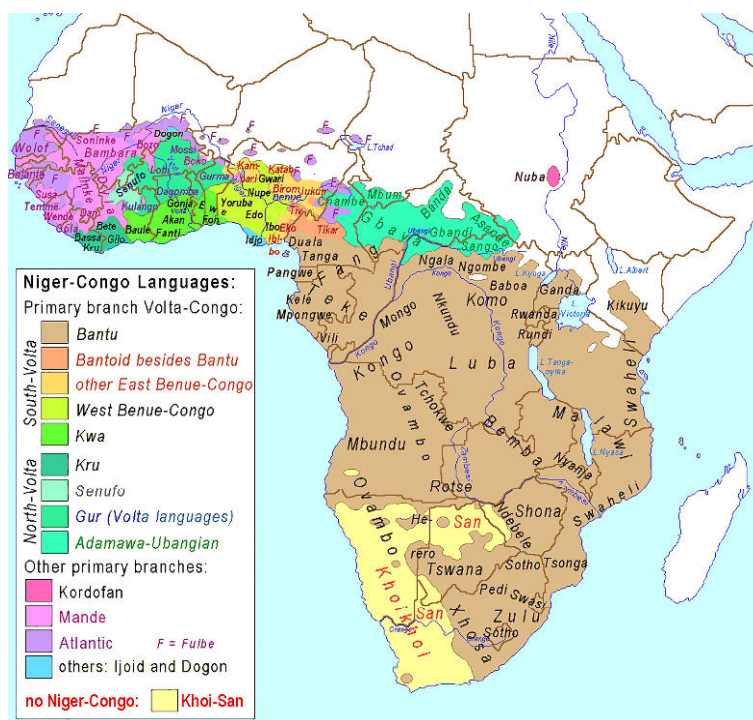
Figure 26. Clasificación y situación geográfica de las distintas ramas de lenguas nigero-congoleñas.

(http://en.wikipedia.org/wiki/File:Niger-Congo_map.png)

Así mismo el origen de estos grupos étnicos y su historia no están muy claros. Las migraciones sub-saharianas por el comercio de oro y sal, y el tráfico de esclavos, posibilitaron frecuentes movimientos de distintos grupos en la zona. Ya en el s. X el sur de Ghana formaba parte del imperio Asante. Los reinos Mole-Dagbane (Mamprusis, Dagombas y Mossis), procedentes del Noreste y fuertemente jerarquizados, se establecieron en la zona norte de Ghana entre los s. XIII-XV y dominaron a los grupos acéfalos instalados allí. Los Kusasi, Frafra y los Sissala, son originarios del Oeste de Sudan que emigraron a la zona en el s. XVII, aunque otros Sissala parece que son descendientes de los grupos Mole-Dagbane. Los Asante forman parte de los grupos Akan que se trasladaron desde Africa-Oeste entre los s. X-XII, mientras que los Fulani llegaron desde Níger y Senegal en el s. XVI pero emigraron al norte de Ghana prácticamente a principios del s. XX. Los Bissa o Busanga se establecieron en el Volta Blanco en el s. XIV. En cuanto a los Bimoba, provienen de la mezcla de los Moba, los cuales emigraron desde Burkina-Faso en el s. XVII, con Mamprusis y Konkombas, después de ser conducidos al norte por los Mamprusi y los Dagomba. Respecto a los Konkomba, parece que son de los pocos grupos originarios de estas tierras, y los Waala, originarios de la ciudad de Wa, capital de la región del Alto Oeste, surgen de la conjunción en el s. XVII de las tradiciones guerreras de los Dagomba y Mamprusi y las tradiciones islámicas transmitidas a través de pequeños grupos de inmigrantes Mandé procedentes de Níger. Tanto los Mamprusi y los Mossi, en el Norte del país, como los Asante, en el Centro, formaban grupos jerárquicamente organizados que adquirieron mayor poder frente al resto de grupos mencionados, que eran acéfalos.

En el s. XV los portugueses aprovecharon los recursos minerales del lugar, y posteriormente llegaron británicos, franceses y holandeses (s. XVI). En el s. XVII la confederación de los Asante unificó los distintos grupos. La solidaridad entre grupos era muy conveniente por la competencia que existía para adquirir zonas de cultivo, para controlar las rutas de comercio y para protegerse. En 1901 las zonas del norte de Ghana se convirtieron en protectorado inglés. Las rivalidades que ya existían entre ciertos grupos étnicos debido a enfrentamientos por el territorio o el tráfico de esclavos, se acrecentaron con la colonización inglesa, la cual fomentó la desigualdad de poderes entre ellos y concedió ciertas cortesías sociales y económicas a determinados grupos en detrimento de otros. En 1957 el país se independizó de la corona inglesa pero las diferencias existentes antes y durante la época colonial son las causantes de las actuales tensiones inter-étnicas.

Tal diversidad en los grupos en cuanto a origen e idioma se extiende no solo a los aspectos meramente culturales, como creencias, costumbres, fiestas, etc…, sino también en algunos grupos a las actividades económicas a las que se dedican. Así pues, mientras los Kusasi y Frafra son agricultores sedentarios, y los Konkomba y Bimoba agricultores de tala y quema, los Fulani son principalmente ganaderos seminómadas, y los Busanga se han dedicado a la metalurgia. Los Mamprusi y Mossi se dedican a la agricultura, aunque algunos Mamprusis poseen ganado y muchos de ellos también son

comerciantes. Los Sissala y Waala, por su parte, se dedican a la agricultura en la estación lluviosa (de Mayo a Septiembre) pero también cazan y pescan en la estación seca (de Noviembre a Abril). Las mujeres Waala hacen además trabajos de recolección y de venta en los mercados. Los Asante han vivido de la agricultura del cacao, la caza y el comercio de madera y oro.

Sin embargo, actualmente un 90% de la población de Ghana vive en áreas urbanas, la economía ha crecido principalmente por las mejoras en la agricultura, aunque también debido al desarrollo de las industrias extractivas de los recursos naturales del país (petróleo, gas y minerales), el sector de servicios y las manufacturas. No obstante, en el norte del país, aún se mantienen los conflictos por el reparto de las tierras de cultivo y las técnicas de cultivo rudimentarias y a pequeña escala, que proveen a sus habitantes de una economía de subsistencia.

3. Estructuras sociales y económicas

En el norte de Ghana la familia juega un importante papel social. En general, en muchos de estos grupos étnicos el concepto de familia tiene un sentido más extensivo que la familia nuclear, como se muestra en su propio lenguaje al utilizar el mismo término para un determinado conjunto de sujetos dentro del ámbito familiar. A la familia más cercana, le siguen los linajes y los clanes, que son formas culturales que cobran gran importancia en la forma de estructurar la sociedad y la economía. Estas agrupaciones culturales influyen tanto a la hora de distribuir la tierra, propiedades y títulos, como para crear señas de identidad en el individuo, ya que le incluye en un grupo de referencia que sirve tanto para recibir ayuda como para decidir alianzas o matrimonios.

Los autores han tratado de definir conceptos tales como los de linaje (Kuper, 1982), clan, tribu (Mafeje, 1971; Ekeh, 1990) o grupo étnico (Cohen, 1978; Heusch, 1997), aunque cada cultura puede darle diferentes significados a tales conceptos. Incluso el concepto de familia puede adoptar significados diferentes en distintos grupos culturales. En el caso de Ghana, todos estos conceptos adquieren complejidad desde el momento en que existe tanta diversidad étnica. Así pues, cada grupo étnico tiene su manera cultural de crear los vínculos. En líneas generales, se podría decir que el linaje define el modo de organización social de la familia y tiene relevancia para designar el grupo de identidad al que pertenece el individuo, con las implicaciones sociales y económicas antes mencionadas. Entre los grupos étnicos que están presentes en este trabajo algunos linajes son matrilineales y otros patrilineales. Los linajes, que son consanguíneos, van desde los vínculos nucleares a las líneas más extendidas en el tiempo. Esto hace que los más amplios linajes, correspondientes a los ancestros más alejados, se subdividan en otros más pequeños hasta llegar al grupo familiar nuclear. Los clanes en estas zonas, sin embargo, pueden vincular a distintos linajes dentro de un determinado territorio ya que el clan asimila también un aspecto territorial, el cual puede ser considerado además, en algunos casos, como unidad mínima a nivel político

(distrito). La tribu, a su vez, se compone de un conjunto de distritos o clanes de un mismo grupo étnico en un territorio mayor. Así pues, un grupo étnico puede estar compuesto de varias tribus. No obstante, el concepto de tribu no aparece tan claro en todos los casos, ni se usa tanto como el resto.

El caso más importante de grupos étnicos matrilineales es el de los grupos Akan, entre los que se encuentran los Asante. Los Asante, como otros grupos Akan, consideran que el individuo recibe la herencia de sangre (Abusua) por parte de la familia materna y el espíritu (Nton) por parte de la línea paterna. De este modo, aunque la inclusión grupal del individuo se realiza a través de la línea materna, y con ella la sucesión de los derechos de la tierra y las herencias de propiedades o títulos, de la parte paterna se recibe los rasgos de carácter o personalidad.

El resto de los grupos étnicos analizados tiene una organización social patrilineal. Tal es el caso de los Mossi, que forman parte de los grupos Mole-Dagbane, cuyos individuos no existen por sí mismos sino como miembros del colectivo familiar. La familia constituye para ellos la entidad más pequeña de la sociedad. Todo lo que hace un individuo es atribuido a las características de su familia.

Existen similitudes en la composición doméstica entre los distintos grupos étnicos de las zonas rurales del norte de Ghana. Se establecen en grupos familiares nucleares o seminucleares situados en un conjunto de cabañas orientadas en forma circular. Cada cabaña es asignada a diferentes miembros de la familia. Las características del conjunto respecto a forma, composición y situación varían según el grupo étnico. Este conjunto familiar suele estar encabezado por un hombre con una o más esposas. La poligamia depende de factores religiosos, económicos y educativos. Además, se incluyen en la unidad doméstica los hijos y sus cónyuges dependiendo del tipo de linaje adquirido culturalmente, y los nietos, además de la posibilidad de inclusión de otro tipo de parientes. Un conjunto familiar puede estar compuesto desde 4 o 5 personas hasta más de 50. Las unidades domésticas más urbanas van adoptando una composición más pequeña en cuanto a número de miembros, pero en las zonas rurales el número de miembros que conviven es mayor.

Estos conjuntos están encabezados por el varón de mayor edad, el cual crea la unidad familiar y es la persona que toma las decisiones respecto a los asuntos domésticos, como el reparto de trabajos, de propiedades y la asignación de espacios de cultivo entre los distintos integrantes del grupo familiar, entre otros asuntos.

No todos los grupos étnicos de la zona han mostrado históricamente la forma jerárquica de organización social. Mientras los Asante, Mossi y Mamprusi son herederos de imperios con marcada estructura social jerárquica y centralizada, el resto de los grupos no disponían de jefes. Después de la época colonial, algunos de los grupos acéfalos han creado nuevos sistemas de jefaturas en un intento de recuperar poder sobre el territorio. A pesar de estas diferencias, la mayoría de grupos prestan un gran respeto a las decisiones del conjunto de personas más ancianas (cabezas del clan o del linaje)

respecto a los asuntos del grupo. Suelen tener una autoridad religiosa para los asuntos espirituales, los cuales están muy relacionados con la tierra (los llamados "sacerdotes de la tierra"; "Tindemba" para los Mamprusi; "Tengabisi" para los Mossi; "Tindana" para los Konkomba, los Kusasi y los Frafra; "Tinteen-tiina", para los Sissala). Existen también los jefes, que suelen dedicarse a mediar en los asuntos relacionados con el gobierno del país (como los asuntos judiciales). Éstos se dedican profesionalmente a esta labor y reciben un salario del Gobierno por ello. Algunos grupos, los de mayor tradición jerárquica, como los Asante o los Mamprusi, mantienen otro conjunto de autoridades locales y regionales que forman una cadena de poder dentro de los clanes y tribus que la componen. Más que un poder real, estos cargos suelen tener un gran poder simbólico del que el grupo se siente muy orgulloso.

Estas diferentes autoridades juegan un papel a la hora de gestionar los recursos agrícolas. En el norte de Ghana existe una tenencia consuetudinaria de la tierra. Este es un sistema tradicional basado en el control, por parte de la comunidad, del uso de la tierra y sus recursos. Esto significa que la comunidad asigna a los individuos derechos de uso o usufructo de determinadas parcelas de tierra, que pueden explotar y trasmitir por herencia a sus descendientes, aunque no vender. La comunidad, a veces, puede reservarse el derecho a reasignar tales usos. Este sistema suele conllevar también el derecho de uso, por parte de todos los miembros de la comunidad, de todos los recursos que ofrece la propiedad comunal, más allá de las zonas de cultivo.

Aunque con algunas diferencias respecto al derecho sobre la tierra entre los grupos étnicos más jerarquizados (región Norte) y los que no lo son tanto (región del Alto-Este y Oeste), la realidad es que las decisiones sobre la tierra las toma el cabeza de la unidad doméstica (Kotey, 1995), el llamado "señor de la tierra". En el caso de los grupos más jerarquizados, tales derechos fueron asignados por sus jefes, aunque, en teoría, el título alodial (el propietario tiene el dominio completo sobre las tierras, es decir, que la propiedad está libre de toda carga señorial), recaía en el jefe supremo del grupo. En el caso de los grupos históricamente acéfalos, la asignación de tierras las realiza la comunidad (Agbosu et al., 2007), y la gestión de uso de los recursos comunales recaen en el sacerdote de la tierra y en las cabezas de linaje y clan (Kotey, 1995). Dichas autoridades mantienen la potestad para decidir sobre el correcto uso de los recursos de la propiedad comunal que no son zonas cultivadas (como los derechos sobre el agua, la madera, plantas medicinales, pastoreo, etc…) y decidir sanciones en caso de su uso incorrecto (Songsore, 2001). Los sacerdotes de la tierra tienen la propiedad ritual de la tierra para la realización de rituales que aseguren su productividad. Para conseguir todos estos derechos sobre la tierra cultivable y el resto de recursos, los individuos deben de pertenecer a la comunidad. Las personas de fuera de la comunidad tienen que pedir permisos por ellos. El cabeza de familia transmite sus zonas de cultivo hereditariamente a sus descendientes, pero para vender la tierra tiene que informar a la comunidad o al jefe. Sin embargo, no se suelen dar muchos casos de venta de tierras.

Parece claro entonces, que las estructuras sociales tienen un importante papel en la gestión económica de las zonas agrícolas del norte de Ghana (Woodman, 1963). La agricultura (Benneh, 1973; Panin, 1987; Der, 2001) es, como se mencionaba anteriormente, el medio de vida más importante en estas zonas, además de la ganadería, caza, pesca y recolección de frutos. No obstante, en este trabajo se trata de mostrar que las estructuras sociales existentes también tienen una enorme influencia en la actitud cooperativa de los individuos hacia ciertos grupos en detrimento de otros. Para ello, se basa en un análisis de cómo funciona la confianza entre dichos grupos.

4. <u>El estudio</u>

El trabajo de campo se realizó en enero-febrero de 2013, en las zonas antes mencionadas de Bawku, Garu y Bende. Los resultados se adquirieron a través de la obtención de redes personales de cooperación, y la realización de entrevistas a un número limitado de participantes, elegidos al azar, dentro de los grupos étnicos antes mencionados. Dada la limitación temporal del trabajo de campo, se han utilizado para la elaboración de las conclusiones, además de los datos recogidos y la observación realizada en ese espacio de tiempo, la lectura de literatura sobre dichos grupos.

Los objetivos del estudio consisten en analizar con quienes cooperan los participantes, en qué medida los diferentes grupos étnicos interactúan entre ellos, qué papel desempeña las relaciones de confianza en la cooperación y cómo se crean y mantienen los lazos de confianza.

4.1 Procedimiento

Para conseguir las redes de ego se pidió a los participantes que hicieran una lista con los nombres de las personas con las que cooperaban habitualmente, el grupo étnico al que pertenecían dichos cooperadores, tipo de relación que les vinculaba, si la cooperación era unilateral o mutua, tipo de cooperación y el nivel de confianza que tenían hacia ellos.

Se realizó además una entrevista grabada con 21 preguntas a cada uno de los participantes. A través de ella se pretende indagar sobre los factores involucrados en la creación, mantenimiento y ruptura de la confianza: preguntas sobre lo que toman en consideración a la hora de decidir confiar por primera vez y mantener la confianza adquirida; en qué personas confían más y a cuáles confían los secretos; si es posible confiar siempre en la familia, el significado que tiene la familia para ellos y cómo son las relaciones familiares; los intercambios que requieren mayor nivel de confianza; cuándo consideran que han traicionado su confianza, si podrían olvidar dicha traición y cómo la castigarían; cómo son las relaciones dentro del mismo clan; si confían en otros grupos étnicos y cómo son sus relaciones con ellos; si se realizan en la comunidad actividades para fomentar la confianza y para integrar miembros nuevos; si la

reputación es importante en la comunidad y de qué modo; si creen que la religión o la actitud del Gobierno pueden influir en la cooperación entre individuos; el nivel de seguridad de los entrevistados y sus valores como grupo.

5. <u>Relaciones de cooperación</u>

Se pasa a explicar los puntos esenciales a destacar de las relaciones de cooperación recogidas en las redes de ego:

5.1. *Grupos de cooperación*

Se ha observado que el grupo de cooperadores habituales no es muy grande: tienen una media de unas 14 personas, sin mucha diferencia entre hombres y mujeres, aunque con una ligera diferencia entre los distintos grupos étnicos. Destacan los Kusasi y los Frafra con un número algo mayor de cooperadores.

En el caso del tamaño del grupo de confianza, según las entrevistas, el número medio de personas declarado por los encuestados es algo mayor que el grupo de cooperación, de unas 23 personas. No obstante, la mayor parte de los encuestados que respondieron a esta pregunta tiene menos de 15 personas de confianza. El promedio sube con los participantes Konkomba que manifiestan tener un mayor número de personas de confianza. Esto no resulta tan extraño si se considera que los asentamientos familiares de los Konkomba entrevistados suelen tener un gran número de miembros que conviven en el mismo lugar, lo que hace que mencionen como personas de su confianza prácticamente a todo el conjunto familiar. Resulta, por tanto, que los grupos habituales de cooperación y de confianza son en su mayoría de pequeño tamaño.

La composición de los grupos de cooperación consta, en primer lugar, de amigos (aproximadamente en la mitad de los casos), después, de familiares, en menor medida vecinos, algunos compañeros de trabajo, y muy pocos conocidos o desconocidos. La gran mayoría de todos ellos son personas de confianza. El grupo de parientes es el que goza de un porcentaje mayor de alto nivel de confianza y, le siguen los amigos y vecinos.

5.2. *Tipos de intercambios*

Cada tipo de vínculo se relaciona con distintos papeles predominantes a la hora de cooperar. Los familiares cooperan en mayor medida que los amigos en actividades que requieren grandes dosis de confianza dentro del entorno de subsistencia en el que viven estas personas, como son el préstamo de dinero e intercambio de servicios. Además, son depositarios de los secretos en mayor medida.

Sin embargo, los amigos amplían las posibilidades de obtención de ayuda a un más largo alcance. Tienen mayor papel que los familiares en la transmisión de información, de consejos, aprendizaje y en la obtención de trabajo, y menos implicación en la prestación de servicios.

Los vecinos destacan como consejeros y para la obtención de trabajo. Los compañeros de trabajo tienen un mayor papel en la transmisión de consejos, aprendizaje e información. En la mejora de la reputación tienen un mayor papel los conocidos, los amigos y los vecinos.

Los intercambios de tipo económico son los que requieren un mayor nivel de confianza entre los entrevistados, como son los asuntos de finanzas, intercambios de animales, negocios, planes de trabajo y asuntos agrícolas. También requieren altas dosis de confianza la ayuda en general y el intercambio de consejos. Sin embargo, en términos absolutos, el intercambio de secretos es el que alcanza el mayor porcentaje de altos niveles de confianza.

5.3. Reciprocidad

Las cooperaciones son recíprocas en un alto porcentaje. Las relaciones de mayor confianza van acompañadas de mayor nivel de reciprocidad. Sin embargo, con los familiares, que son aquellos en los que se deposita mayores niveles de confianza, se mantiene menor nivel de reciprocidad que con los amigos o los compañeros de trabajo. Esto sugiere que los vínculos afectivos familiares son un buen mecanismo para asegurar la cooperación pese a la menor reciprocidad (tal vez por la educación recibida sobre el papel de la familia). Por el contrario, los cooperadores tan sólo conocidos o desconocidos, y los vecinos, tienen altos porcentajes de donaciones a los participantes, que superan las relaciones de reciprocidad. Esto parece mostrar que los cooperadores que son de menor confianza se mantienen, quizá no muy a largo plazo, porque proporcionan un claro beneficio para el individuo y son utilizados para asuntos menos arriesgados. De la misma manera, los intercambios que requieren mayor nivel de confianza son también los que tienen mayores proporciones de reciprocidad, tal vez para disminuir el riesgo.

Los grupos étnicos que poseen mayor número de cooperadores –Kusasis y Frafras– son los que muestran a su vez una mayor diversidad étnica entre sus cooperadores, aunque incluso ellos tienen alrededor de la mitad de cooperadores de su misma etnia. El resto de grupos muestran un elevado porcentaje de endogamia étnica en sus redes de cooperadores habituales. Se demuestra, así pues, que en la creación de estas agrupaciones, tanto los linajes familiares como el grupo étnico propio juegan un predominante papel en la cooperación de los individuos.

6. <u>Relaciones de confianza</u>

En este apartado se describen los principales aspectos a considerar de las relaciones de confianza establecidas en la zona: la descripción de los diferentes grupos de confianza y los elementos que intervienen en la dinámica de la confianza. Dicha información proviene de las entrevistas.

6.1 Grupos de confianza

6.1.1. Familia

Los parientes son, de nuevo, las personas en quienes más se confía, y en segundo lugar los amigos, aunque el número de cooperadores amigos es mayor que el de familiares. Se observa pues, que para cubrir las necesidades de cooperación se aumenta el número de personas, aunque el nivel de confianza disminuya un poco.

Sin embargo, no por tener una relación de parentesco se asegura la existencia de confianza. Aunque el papel de los lazos de parentesco es muy importante en la sociedad ghanesa, la adjudicación de confianza depende, en último término, del comportamiento de los individuos: los encuestados se dividen prácticamente por igual entre los que declaran confiar siempre en la familia y los que no. Aunque una gran mayoría declara tener buena relación con sus familiares, una quinta parte confiesa tener problemas con la familia. Además, un gran porcentaje de las personas entrevistadas define a la familia como grupo de apoyo o ayuda, o las personas con las que conviven o se identifican. Así pues, las necesidades que cubre la entidad familiar son las mismas que podrían cubrir las relaciones de amistad, o cualquier otro tipo de relación social.

6.1.2. El clan frente a otros grupos étnicos

Aunque existe un alto nivel de interacción entre los grupos étnicos, creado por lazos de matrimonio, convivencia y gran tolerancia de las creencias religiosas, siguen existiendo divisiones importantes en las relaciones entre ellos, además de las diferencias en el idioma. Pese a aquellos que argumentan que los clanes, incluso los mismos grupos étnicos, no siempre son el resultado de una diferenciación cultural e histórica clara y se moldean según las necesidades de los grupos, sin ser estáticos (incluso se ven modificados a nivel individual con los movimientos migratorios), dichas agrupaciones están muy presentes en el sentimiento y comportamiento diario de los individuos.

Prueba de ello es que gran parte de los encuestados declara tener buenas relaciones con los miembros de su mismo clan, mientras que tan sólo un porcentaje muy bajo declara lo mismo respecto a otros grupos étnicos. Los pocos conflictos que existen con miembros del mismo clan prácticamente se refieren a algún problema con la tierra, mientras que en el caso de otros grupos, se mezclan problemas de identidad, políticos, de poder, de incomprensión, falta de unidad y de confianza, diferencias por el idioma,

etc… Más aún, algo menos de la mitad de los entrevistados declara confiar en otros grupos étnicos. La afinidad al clan se comprende, además, si se tiene en cuenta que algo menos de la mitad de las respuestas hacen referencia a la ayuda o apoyo recibidos como ventaja de pertenecer a un clan, y una tercera parte, al sentimiento de unidad que les proporciona. Esto demuestra el papel cultural de apoyo que se le atribuye al clan en las sociedades ghanesas, al igual que ocurre con la familia.

Al mismo tiempo, existe una larga trayectoria histórica detrás de los distintos grupos étnicos. Además de las diferencias culturales y de procedencia, han existido confrontaciones entre los distintos grupos étnicos, principalmente por la apropiación del territorio así como de sus recursos, por el intento de obtener poder y supremacía sobre los demás, e incluso para rentabilizar el tráfico de esclavos. Este ha sido el caso de las luchas que han existido durante el s. XX entre Konkombas y Bimobas, en la zona del Alto Este, por conseguir la jefatura, entre Konkombas y Dagombas (Hippolyt, 2002), o Konkombas y Mossis. Los Konkomba fueron invadidos en el s. XVI por los Nanumba, los Gonja y los Dagomba (que tienen relaciones hermanadas con los Mossis). Fueron sus vasallos y obligados a pagar tributos por el uso de la tierra. En el s. XVIII los Asante conquistaron a los Dagomba y les pidieron tributos. Entre esos tributos estaban los Konkomba que eran capturados y entregados a los Asante como esclavos. Actualmente, Dagombas y Konkombas mantienen enfrentamientos por el derecho a la tierra, y existen además entre ellos algunas tensiones religiosas (los Dagomba son musulmanes y los Konkomba tradicionalistas). Existen también tensiones entre Kusasis y Mamprusis por la supremacía en Bawku y por la apropiación de la tierra: los Kusasi alegan su poder en base a ser esta ciudad su asentamiento original, mientras que los Mamprusis, acostumbrados a la jefatura, recibieron en esta zona mayores poderes del Gobierno británico durante el protectorado. Dicha rivalidad entre grupos étnicos se observa igualmente en los datos de este estudio, con los problemas que existen en Bende entre los Bimoba, que son mayoría, y prácticamente el resto de grupos étnicos de la zona. En Bende, además, los Fulani se relacionan poco con otros grupos, excepto por motivos laborales (cuidado del ganado). Los entrevistados también comentan las confrontaciones de otros grupos de fuerte tradición jerárquica, como los Asante, con grupos étnicos como los Konkomba o Kusasi, aunque en la región norte no habitan muchos Asante.

Se observa entonces cómo existe un hermanamiento con determinados grupos de apoyo, en este caso linajes y clanes, frente a un distanciamiento y a veces confrontación, con otros clanes, tribus o grupos étnicos, por la apropiación de recursos y privilegios.

6.2. Dinámica de la confianza

6.2.1. Factores que promueven la confianza

A la hora de decidir confiar por primera vez, casi la mitad de los entrevistados tienen en cuenta cualquier indicio del comportamiento de la persona. Muy pocas

personas deciden confiar de antemano, fijarse en la apariencia, o usar referencias de otros. Pocos también, tienen en cuenta simplemente lo que pueden conseguir con el vínculo (capital social). Algunos grupos étnicos como los Asante, los Mamprusi o los Sissala prestan mucha importancia a la forma de saludar para crear un primer vínculo hacia la confianza.

Las actividades que se realizan en las sociedades estimulan un acercamiento hacia la confianza y, entre ellas, las más mencionadas son las diferentes formas de reuniones: los festivales realizados por cada grupo étnico; las fiestas; los funerales; los rituales de paso existentes en algunos grupos étnicos; los sacrificios que se realizan en la religión tradicionalista para contentar a los ancestros, los cuales son intermediarios con los espíritus de la tierra; las reuniones religiosas; la celebración de los matrimonios; etc… Los funerales tienen una gran importancia en estas zonas y se realizan en dos fases: el Kumian (entierro) y el Kukoan (fiesta celebrada al año siguiente del fallecimiento). Durante el Kukoan, todas las personas invitadas comparten una fiesta en honor al fallecido hasta altas horas de la madrugada, con música, comida, bebida y bailes.

En estas sociedades del norte de Ghana, compartir labores, como trabajar juntos en el campo o en las labores de forestación, tienen un peso destacado en la creación de vínculos de confianza, aunque también compartir charlas, juegos, canciones, creencias religiosas, etc… Igualmente es importante mostrar una actitud de respeto hacia los demás y hacer sentir al otro aceptado y como en casa.

De igual manera que en la creación de la confianza, el indicador básico para mantener la confianza en el tiempo es el comportamiento del individuo, aunque también se menciona la ayuda recibida y la buena comunicación, por medio de saludos, conversaciones, compartir los secretos, etc. Se da mucha importancia en estas sociedades al intercambio de consejos.

6.2.2. Ruptura de la confianza

La causa mayormente mencionada de traición de la confianza se basa en no respetar los secretos, por encima de no recibir ayuda en caso de necesidad. También se menciona la no reciprocidad de la confianza.

Aunque algo más de la mitad de los entrevistados afirma ser capaz de olvidar la traición de la confianza, dependerá del tipo de traición, de la fuerza del vínculo afectivo mantenido, del número de ayudas recibidas anteriormente y, a veces, de si la persona reconoce su error. No obstante, casi una tercera parte de los entrevistados declara no ser capaz de olvidar la traición de la confianza, y es que algunos de los entrevistados declaran tener mayor dificultad para olvidar la traición que para perdonarla, tal vez como modo de protección frente al posible riesgo que supone seguir interactuando con

una persona que ya ha traicionado anteriormente. La religión no parece tener mucha influencia a la hora de perdonar y menos a la hora de olvidar la traición de confianza.

Alrededor de la mitad de los entrevistados castigarían la traición de la confianza, sobre todo con distintas formas de evitación. Pocos utilizarían medidas de acercamiento a la persona, hablando de ello, dando tiempo o aconsejando al individuo. La forma más usada de acercamiento en caso de conflicto se basa en la comunicación, y algunos hablan de la importancia de los mediadores (familiares, jefes o líderes tradicionales, líderes religiosos o Gobierno).

6.2.3. Reputación

La reputación tiene un papel sustitutivo de la confianza en personas no conocidas directamente. En las sociedades estudiadas tiene una gran importancia, y sirve mayormente entre los entrevistados para introducir al individuo en el grupo, recibir ayuda en caso necesario, y ser respetado; frente al ostracismo, falta de respeto y ayuda que reciben las personas de mala reputación. Resulta claro que la reputación sirve sobre todo en los casos en los que es necesario extender las redes sociales, mientras que el comportamiento directo es el que se tiene en cuenta en las pequeñas redes habituales del linaje y el clan.

6.2.4. Valores de grupo

El sistema de valores dentro de los grupos étnicos fomenta, de diferentes formas, el acercamiento, y promociona la confianza entre sus miembros. Esto se muestra en los resultados de este estudio. Por ejemplo, los Kusasi mencionan como valores de grupo fomentar el mantenimiento de su cultura y tradiciones; los Bimoba mencionan entre sus valores, aparte de lo anterior, la necesidad de mantener sus derechos como miembros de su comunidad y construir una mejor comunidad; los Frafra enfatizan el valor de ayudar a otros Frafra; los Asante hacen hincapié en mantener su lengua y herencias; los Gruni le dan valor a hablar su idioma y usar sus vestimentas tradicionales, al igual que los Waala y los Mamprusis; los Konkomba dan mucha importancia a la unidad de su grupo; y los Fulani dan mucho valor a compartir lo que tienen, especialmente la leche, con sus familiares y ancestros.

6.2.5. Religión

Aunque casi la totalidad de los entrevistados afirma que la religión influye en la actitud cooperativa de las personas, existe falta de coherencia de esta afirmación con su comportamiento, como ocurre a la hora de olvidar o perdonar la traición de la confianza, u olvidar los conflictos existentes con individuos de distintos clanes o grupos étnicos.

La religión no parece tener más influencia en la confianza y en la cooperación que los valores inculcados entre los individuos, ya que muchos entrevistados mencionan la ayuda y el respeto a los demás dentro de su sistema de valores. Incluso para algunos musulmanes, su religión es un motivo de separación de las personas que no comparten su fe, aunque otros musulmanes opinen lo contrario. Tal vez los valores religiosos puedan influir, de alguna manera, en una actitud general de apertura y cooperación hacia las personas que no son conocidas, al igual que los valores inculcados fuera de la religión, pero esto sólo implica ciertas actitudes cooperativas que no son las más habituales entre los sujetos (como muestran las redes cooperativas de ego), ni tampoco son las de mayor resistencia ante las dificultades. La actitud cooperativa depende, según se ha mostrado, de otros muchos factores como son la experiencia directa con los individuos, su relación continua con ellos y su nivel de confianza.

6.2.6. Influencia del Gobierno

Se trata de una sociedad cuyos miembros poseen un apreciable porcentaje de inseguridad ante la posibilidad de conflictos, robos u otros peligros, lo cual podría influir en la actitud de confianza hacia desconocidos, pero, según se ha visto, no tanto hacia las personas del linaje o el clan, que son las personas con las que se coopera habitualmente. Otros problemas que provocan inseguridad son las cuestiones económicas.

Las carencias y problemas anteriores son las razones que casi la totalidad de los entrevistados utilizan para argumentar que el Gobierno influye positivamente en las actitudes confiadoras y cooperativas entre los ciudadanos. Los motivos alegados son la creación de políticas de seguridad, de leyes o normas, sus políticas económicas, las políticas que fomentan la unidad entre los ciudadanos y las políticas educativas. Los que consideran lo contrario argumentan la negativa influencia de las malas políticas de gobierno, la necesidad de una mayor promoción de la educación entre los individuos, y el predominio de los intereses propios de los políticos al interés general. Las actividades gubernamentales podrían considerarse como sustitutos del trato personal, los valores del grupo y la reputación, cuando se intenta aumentar el alcance de los vínculos entre personas desconocidas, en este caso, ciudadanos de un país. Los resultados de este trabajo muestran que la confianza y la cooperación dependen más del trato personal que de otro tipo de medidas. Así pues, estas medidas pueden afectar a nivel general y bajo determinadas circunstancias, pero no son las motivaciones más utilizadas habitualmente por los individuos a la hora de depositar su confianza o cooperar.

7. Consecuencias para la subsistencia del individuo

Se ha visto, pues, que el caso del norte de Ghana es un buen ejemplo de las escasas fronteras existentes entre lo social, lo cultural y lo económico, y de cómo los

humanos recuren a prácticas sociales que aseguren altos niveles de confianza, cruciales en los contextos más difíciles. Para ello, se recurre a la creación de grupos fuertemente cohesionados, lo cual se consigue de forma más eficaz en grupos más pequeños. La prueba más radical de ello es el mantenimiento de la amplia diversidad étnica en los puntos más hostiles del continente africano. Dicha tendencia se incrementa en las sociedades más desarrolladas en periodos de mayor crisis económica.

En este sentido, en el norte de Ghana, al igual que en otras zonas de África, se ha utilizado la estructura social basada en el linaje, el clan y el grupo étnico. Aunque sin ser estática, juega un relevante papel en la creación de vínculos de confianza y cooperación entre sus miembros, frente a la competencia con el resto de grupos por el poder y territorio (subsistencia como fin último). Este sistema, que une lo social con lo económico, sobre todo se ha mantenido en la región norte del país, donde los recursos económicos de estos grupos siguen siendo el autoconsumo y la economía de subsistencia.

Del mismo modo que observaban algunos autores de la corriente de la antropología ecológica (White, 1943; Steward, 1955; Harris, 1966; Rappaport, 1967), se observa que el entorno puede jugar un papel en las configuraciones sociales y culturales. En un entorno hostil, en el que predomina un paisaje semiárido de sabana y una agricultura precaria, con condiciones climatológicas adversas, los individuos necesitan de un mayor apoyo de otros para sobrevivir. En la región norte de Ghana la cantidad de lluvias es menor que en otras regiones del país y los efectos del Harmattan, viento seco procedente del desierto, que hace descender la humedad y origina días cálidos, dura más que en la región sur (unos cuatro meses del año). Con estas condiciones difíciles, además de la unidad básica del linaje, el clan ofrece una amplitud del grupo en el que apoyarse, al igual que el grupo étnico. El emprendimiento social, así pues, se basa en la creación de unos vínculos sustentados en valores que fomentan especialmente la pertenencia y ayuda a los miembros del propio grupo (fuerte endogamia étnica en la cooperación).

En lugares con recursos escasos, era de esperar la confrontación por el reparto de poder y de la tierra. Esto ha mantenido las diferencias entre los grupos étnicos y sus conflictos. Ni siquiera la existencia de un Gobierno central ha podido homogeneizar tal diversidad cultural, aunque las estructuras normativas y las gestiones políticas posibiliten una mejora a nivel general para mantener la cohesión ciudadana. Sin embargo, dicha cohesión es más débil y los vínculos que proporciona no son los más utilizados en la cooperación habitual, los cuales funcionan sobre todo en el ámbito del pequeño grupo de confianza personal.

Al margen de pocas excepciones, existe un nivel muy alto de tolerancia religiosa en las sociedades del norte de Ghana. La convivencia de muy diversas religiones está presente dentro de un mismo grupo étnico, incluso dentro de una misma familia. Sin embargo, las creencias espirituales no tienen gran influencia en el comportamiento cooperativo ni en los vínculos de confianza general por encima de los valores culturales

y la educación recibida entre los individuos del grupo étnico, y menos aún en la confianza personal que radica fundamentalmente, como se ha visto, en el compromiso mutuo y el apoyo recibido.

Así pues, aquí quedan reflejados los elementos principales que impulsan la vinculación de los grupos de cooperación. Las asociaciones en Ghana constituyen un claro ejemplo de emprendimiento social que ofrece puentes de similitud a las praxis sociales que están surgiendo en sociedades desarrolladas económicamente en tiempos de crisis, aunque adopten otras formas culturales. Frente a las tendencias individualistas que han caracterizado a las grandes sociedades como consecuencia de la aplicación de economías capitalistas neoliberales, los individuos siguen moviéndose dentro de ellas en contextos micro-sociales en cualquier ámbito de sus vidas. Es, sobre todo en los periodos de crisis, cuando tales estructuras se refuerzan en mayor medida. Tales estructuras son las que han utilizado nuestros antepasados durante la mayor parte de la historia evolutiva humana, lo cual hace pensar que el mecanismo psicológico de la confianza, muy articulado alrededor de las relaciones sociales cercanas, proviene de dicho contexto y está especialmente adaptado para gestionar los entornos más duros.

A cross-cultural comparison of trust-based social networks: Northern Ghana and South-West Mexico groups.

The cross-cultural analysis of the trust and cooperation networks in some areas of Northern Ghana and Oaxaca (Mexico), where a great ethnic diversity exists in a geographical area, is carried out in order to identify the features that better serve to promote social cohesion. This work shows how the mechanism of personal trust at an individual level can be extended at the community level, through cultural resources that are adapted to the groups' needs. Using ego networks of cooperation and interviews as methodologies, this work distinguishes two models of trust and cooperation networks, relative to the different environments of participant groups. However, some "universal" traits can be identified: the importance of the small groups of personal trust, and the emotional aspect of bonds, as the best ways to get adapted to difficult situations by promoting cooperation. Ethnic diversity in a region can also be explained from this perspective, as a basic strategy for increasing cooperation when it is most needed. These traits are primitive in humans and appeared during our evolutionary history. This work also suggests that these emotional bonds are more effective than a normative, compulsory one, to keep the cohesion of groups.

1. <u>Introduction</u>

In order to study the reasons which underlies human sociality, researchers have investigated the mechanisms which drove the evolution of cooperation between individuals, and made them live in societies. Different accounts have been proposed to explain human cooperation. Some appeal to biological reasons: survival of genes –kin selection (Trivers, 1971; Dawkins, 1976; Hamilton, 1981), group selection (Boyd & Richerson, 1990; Wilson & Sober, 1994; Bergstrom, 2002) –, the "reasoned" assurance of direct or indirect reciprocity (Trivers, 1971; Axelrod, 1984; Caporael et al., 1989), or the natural human inclination to punish selfish behavior –strong altruism (Boyd et al., 2003; Gintis et al., 2003; Bowles & Gintis, 2004; Gintis et al., 2008; Boyd et al., 2010). The idea is that cooperation is biologically advantageous for the species that finds a way to foster it.

At the same time, to test some of the previous hypotheses, some authors have resorted to models based on the game theory (Henrich et al., 2004; Henrich et al. 2006; Hoffman et al. 2007; Ermisch et al., 2009; Gächter & Herrmann, 2009; Dal Bó &

Fréchette, 2011). These models are limited from several points of view. On the one hand, the experimental games largely used are played anonymously while individuals use to cooperate just with the people they know (Acedo-Carmona & Gomila, 2013). In addition, such models need to be complemented by knowledge of the historical, economic, social and cultural context in which people move, all of which can influence their cooperative behavior. Therefore, it is also necessary to complement the formal analysis of cooperation with naturalistic fieldwork. Similarly, research on the evolution of cooperation requires cross-cultural studies in order to find some "universal traits" of cooperation and distinguish them from cultural influences. Otherwise, the explanations and some of simulations used seem to be too simple to explain the diversity of cooperative behaviors that appears in human societies. In order to better understand this complexity, we propose a more subtle and unconscious mechanism based on the intermediation of trust and we consider how it works in two different social settings, which share a general trait: multiple ethnic groups sharing the same geographical space.

Although trust has also received attention in research, it has not been included in the evolutionary explanations of cooperation (Acedo-Carmona & Gomila, 2012). However, many have been the trust analysis that have used formulas for its measurement (Yamagishi, 1998; Glaeser et al., 2000; Naef & Schupp, 2009; Miller & Mitamura, 2011; Wang & Gordon, 2011), despite the difficulty of this challenge, given the complexity of the elements that affect it. As well, in many occasions such measurements have been focused more on the notion of general trust (Yamagishi, 1998; Putnam, 2000; Uslaner, 2002) –attitude toward any unknown individual– than on personal trust (Yamagishi, 1998; Putnam, 2000) –which arises from previous positive experiences with known individuals.

However, apart from the conscious and reasoned cooperation carried out at specific situations, the most powerful forces affecting a majority of the cooperative relationships seems to be conducted through another mechanism, that of personal trust, resulting in higher levels of cooperative relationships (Acedo-Carmona & Gomila, 2013, 2014). Personal trust provides a feeling of security, resulting from the expectation of positive behaviors of the trust circle members. This mechanism unconsciously guarantees the own pro-social behavior towards these trusted persons.

The study Acedo-Carmona & Gomila (2014) also showed how the topology of networks of trust can offer information on the way how trust works within groups. The work already showed the dominance of the small trust circles within the groups' trust networks. According Zhou et al. (2005), Stiller & Dunbar (2007) and Roberts et al. (2009), humans need to limit the number of people that are included in the closest circles because of cognitive and time reasons, although trust could be other element to take into account. However, experimental games methodology, despite our effort to contrast cooperation with trusted people in comparison to other people, which is closer to the social reality, misses the context analysis and the natural behavior of individuals in their environment. Even the exemplar study of Henrich et al. (2004), which complemented the results with experimental games with ethnographic interpretation,

failed to do so in a satisfactory way, given the shortcomings of the anonymous games methodology. Naturalistic fieldwork is clearly required.

On the other hand, it is questioned whether the need of closeness and familiarity at the time to create a trust circle at an individual level (Acedo-Carmona & Gomila, 2013, 2014), may provide the basics of an explanation for the degree of cohesion of a societies.

The hypothesis used as the base of this work refers to the idea that humans keep nowadays the mechanisms adopted along their evolutionary history, as the most adapted ways to face survival and difficult contexts. One of these mechanisms is thought to be personal trust, and the sociality in small groups derived from this personal trust mechanism.

From both counts, therefore, it is relevant to analyze how trust and cooperation networks are organized in different cultures with different environmental constraints. At the same time, it is also interesting to analyze some areas where an unusual degree of cultural diversity is kept in time. Such is the case of the two areas compared in this work: Northern Ghana (NGHA) and the Oaxaca region (OAX), Mexico. In NGHA, cultural diversity persists despite the continuous interaction among groups in the same region, and in OAX, even after a long history in common.

Previous work on the ethnic groups in NGHA (Acedo-Carmona & Gomila, 2014) suggests that culture serves as a tool to boost the necessary ties, in order to get a certain level of "personal trust" in cooperative networks with a larger number of members. This work also suggests that the ethnic diversity serves as a way to face the contexts with hard difficulties to survive.

Nevertheless, the cross-cultural comparison NGHA-OAX trust-based networks of cooperation, presented in this work, aims at advancing our account, by confirming the existence of small circles of trust and cooperation at the society level, and testing the previously mentioned mechanisms as possible universal traits in humans. In addition, the work also tries to confirm the conditions of group diversification, sometimes at the cultural level, as an adaptation to adapt to harsher environments and social conditions. .

At the same time, this comparison may contribute to better understand which cultural formulas are adopted to get adapted according to the individuals' need for trust, with different degrees of group cohesion as a consequence. Different cultural tools to keep group bonds can be illuminated in this vein.

Therefore, for these goals, this study presents a methodology based on the comparison of personal networks of cooperation of the different ethnic groups in both places. It also uses interviews to deepen into the analysis of the characteristics of trust and cooperation networks. In addition, it takes into account the cultural, social, economic, political and historical contexts that underlie these groups.

The work supports the previous hypothesis that small groups of trust and cooperation are the basic, universal, form of sociality. This social form is modulated by the particular environment the group is placed and the cultural strategies developed to foster trust and cooperation beyond such a basic social unit. Comparing the Ghana and Oaxaca groups reveals different strategies in this respect, which have to do with the differences in environmental conditions. The more scarce the resources, the higher the degree of social cohesion needed to sustain the society and the greater the push towards keeping ethnic diversity.

2. **Background**

2.1. *Areas and groups of research*

Oaxaca (Mexico)

Oaxaca is one of the 32 federal entities that compound Mexico. It is located in the South of the country, in the southwest of the Tehuantepec Isthmus. It is distributed in 8 regions, which comprises 30 districts (Fig. 27). The places and ethnic groups visited in the study were:

- In the **Mixtec** region (area Northwest of Oaxaca): *Mixtecs* (Spores, 2008; Joyce, 2010) from **Yolotepec de la Paz**, in the Tlaxiaco district, with a population of 151 inhabitants.

- In the **Central Valleys** region: *Mestizos* (Chance, 1979) from **Oaxaca de Juarez**, in the Center district, with a population of 255.029 inhabitants; and *Zapotecs* (Zeithin, 1990; Joyce, 2010) from **Teotitlán del Valle** in Tlacolula district, with 4,357 inhabitants.

- In the **Isthmus** region: *Chontales* (Oseguera, 2004) of several towns in the District of Tehuantepec, from their **highland areas –colonia Marilú**, with 411 inhabitants, and **San Miguel Ecatepec**, with 677 inhabitants, both in Magdalena Tequisistlán, and **San Miguel Tenango**, with 552 inhabitants–, and from their **coastal areas –San Pedro Huamelula**, with 2,100 inhabitants and **Santiago Astata**, with 3,642 inhabitants–; *Zapotecs* (Zeithin, 1990; Campbell, 1993) from **Juchitán de Zaragoza**, with 74.825 inhabitants, and *Zoques* (Trejo, 2006) from **San Miguel Chimalapa**, with 135 inhabitants, both of them in Juchitán district.

Such diversity of ethnic groups is accompanied by the same diversity of languages or dialects. The participants' languages, in addition to Spanish language, comes from different families of languages: **Otomanguean languages** (the Zapotec language in different dialects: the main Zapotec in Tequisistlán Valley and the Tehuantepecan Zapotec in Juchitán; and the Mixtec language), **Toto-zoquean languages** (Mixes languages and the Chimalapas Zoques languages), and **the Hokan**

languages from Southern area (Chontal language from Oaxaca or also called Tequistlatecs –highland and coastal dialects).

Figure 27. Situation of Oaxaca, its regions and districts, and the visited locations –red and blue points. (http://revistatzacualli.blogspot.com.es/. Modified by Cristina Acedo)

Northern Ghana

Ghana has 10 administrative regions, including the regions in the North and the Upper-East (Fig. 28) where the study was conducted. The places and ethnic groups visited in the study were:

- In the **Upper-East** region: groups from the area such as the *Kussasis* (Syme, 1932; Hilton, 1962; Awedoba, 1989, 2001), *Frafras* (Hart, 1971), *Bissas* and *Mossis* (Zahan, 1967), and other groups from other regions of the country such as the *Ashanti* (Rattray, 1931, 1932) in the Ashanti region, and *Sissalas* and *Waalas* (Wilks, 1989) in the Upper-West region, everyone installed in **Bawku**, in the Bawku Municipal district, with 56.830 inhabitants; and *Kussasis* from **Garu**, in the Garu-Tempane district, with 20.802 inhabitants.

- In the **Northern** region: *Mamprusis* (Drucker-Brown, 1975, 1992; Schlottner, 2000), *Bimobas* (Fussy, 1979; Laari, 1987; Assimeng, 1990), *Konkombas* (Tait, 1961) and *Fulanis* (Oppong, 2002; Tonah, 2005), from **Bende**, in the Bunkpurugu-Yunguo district, with approximately 5.875 inhabitants.

Participants from Bawku live in an urban environment, and participants from Bende and Garu live in rural areas.

The different languages of all these ethnic groups are part of the set of Nigerien-Congolese languages: the languages **Kwa** (Ashantis), **Gur** (Bimobas, Mamprusis, Mossis, Kussasis, Sissalas, Walas, Frafras, Konkombas), **Mande** (Bissas) and **Fulbe** (Fulanis). However, each of these branches has resulted in different languages and dialects for each of these groups.

Figure 28. Situation of Ghana, its districts and the visited areas.

2.2. Historical and cultural context

Both areas have a wide diversity of ethnic groups. However, the circumstances in which such multiple groups have emerged and the levels of interaction among groups are different. In both zones the different cultural groups have coexisted for a long time, but a sense of own identity has been kept, despite interacting or sharing a common history. In order to understand better this question, below there is a brief review of the historical context where both social and cultural networks structures have been created.

Oaxaca

The settlements in the current region of Oaxaca followed different stages: agricultural settlements (9,000 to 1,500 B.C), "villages" (1,500 to 500 B.C.), urban settlements (500 B.C. to 800 A.D.), and "city-states" (750 to 1,521 A.D.). These concentrations were constituted by the union of family lineages (Bandelier, 1982). They were growing until the appearing of cities and "cultural civilizations". Examples of this are the large concentrations of Olmec, Zapotec and Mixtec people in the Middle Pre-classic period (1,200 - 400 B.C.). These City-States became more complex and extended to other areas. They were creating hierarchical figures who managed different aspects of group life: a maximum governor, advisers, officials (judges and guardians), army heads, province governors and tax collectors. Therefore, they were societies organized by strict normative regulations.

Although these cities influenced each other, they kept their own identity, cultural traits and management. The Mixtec people, for example, were organized into

independent Lordships. The same happened with alliance between cities such as Teotihuacan, Monte Alban (Zapotec city) and Tikal (Mayan city) during the Early Classic period (200-600 A.D.), and with the Toltec people in the Late Classic period (600-900 A.D.) and the Early Post-classic period (800/900-1,100 A.D.). In the Late Post-classic period (1,100-1521/1694 A.D.) begins a period of wars, in which some groups invade others' territory, such as the Mixtec people who force Zapotec people toward the Isthmus regions, and the Aztecs –the Mexica people– who were moving towards Oaxaca and Yucatán from the North. However, the Aztecs allowed self-management in the conquered territories in exchange for receiving tributes.

This same autonomy in the management of their own affairs is maintained during the Spanish colonization. Despite the exploitation of indigenous people and the inclusion of new taxes that squeezed their resources, the Spanish Crown allowed the Indians to keep in many cases their self-management, through the communal possession of territory (Reina, 2004). The settlers were more interested in the profit from local resources by the intermediation of the noble elite –"caciques"– collecting taxes, than in intervene directly into the management of resources. The colonization pressure influenced positively the revival of ethnic communities because it was a way used by indigenous to join the community efforts in order to survive, face to the settlers' pressures.

Along the colonial period and the independence of the Republic of Mexico, governors pursued progressively a cultural homogenization trying to privatize lands and creating municipalities to get the most possible control over resources and people (Nahmad, 2013). However, far from getting the control of indigenous people, these policies helped to reaffirm their cultural differentiation and the communal fight to maintain the "*usos y costumbres*" system –their self-management–, that guaranteed the participation of the community members in community decisions, including the communal possession of land. In this way, territory, community and cultural identity merged into the same goal of subsistence of individuals against their exploitation and marginalization by the powerful elite –firstly Spanish nobles, and Creole and wealthy Mestizos later. Not in vain the inherited Mesoamerican believes largely already linked the group identity with a specific territory (Barabas, 2006, 2008).

In sum, these groups, previously the pre-Hispanic groups keeping their cultural specificities in spite of their mutual influence, subsequently in the Colonial and Republic periods, reaffirming identity as groups of indigenous people, and finally with the communal self-management in municipalities, became into the current ethnic groups (Reina, 2004). In the case of Oaxaca, these municipalities were also physically separated due to the character mountainous of these regions and the great climatic diversity. All these elements contributed to the great ethnic diversity that currently appears in the Oaxaca region, where there is a large number of small municipalities with their own cultural specificities, respect to clothing, customs, dances, festivals and

dialects, despite that also they have quite common cultural elements due to its long history in common.

Ghana

The origin of the ethnic groups that exists in Ghana and their history are not very clear (Southall, 1970; Schildkrout, 1979; Ranger, 1983, 1993; Lentz, 2000). The members of these groups, as well as in Mexico, belong to different joint lineages, but in this case, turning to the figure of "clan", which is very important among the African groups. In the Northern Ghana, in addition to the settlements of acephalous groups of indigenous people, other tribes settled coming from other areas.

The North of Africa has had a long history of nomadic tribes moving across the continent and a long tradition of movement of traders. Sub-Saharan migrations by the trade of gold and salt, and the slave trade, caused frequent movements of different groups in the area.

Akan people seem to have migrated from Africa-West between the 10th to 12th centuries to the wooded areas of the current Ghana and established small States in the mountain regions. Already in the 10th century, South of Ghana was part of the Asante Empire. These groups were also small "city- states" that, over the centuries, came together to form an empire in the 18th century.

In the North of Ghana, it seems that the Mole-Dagbane Kingdoms (Mamprusi, Dagomba and Mossi people) were settled, between the 13th to 15th centuries, coming from North-East African areas, which overlooked the acephalous people installed there. The Kussasi, Frafra and Sissala people, that also inhabit some areas of Northern Ghana, came from West of Sudan and migrated to the area in the 17th century, although other Sissala people seem to be descendants of the Mole-Dagbane groups. The Fulani people came from Niger and Senegal in the 16th century but migrated to Northern Ghana practically at the beginning of the 20th century. The Bissa or Busanga people settled in the White Volta in the 14th century. The Bimoba people are the mixture of the Moba people, who migrated from Burkina Faso in the 17th century, with Mamprusi and Konkomba people, after being driven to the North by the Mamprusi and Dagomba people. Regarding to the Konkomba people, it seems that they are some of the few originating groups of these lands. The Waala people, from the city of Wa, capital of the Upper-West region, arise from the conjunction in the 17th century of the warrior traditions of the Dagomba and Mamprusi people and Islamic traditions transmitted through small groups of Mande immigrants from Niger. Both, the Mamprusi and the Mossi people in the North and the Asante people in the Center of Ghana, were centralized and hierarchical groups that gained more power, compared to the other mentioned groups, who were acephalous. In these cases, however, the more powerful groups were assimilating the social forms of the groups whom were mixed with (Rattray, 1932). On these historical data there are controversies among authors.

In short, all of these groups are the result of the creation of different lineages that were forming their own cultural traits over time. The dynamics of separation and union to form new lineages with own cultural traits have been continuous. The cultural diversity is observed in their different languages and dialects, beliefs, customs, festivals, etc.; differences either really based on history or on a common imaginary.

In the 15th century, the Portuguese people exploited the mineral resources of this area, and subsequently came British, French and Dutch people (in the 16th century). In the 17th century, the Asante Confederation unified the groups. Solidarity between groups was convenient because of the competition that existed to acquire farmlands, control trade routes and protect each other. In 1901, the areas of Northern Ghana became English Protectorate. The rivalries that existed among certain ethnic groups, because of the fights for territory or slave trade, were increased with the English colonization, which promoted inequality of power between them and granted certain social and economic courtesies in some ethnic groups in detriment of others. In 1957, the country became independent but the differences before and during the colonial period are the origin of the current inter-ethnic tensions and the cultural reaffirmation of groups.

There are, in this case, groups that also have influenced each other at a cultural level, but the survival pressures and their different allocation of power regarding to others have led them to strengthen their ethnic identity.

2.3. Economic contexts

Resources and the economic development of the two countries are also different. While in OAX the GDP per capita by purchasing power parity (PPP) –gross domestic product per capita converted to international dollars using purchasing power parity rates– in 2013 was $16,463, in NGHA was $3,974 (World Bank data) .

While OAX is one of the poorest regions of Mexico, it is in a better position than NGHA, both because of the productive resources of its environment and its level of economic development.

In OAX people live mainly from agriculture, as well as tourism, the sector of services, crafts, fishing, salt in some coastal areas of the Isthmus region, and recently the wind energy. The climatic diversity in OAX allows the cultivation of a wide range of products such as cane sugar, lemon, orange, alfalfa, barley, corn, avocado, pineapple, rice, melon, watermelon, agave, coffee and tobacco. In general, the landscape of OAX offers abundant vegetation and the rains per year are 1,550 mm.

Ghana, however, is one of the poorest countries in the world, even though its economy has grown mainly by improvements in agriculture, due to the development of the extractive industries, the natural resources of the country (oil, gas and minerals), the

sector of services and manufacturing. However, the North of the country is dominated by the Savannah with areas of grasses, baobabs and acacia trees. These arid areas – 1,015 mm of rain per year– are used mostly for slash and burn farming and livestock. Also, the effects of the Harmattan, dry wind from the wilderness, which calls down the moisture and causes warm days, lasts about four months of the year. Conflicts because of the distribution of farmland and rudimentary and small-scale farming techniques provide the inhabitants of a subsistence economy.

2.4. Social and political structures

Both in OAX and NGHA, relatives play an important social role. However, there are some differences between these countries in the relatives' networks and also in other social structures:

Oaxaca

In OAX, the nuclear family –parents and children– is the most widespread form of cohabitation. Sometimes, grandparents or other solitary members of the family can be part of the household, but normally children change their place of residence when they get married. In many cases, the ties between siblings become weaker, especially because of their different place of residence. Other social groups are those arisen from the bonds created in the educational, work and neighborhood contexts in which individuals move, characteristic of societies with greater number of inhabitants and more complex social organizations.

However, the sense of community is deeply-rooted among these groups. Both in urban areas –"*colonias*"– as in the rural area –"municipality"–, people create a sense of community. The community has a role for the self-management of common affairs (Maldonado, 2013). The community is organized through periodic assemblies where all adult members can and must attend to –women increasingly are being more accepted in these meetings. The community is also managed through some public service obligations –"*tequios*"– that are required to its members. In the cities, such communities are constituted around the territory occupied, which allows the coexistence of people settled from other municipalities –different cultural traits–, and with *Mestizos*.

However, in rural areas, the municipality –administratively established territory– becomes a core of cultural identity, especially as a result of the Spanish colonization and subsequent policies carried out by the Republic of Mexico. The inhabitants of such municipalities are part of different cultural groups, who have kept certain cultural traits over the time and in other occasions have developed cultural variations –different dialects, clothing, costumes or dances with certain modifications, etc.– in order to acquire specific hallmarks. The internal community administration regulated by "*usos y costumbres*" has allowed them some way of self-management. This form of community self-management implies the direct involvement of the whole community, again in

periodic assemblies, to decide on common issues. Also, the communal administration of farmlands has given rise to a system of distribution and appropriation of lands for its exploitation, while the property remains communal. However, the current gradual inclusion of political parties in municipalities is threatening both the "*usos y costumbres*" system and the communal distribution of land.

All of these forms of self-management and community membership –urban or rural– are accompanied by its implicit normative communal sense that forces its members to comply their "*tequios*" –community services–, which have a strong tradition. Failure to comply with the mandatory services has negative consequences for those individuals that omit their duties. Therefore, group cohesion has a great normative and authoritative basis. The "*tequio*" has a more extended sense as help to others in order to get a future help if necessary. This sense of required reciprocity is very internalized in individuals, but again in an unconscious normative sense.

Ghana

In NGHA the extended family still cohabits to a greater extent than in OAX and, in many cases, family in NGHA includes a greater number of people, as it is shown in the language, using a same term to name different relatives. In addition, in NGHA, the closest relatives follow lineages –matrilineal or patrilineal– and clans, which are cultural ways that gain importance in the way of structuring society and economy.

In NGHA monogamy or polygamy are allowed, depending on one's religion. Polygamy occurs very frequently. Relatives that cohabite generally are the extended family, especially in rural areas. Family is composed by the husband and several wives, and the rest of the lineage members –matrilineal or patrilineal– depending on the ethnic group, so that the domestic group may consist of up to 50 people. The most of the ethnic groups in NGHA are patrilineal, just the Akan groups have matrilineal lineages. In urban areas the relatives' cohabitation tends to be composed of a smaller number of people.

These social structures are also strongly linked to economic aspects, since properties and titles are distributed by lineage, group belonging implies group support, and the signs of identity establishes the rules for partnerships and marriages. Also the household head –landlord– can decide about the transfer of exploitation rights on the lands the community gives to him, as well as on the management and allocation of tasks among the family members.

The concept of clan usually refers to a group united by ties of kinship or by a common ancestor. In the case of Ghana the clan can also have a territorial sense and can refer to a lineage, a set of lineages, or groups that occupy a territory in common.

Apart from the family and clan, there are other social structures such as the "community" –group of individuals that reside in a territory in common–, that may

constitute a clan or several clans; the "heads of clan or lineage" –group of elders– who decide internal clan' or lineage' issues; the "priests of the Earth" –religious authorities–; and "the chiefs" –who manage the judicial affairs and are mediators in matters with the Government. The "community" assigns the farmlands (Agbosu et al., 2007), and the "heads of clan or lineage" and the "priests of the land" manage communal resources – such as water, hunting, fishing, use of forests, etc.– and oversee the rules compliance on such resources (Kotey, 1995).

There are conflicts among some ethnic groups through the acquisition of administrative power, the land rights and by historic conflicts among certain ethnic groups that tried to impose on others. The British colonial Government gave greater power to some groups, especially those who already possessed a more hierarchical social structure and power before the colonization, but currently the groups that were historically acephalous are trying to claim their space of power (Manboah-Rockson, 2004). All of these reasons strengthened ethnic identity.

However, in this case the groups are linked by a sense of identity and belonging attached to the concepts of lineage and clan, differently to the normative cohesion of OAX groups. Although in both areas there are some elements in common with respect to the existence of communal ownership of land and the ethnic reaffirmation as a way of protection, in NGHA there is a much more interaction between ethnic groups, despite the history of conflicts between some of them. In NGHA can often be seen marriages between people coming from different ethnic groups. However, in OAX the different ethnic groups have less contact with each other.

3. Methods

3.1. Procedures

Two methods has been used at the same time to collect data: participants' networks of usual cooperators –ego networks–, and personal interviews.

Ego's networks

Ego networks refer to the personal networks of cooperation. In order to get them, participants are asked to list the names of people they usually cooperate with. They are also asked for the cooperators' ethnic groups, type of relationship between ego and his cooperators, type of cooperation they keep, whether the cooperative relationship is one-sided or mutual (reciprocity), and the trust level they keep towards cooperators. In Annex 5 there appears this form for OAX groups and Annex 6 for NGHA groups.

Interviews

Participants were interviewed about trust and cooperation. The interview consisted of 21 questions –Annex 7 for OAX and Annex 8 for NGHA–, which focused on the factors involved in the creation, maintenance and breakdown of trust, looking for the factors that might be universal and those that might be culture-related: questions on

what they took into account at the time to decide trusting someone for the first time; who they trusted more and who were their trustees for secrets; if it was possible to trust always the family, their meaning of family and their family relationships; the exchanges that required higher levels of trust; what type of situations they considered as a betrayal of trust, if they would be able to forget such a circumstance, and how they would punish it; their relationships within the same clan; if they trusted other ethnic groups and their relationships with them; activities carried out in the community to promote trust and integrate new members; importance of reputation in community; the influence of religion or the Government attitude for trust and cooperation among individuals; and the level of respondents' feeling of safety and their values as group. Among the list of questions, those making reference to known trustees concern personal trust, but other questions refer to general trust –such as trusting other ethnic groups in general, or the influence of religion or Government authorities in assuring cooperation, for example.

3.2. Participants

Ego networks

In OAX, 66 persons participated: 34 males –51.5%– and 32 females –48.5%. The participants' ethnic groups are: 15 Chontales –22.7%–, 10 Mestizos –15.2%–, 1 Mixe –1.5%–, 1 Mixtec –1.5%–, 17 Zapotecs from Juchitán –25.8%–, 12 Zapotecs from Teotitlán del Valle –18.2%– and 10 Zoques –15.2%. The distribution of these ethnic groups by gender is collected in Fig. 29.
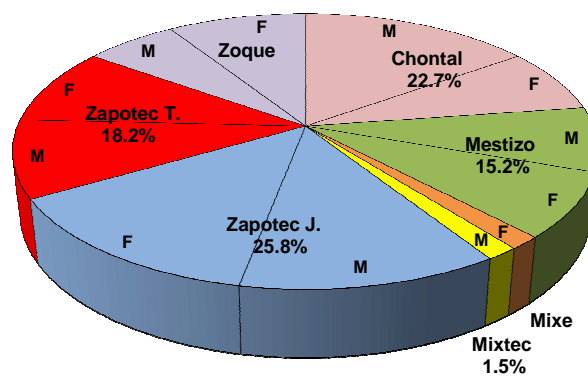
Figure 29. Distribution of participants by ethnic groups in the method of ego's networks of cooperation. M means male and F means female.

In NGHA, 46 persons participated: 33 males –71.7%– and 13 females –28.3%. The participants' ethnic groups are: 9 Bimobas –19.6%–, 1 Frafra –2.2%–, 9

Konkombas –19.5%–, 11 Kussasis –23.9%–, and 16 Mamprusis –34.8%. The distribution of these ethnic groups by gender is collected in Fig. 30.
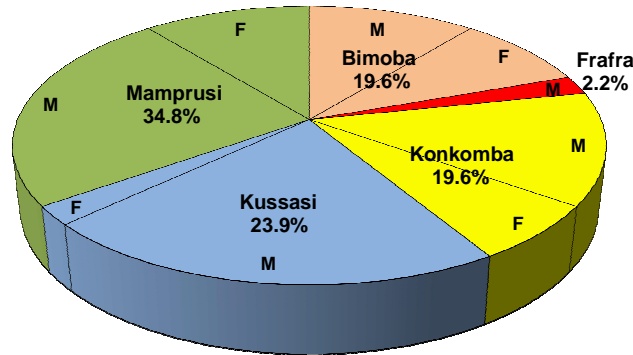
Figure 30. Distribution of participants by ethnic groups in the method of ego's networks of cooperation. M means male and F means female.

Interviews

In OAX, 35 persons were interviewed: 19 males –65.5%– and 10 females – 34.5%. The ethnic groups of participants are: 6 Chontales –17.1%–, 8 Mestizos – 22.9%–, 2 Mixes –5.7%–, 3 Mixtecs –8.6%–, 5 Zapotecs –14.3%–, 8 Zapotecs from Juchitán –22.9%–, 3 Zoques –8.6%. The distribution of them by gender is collected in Fig. 31.
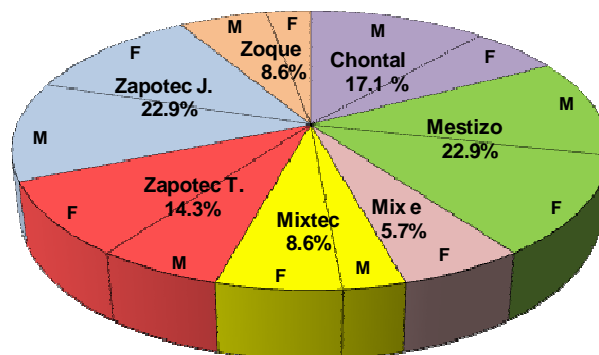
Figure 31. Distribution of interviewees by ethnic groups and gender. M means male and F means female.

In NGHA, 29 persons were interviewed: 19 males –65.5%– and 10 females – 34.5%. The ethnic groups of participants are: 1, Akan –3.4%–, 1 Asante –3.4%–, 4 Bimobas –13.8%–, 1 Bissa –3.4%–, 1 Frafra –3.4%–, 3 Fulanis –10.3%–, 1 Gruni – 3.4%–, 4 Konkombas –13.8%–, 5 Kussasis –17.2%–, and 4 Mamprusis –13.8%–, 1

Mossi –3.4%–, 1 Sissala –3.4%– and 2 Waalas –6.9%. The distribution of them by gender is collected in Fig. 32.
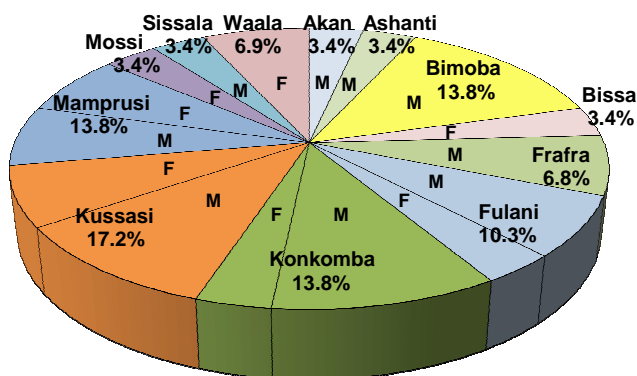
Figure 32. Distribution of interviewees by ethnic groups. M means male and F means female.

4. Results

4.1. Comparison of cooperators' and trustees' networks

Small-size of trust and cooperation networks (personal trust)

In both cases, the number of usual cooperators isn't very high. The mean among different ethnic groups doesn't exceed the 15 people. The mean of usual cooperators is fewer in OAX –9.36– than in NGHA –14.39 (Tab. 3).

Number of usual cooperators					
	N	Mean	Std. Deviation	Variance	Median
OAX	66	9.36	5.615	31.527	7.00
NGHA	46	14.39	11.008	121.177	10.50

Table 3. Comparison of mean number of usual cooperators.

Although the mean of trustees is higher than the mean of usual cooperators, it does not exceed 24 people. Again, the mean of trustees is fewer in OAX –12.50– than in NGHA –23.67 (Tab. 4).

Number of trustees					
	N	Mean	Std. Deviation	Variance	Median
OAX	34	12.50	19.288	372.015	6.00
NGHA	27	23.67	33.552	1125.769	10.00

Table 4. Comparison of mean number of trustees.

The participants' trust levels towards their networks of usual cooperators are detailed in Tab. 5, in terms of mean number of usual cooperators distributed by each of the trust levels. It is also noted that there are more usual cooperators with high trust levels in NGHA than OAX (Fig. 33).

	Number of cooperators by trust level				
GROUP		Very.high.trust	High.trust	Middle trust	Low.trust	No.trust
OAX	Mean	3,02	3,27	2,38	,52	,18
	N	66	66	66	66	66
	Std. Deviation	2,421	3,698	2,021	1,026	,763
	Variance	5,861	13,678	4,085	1,054	,582
	Median	2,50	2,00	2,00	0,00	0,00
NGHA	Mean	5,09	6,59	1,65	,70	,30
	N	46	46	46	46	46
	Std. Deviation	4,979	8,145	3,928	1,631	,840
	Variance	24,792	66,337	15,432	2,661	,705
	Median	4,00	4,00	0,00	0,00	0,00
Total	Mean	3,87	4,63	2,08	,59	,23
	N	112	112	112	112	112
	Std. Deviation	3,812	6,131	2,963	1,305	,794
	Variance	14,531	37,586	8,777	1,704	,630
	Median	3,00	3,00	1,00	0,00	0,00

Table 5. Comparison of mean number of usual cooperators distributed by trust levels.
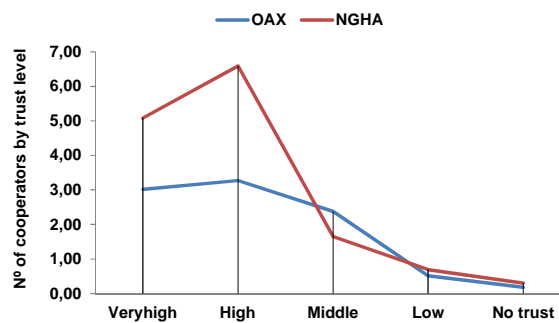
Figure 33. Representation of mean number of usual cooperators distributed by trust levels.

In general, there are significant differences –one-tailed Mann-Whitney test– respect to the number of usual cooperators (U = 1135, z = -2.27, N = 112, p < 0.03, r = -0.214) and trustees (U = 302.5, z = -2.28, N = 61, p < 0.02, r = -0.291) among OAX and NGHA: a higher number of people in both cases in NGHA. In addition, the numbers of usual cooperators that are low or not trusted show no significant differences (U = 1514.5, z = -0.027, N = 112, p < 0.5, r = -0.002 and U = 1404, z = -1.256, N = 112, p < 0.2, r = -0.118 respectively) between the two countries, but significant differences were found between the number of cooperators with very high (U = 1191.5, z = -1.95, N

= 112, p < 0.03, r = -0.184), high (U = 1039.5, z = -3.75, N = 112, p < 0.003, r = -0.269) and middle (U = 902.5, z = -3.75, N = 112, p < 0.001, r = -0.354) trust levels: a higher level of very high and high trusted cooperators in NGHA and middle trusted cooperators in OAX (Tab. 6).

Comparison of OAX & NGHA trust (one-tailed Mann Whitney test)							
GROUPS	**N. coop.**	**N. Trustees**	**Trust level**				
			Very high trust	**High trust**	**Middle trust**	**Low trust**	**No trust**
OAX / NGHA	U = 1135 **p < 0.03**	U = 302.5 **p < 0.02**	U = 1191.5 **p < 0.03**	U = 1039.5 **p < 0.003**	U = 902.5 **p < 0.001**	U = 1514.5 p < 0.5	U = 1404 p < 0.2

Table 6. Comparison of differences in number of cooperators, number of trustees and trust levels of usual cooperators between OAX and NGHA.

Analysis of trust and cooperation networks by type of location of participants

Given the heterogeneity of participants respect to location in both countries (Tab. 7, Fig. 34), it is questioned if the difference in the number of cooperators (Tab. 8, Fig. 35), trustees (Tab. 9, Fig. 36) and trust levels towards the usual cooperators (Tab. 10, Fig. 37) can be influenced by this factor. The composition of participants in NGHA includes people dispersed in rural areas, others who reside in urban areas of less than 6,000 inhabitants and those living in urban areas of over 50,000 inhabitants. In the case of OAX, participants are divided between those who reside in the two types of urban areas mentioned previously (Fig. 37).

Composition of participants by types of location					
	Ego's networks (N)		Interviews (N)		%
	OAX	NGHA	OAX	NGHA	OAX	NGHA
Rural areas		16		7	0,00%	30,67%
Urban areas no more than 6,000 inh.	39	25	17	10	55,45%	46,67%
Urban areas more than 50,000 inh.	27	5	18	12	44,55%	22,67%
Total	66	46	35	29	100,00%	100,00%
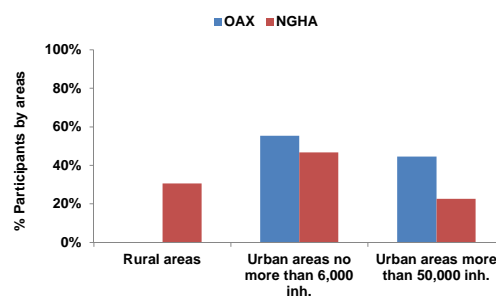
Table 7 and **Figure 34.** Comparison and representation of the number of participants by location.

N. cooperators						
	Rural areas		Urban areas			
			No more 6,000 inh.		More than 50,000 inh.	
	OAX	NGHA	OAX	NGHA	OAX	NGHA
Mean		15,06	10,33	10,36	7,96	**32,00**
N		16	39	25	27	5
Std. Deviation		8,054	6,084	6,383	4,612	**19,672**
Variance		64,863	37,018	40,740	21,268	387,000
Median		14,00	8	10,00	7,00	44,00
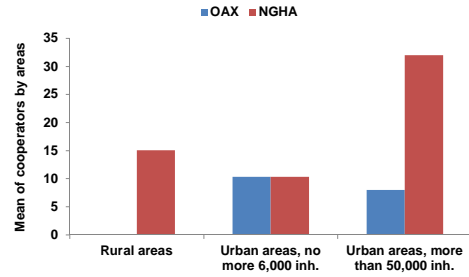
Table 8 and **Figure 35.** Comparison and representation of the participants' mean number of usual cooperators by location.

N. trustees						
	Rural areas		Urban areas			
			No more 6,000 inh.		More than 50,000 inh.	
	OAX	NGHA	OAX	NGHA	OAX	NGHA
Mean		48,29	12,71	21,88	12,29	10,50
N		7	17	8	17	12
Deviation		**51,661**	13,990	**29,878**	**23,905**	7,740
Variance		2668,905	195,721	892,696	571,471	59,909
Median		50,00	9,00	11,00	4,00	10,00
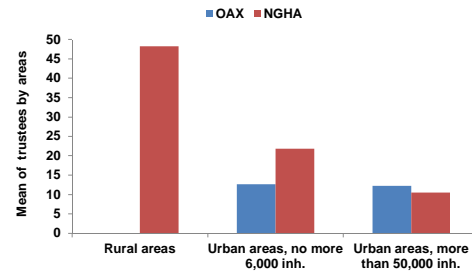
Table 9 and **Figure 36.** Comparison and representation of the participants' mean number of trustees by location.

Mean of n. cooperators by trust level										
GROUP		Very high trust		High trust		Middle trust		Low trust		No trust
		OAX	NGHA	OAX	NGHA	OAX	NGHA	OAX	NGHA	OAX	NGHA
Rural areas	Mean		4,31		6,38		2,19		1,50		,69
	N		16		16		16		16		16
	Std. Deviation		6,107		3,384		2,428		2,366		1,250
	Variance		37,296		11,450		5,896		5,600		1,563
	Median		2,00		5,50		1,00		,50		,00
Urban areas no more than 6,000 inhab.	Mean	3,08	6,00	4,10	4,00	2,62	,32	,36	,04	,18	,00
	N	39	25	39	25	39	25	39	25	39	25
	Std. Deviation	2,860	4,463	4,235	4,601	2,098	,690	,959	,200	,823	,000
	Variance	8,178	19,917	17,937	21,167	4,401	,477	,920	,040	,677	,000
	Median	2,00	5,00	3,00	2,00	2,00	,00	,00	,00	,00	,00
Urban areas more than 50,000 inhab.	Mean	2,93	3,00	2,07	20,20	2,04	6,60	,74	1,40	,19	,60
	N	27	5	27	5	27	5	27	5	27	5
	Std. Deviation	1,639	2,550	2,336	17,398	1,891	10,286	1,095	1,673	,681	,894
	Variance	2,687	6,500	5,456	302,700	3,575	105,800	1,199	2,800	,464	,800
	Median	3,00	3,00	2,00	14,00	2,00	1,00	,00	1,00	,00	,00
Total	Mean	3,02	5,09	3,27	6,59	2,38	1,65	,52	,70	,18	,30
	N	66	46	66	46	66	46	66	46	66	46
	Std. Deviation	2,421	4,979	3,698	8,145	2,021	3,928	1,026	1,631	,763	,840
	Variance	5,861	24,792	13,678	66,337	4,085	15,432	1,054	2,661	,582	,705
	Median	2,50	4,00	2,00	4,00	2,00	,00	,00	,00	,00	,00

Table 10. Comparison of the participants' mean numbers of usual cooperators distributed by location and trust levels.
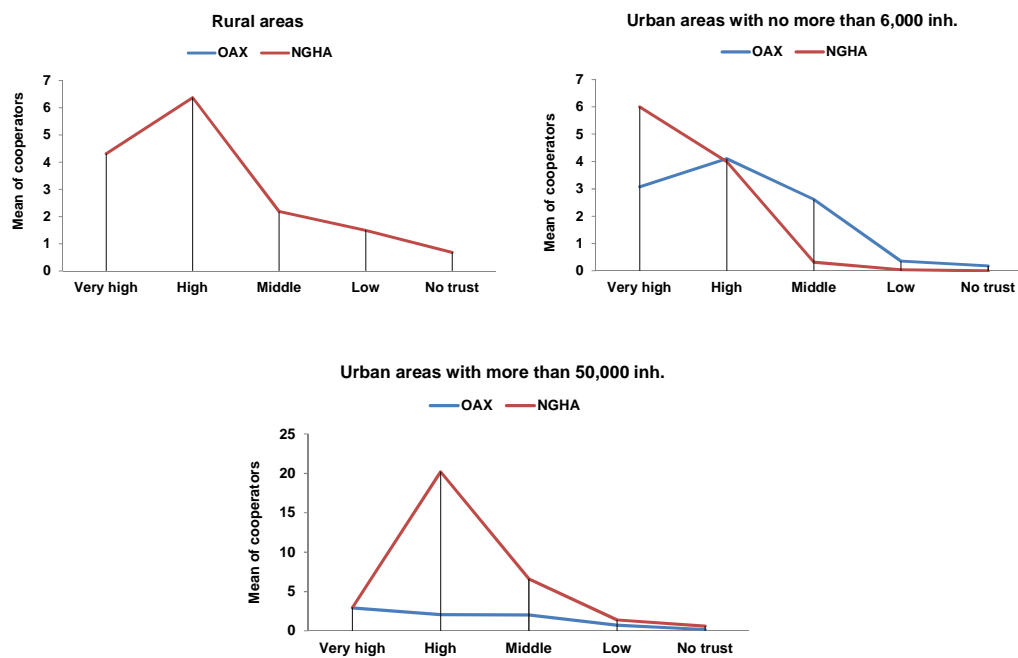
Figure 37. Representation of the participants' mean numbers of usual cooperators distributed by location and trust levels.

In OAX, the participants' different settlements didn't show significant differences –one-tailed Mann-Whitney test– between small and big urban areas in number of trustees, number of usual cooperators, or number of cooperators with very high, middle and no trust level, but there are significant differences in the number of usual cooperators with high trust levels ($U = 382$, $z = -1.908$, $N = 66$, $p < 0.03$, $r = -0.234$) –higher number of cooperators in small urban areas–, and low trust levels ($U = 407.5$, $z = -1.983$, $N = 66$, $p < 0.03$, $r = -0.244$) –higher number in big urban areas.

In NGHA, there doesn't appear either significant differences in the number of trustees according to the area, but there are significant differences between the number of usual cooperators between rural and small urban areas ($U = 124$, $z = -2.037$, $N = 41$, $p < 0.03$, $r = -0.318$) –a higher number of usual cooperators in rural areas–, and between small and big urban areas ($U = 24$, $z = -2.152$, $N = 30$, $p < 0.02$, $r = -0.392$) –a higher number in big urban areas. Respect to the level of trust of usual cooperators, there are significant differences in each of the trust levels between rural and small urban areas (Very high: $U = 131.5$, $z = -1.843$, $N = 41$, $p < 0.04$, $r = -0.287$; High: $U = 101$, $z = -2.660$, $N = 41$, $p < 0.004$, $r = -0.415$; Middle: $U = 83$, $z = -3.512$, $N = 41$, $p < 0.001$, $r = -0.548$; Low: $U = 105.5$, $z = -3.490$, $N = 41$, $p < 0.001$, $r = -0.545$; No trust: $U = 137.5$, $z = -2.939$, $N = 41$, $p < 0.007$, $r = -0.458$) –a higher number of usual cooperators with very high trust level in small urban areas and a higher number of usual cooperators with high, middle, low and no trust in rural areas. There are also significant differences in number of usual cooperators with high trust level between rural and big urban areas ($U = 19$, $z = -1.745$, $N = 21$, $p < 0.05$, $r = -0.380$) –a higher number in big urban areas–,

and in the number of usual cooperators in each of the trust levels except the very high one between small and big urban areas (High: U = 19.5, z = -2.410, N = 30, p < 0.008, r = -0.440; Middle: U = 34, z = -2.040, N = 30, p < 0.04, r = -0.372; Low: U = 26.5, z = -3.391, N = 30, p < 0.006, r = -0.619; No trust: U = 37.5, z = -3.216, N = 30, p < 0.03, r = -0.587) –a higher number in big urban areas.

Comparing the different areas between the two countries, there are not significant differences in the number of trustees and usual cooperators between small urban areas. There are not either significant differences in number of trustees but there are significant differences in number of usual cooperators between big urban areas (U = 21.5, z = -2.412, N = 32, p < 0.008, r = -0.426) –a higher number of usual cooperators in NGHA. Also, there are some significant differences in the trust levels towards usual cooperators between small urban areas. There are not significant differences in the high levels, low levels and no trust, but there are differences in the number of cooperators with very high trust levels (U = 290, z = -2.735, N = 64, p < 0.004, r = -0.341) –a higher number in NGHA–, and middle trust levels (U = 156.5, z = -4.809, N = 64, p < 0.001, r = -0.601) –a higher number in OAX. Between big urban areas there are significant differences in number of usual cooperators with high trust levels (U = 17, z = -2.663, N = 32, p < 0.004, r = -0.470) –a higher number in NGHA.

Therefore, with respect to trust and cooperation, in OAX there is an effect of the type of participants' locations– a higher level of trust on usual cooperators in small urban areas than in the big ones. In NGHA, this location effect is confusing: there are more usual cooperators in rural and big urban areas than small urban areas, and significant differences in trust levels, in every trust levels between rural and small urban areas –a higher number in small urban areas for very high trusted usual cooperators and a higher number in rural areas for all the other trust levels–, and between big and small urban areas in every trust level except the very high trust level –a higher number in big urban areas.

However, comparing OAX and NGHA there are more usual cooperators in NGHA in big cities, and even when there are a higher trust level in usual cooperators of small urban areas than in the big ones in OAX, in the small urban areas of NGHA there are more usual cooperators with very high trust levels and more usual cooperators in OAX with middle and low trust level. Also, there are more usual cooperators with high trust levels in the big cities of NGHA.

In short, since the number of trustees doesn't change significantly because of participants' location and the number of cooperators changes only in NGHA, the trust levels of usual cooperators differ between the two countries, being higher in NGHA. If the rural areas of NGHA are added, then more significant differences between the two countries appear. In the next tables (Tab. 11, 12, 13) appears the details of signification of the previously mentioned differences by locations in number of trustees, cooperators and trust levels of usual cooperators respectively.

7. A cross-cultural comparison of trust-based social networks: Northern Ghana and South-West Mexico groups

|		OAX		NGHA			OAX-NGHA	
		Small urban	Big urban	Rural area	Small urban	Big urban	Small urban	Big urban
Comparison n. trustees OAX & NGHA by area type								
N. trustees	Rural area				U = 24.5 p < 0.4	U = 24.5 p < 0.08		
	Small urban		U = 97.5 p < 0.06			U = 32 p < 0.2	U = 42.5 p < 0.08	
	Big urban							U = 71.5 p < 0.1

Table 11. Details of significant differences in number of trustees by locations.

		OAX		NGHA			OAX-NGHA	
		Small urban	Big urban	Rural area	Small urban	Big urban	Small urban	Big urban
Comparison n. usual cooperators OAX & NGHA by area type								
N. coop.	Rural area				**U = 124 p < 0.03**	U = 21.5 p < 0.07		
	Small urban		U = 407 p < 0.06			**U = 24 p < 0.02**	U = 466 p < 0.4	
	Big urban							**U = 21.5 p < 0.008**

Table 12. Details of significant differences in number of usual cooperators by locations.

			OAX		NGHA			OAX-NGHA	
			Small urban	Big urban	Rural area	Small urban	Big urban	Small urban	Big urban
Comparison trust levels toward usual cooperators OAX & NGHA by area type									
Trust level	Very high trust	Rural area				**U = 131.5 p < 0.04**	U = 38.5 p < 0.5		
		Small urban		U = 487 p < 0.4			U = 38 p < 0.1	**U = 290 p < 0.004**	
		Big urban							U = 66 p < 0.5
	High trust	Rural area				**U = 101 p < 0.004**	**U = 19 p < 0.05**		
		Small urban		**U = 382 p < 0.03**			**U = 19.5 p <0.008**	U = 465.5 p < 0.4	
		Big urban							**U = 17 p < 0.004**
	Middle trust	Rural area				**U = 83 p < 0.001**	U = 37.5 p < 0.5		
		Small urban		U = 432.5 p < 0.2			**U = 34 p < 0.04**	**U = 156.5 p < 0.001**	
		Big urban							U = 67.5 p < 0.6
	Low trust	Rural area				**U = 105.5 p < 0.001**	U = 36.5 p < 0.4		
		Small urban		**U = 407.5 p < 0.03**			**U = 26.5 p < 0.006**	U = 417.5 p < 0.06	
		Big urban							U = 51 p < 0.3
	No trust	Rural area				**U = 137.5 p < 0.007**	U = 38 p < 0.6		
		Small urban		U = 526 p < 0.7			**U = 37.5 p < 0.03**	U = 450 p < 0.3	
		Big urban							U = 47 p < 0.2

Table 13. Details of significant differences in trust levels of usual cooperators by locations.

Deciding to trust new people (general trust)

Although the decision of trusting for the first time in both countries is mostly based on the other's behavior –47.95% in OAX and 48% in NGHA of the total replies–, greater signs of general trust are found again in NGHA. There are a higher percentage of people who "trust in advance" –18%– and sometimes relying on "appearance" – 14%–, among Ghanaian groups. However, in OAX, "references" are needed to trust to a greater extent –15.07%–, and many people claim to "not be able to trust in advance" – 21.92% (Tab. 14).

	Decide trust firstly	
	OAX	NGHA
Behavior	47,95%	48,00%
Trust firstly	2,74%	18,00%
Appearance	1,37%	14,00%
References	15,07%	12,00%
Social Capital	1,37%	6,00%
Trust reciprocity	2,74%	
No possible	21,92%	
Other's opinion	1,37%	
Make questions	5,47%	
Visit home		2,00%

Table 14. Comparison of reasons to trust for the first time.

4.2. Composition of cooperators' and trustees' networks

It could be interesting to figure out the composition of the cooperators' and trustees' networks in both countries, in order to know more about the possible influence of these networks on the different levels of trust.

The networks of usual cooperators are composed by relatives, friends and neighbors in both countries, but in the case of OAX, most cooperators are relatives – 51.13%–, and then friends and neighbors –16.99% and 15.86% respectively– in a similar way. However, in the case of NGHA, most usual cooperators are friends – 49.24%–, followed by relatives –28.33%– and neighbors –11.67%– (Tab. 15, Fig. 38).

	% Cooperators	
	OAX	**NGHA**
Relative	**51,13%**	28,33%
Friend	16,99%	**49,24%**
Co-worker	6,15%	6,36%
Neighbor	**15,86%**	11,67%
Acquaintance	**8,58%**	3,18%
Unknown	0,49%	0,76%
Chief	0,32%	,0%
Girldfriend	0,16%	,0%
Godmother	0,16%	,0%
Godson	0,16%	,0%
Guardian	,0%	0,45%
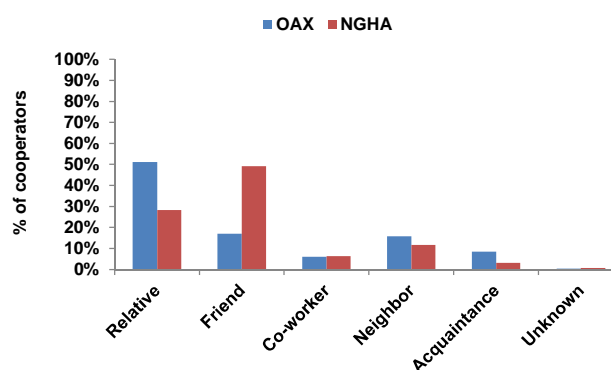
Table 15 and **Figure 38.** Type of relationship of participants with their usual cooperators.

In the same way, there is more relatives –80.67% face to 66.22%– and less friends –7.95% face to 13.52%– in the OAX than in NGHA circles of trustees, although most of trustees in both cases are relatives (Tab. 16, Fig. 39).

% The most trusting people		
	OAX	**NGHA**
Relatives	**80,67%**	**66,22%**
Friends	**7,95%**	**13,52%**
Co-workers	3,41%	1,35%
God	1,14%	
Godparents	4,55%	
Godchildren	1,14%	
Neighbords	1,14%	
People with whom live		4,06%
People with same language		1,35%
Same group or clan		1,35%
People who believe in you		1,35%
People who help you		1,35%
Men more than women		1,35%
Chief		2,70%
Assembly/Committee		1,35%
Children in the community		1,35%
In travel, mamprusis		1,35%
Women		1,35%
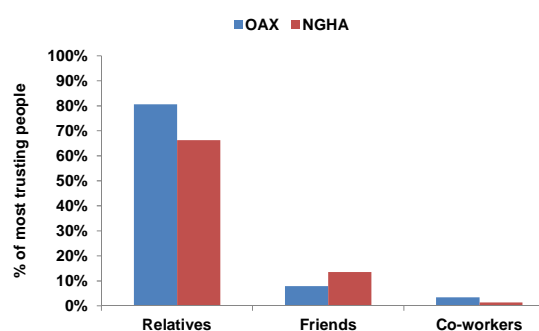
Table 16 and **Figure 39.** Type of relationships of participants with their trustees.

Nevertheless, in NGHA there are more usual cooperators with high and very high trust levels and in OAX a higher number of usual cooperators with middle and low trust levels predominate, for any type of relationship with usual cooperators, except for the proportion of friend cooperators with low trust levels, which is slightly higher in NGHA. The number of usual cooperators with low trust level is very small and similar in both countries, although NGHA have higher proportion of acquaintances cooperators with low trust levels than OAX (Fig. 40).
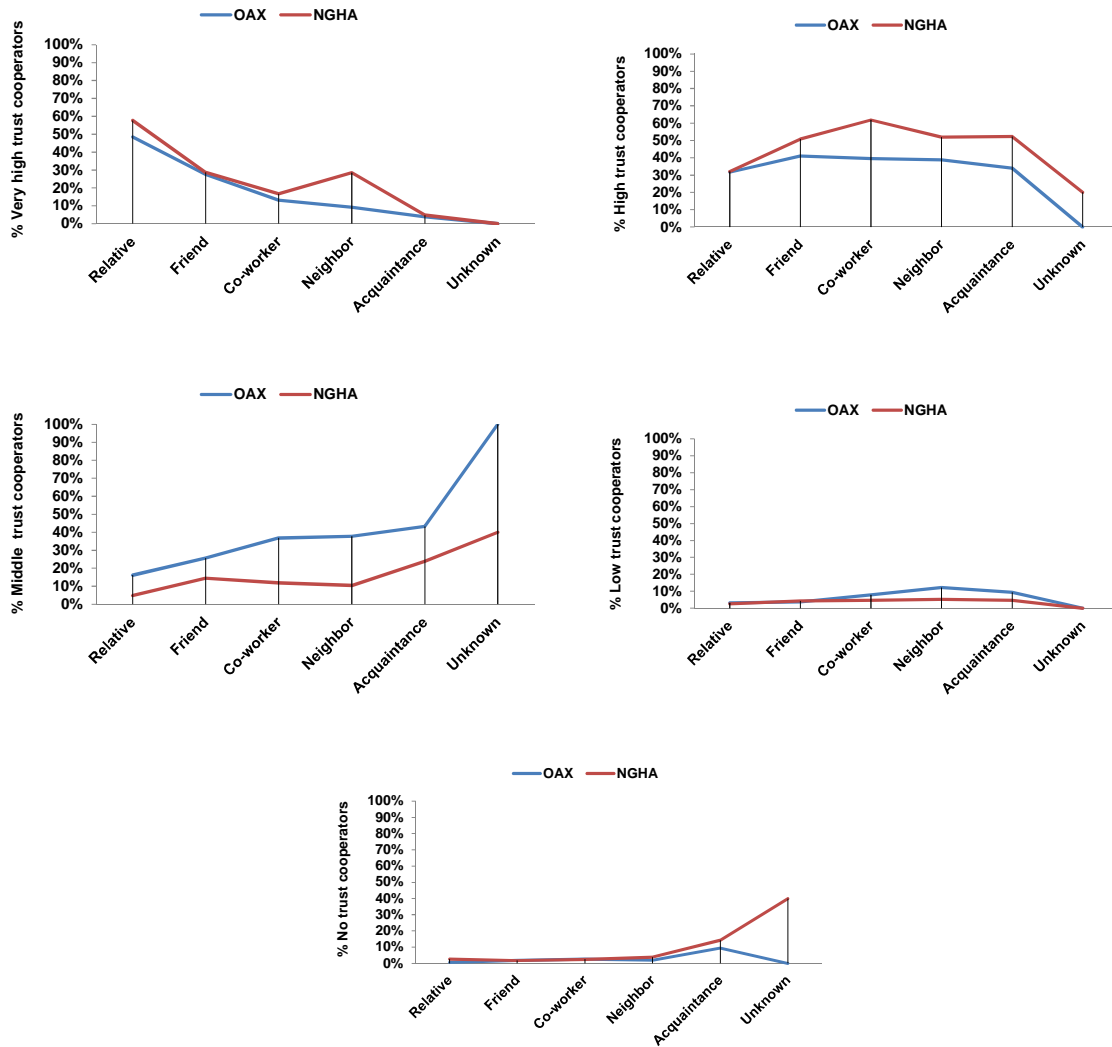
Figure 40. OAX-NGHA comparison of proportion of usual cooperators distributed by trust levels and type of relationship.

The more "embeddedness within relatives" in OAX with respect to NGHA appears also supported by the proportion of good relationships between relatives and the proportion of interviewees that confess to trust always the family (Tab. 17).

% Family relationships		
	OAX	**NGHA**
Good	**74,00%**	**68,97%**
Conflicts	26,00%	31,03%

% Trust always the family		
	OAX	**NGHA**
Yes	**51,42%**	**44,83%**
No	34,28%	44,83%
Close family, no extended	2,86%	6,89%
It depends	8,58%	3,45%
Own family, no husband's family	2,86%	

Table 17. Details of participants' relationships with their relatives and the proportion of participants who trusts always the family.

Similarly, relatives are largely used for secrets, but since in NGHA friends are mentioned by the 15.28% of participants, in Oaxaca the 7.02% declared not to trust their secrets anybody (Tab. 18).

% People for secrets		
	OAX	**NGHA**
Relatives	**71,93%**	**70,82%**
Friends	7,02%	**15,28%**
Nobody	**7,02%**	
God	3,51%	1,39%
Religious people		1,39%
Boss	1,75%	
Co-worker	3,51%	
People of the community		1,39%
Chief		1,39%
Assembly/Committee		1,39%
District director		1,39%
Women		1,39%
Elders		1,39%
Kusasis		1,39%
Mossis		1,39%
It depends on the secret	1,75%	
There are not secrets	3,51%	

Table 18. People for secrets in percentages.

As well, it is noted that in NGHA the group of usual cooperators is more extended outside the nuclear family than in OAX. In fact, in NGHA there is a greater interaction of participants with their nearest network of people, apart from close relatives: extended family, "*compadres*" and community members in OAX, and their same clan in NGHA (Tab. 19). In OAX they are more people who declare having little to do with some of these networks than in NGHA.

% Relationships				
	OAX			**NGHA**
	Extended-family	**"Compadres"**	**Community**	**Same clan**
Good	**62,22%**	**63,64%**	**65,75%**	**78,13%**
Conflicts	8,89%	27,27%	21,92%	21,87%
Little relationship	**28,89%**		**12,33%**	
Neutral		9,09%		

Table 19. Comparison of the participants' relationships with their closest networks of people apart from their close relatives.

In addition, a more extended sense of family is found in NGHA when the meaning of family is analyzed in both regions. In this sense, people in NGHA emphasize the familiar sense of lineage –"identity and origins" (14.05%)–, on the union

of persons –"be together" (26.57%)–, and on the mutual help (29.70%). These percentages were obtained for the total interview replies. However, in OAX, family support is mentioned in the 24.38% of the responses, and most of the other answers emphasize emotional states: "something valuable", "give love", "respect", "happiness", "pride", etc. (Tab. 20).

Thus, in NGHA there is a wider sense of family, which extends to a greater number of individuals –lineage– that are related to the nearest help community. This same sense of mutual help is extended to the individuals' same clan.

% Meaning of family		
	OAX	NGHA
Being together	3,66%	**26,57%**
Identity and origins	2,44%	**14,05%**
Help	**24,38%**	**29,70%**
Something valuable	**12,19%**	9,38%
Trustful people	6,09%	4,69%
Comfortable people	6,10%	3,12%
They listen to you	3,66%	1,56%
Give love	7,32%	1,56%
Children, be alive and happy	8,54%	4,69%
Not to be alone	8,54%	1,56%
Big influence on the person	3,66%	1,56%
The best unit of society		1,56%
Friends and neighbors as family	2,44%	
Obligations	3,66%	
Respect	2,44%	
Happiness	3,66%	
Pride	1,22%	

Table 20. Meanings of family for the interviewees.

At the same time, in NGHA there is a higher interaction among ethnic groups than in OAX –a 57.78% of participants in OAX declared to have no contact with other ethnic groups. This situation makes the NGHA sample to have more participants who have good and bad relationships with other ethnic groups than the OAX sample (Tab. 21).

% Relationships			
		OAX	NGHA
	Good	8,89%	12,35%
	Conflicts	11,10%	19,35%
Other	Conflicts with some of them		26,41%
ethnic	Neutral	22,23%	22,89%
groups	No contact	57,78%	
	It depends of heads relationship		1,75%
	It is not known		17,25%

Table 21. Comparison of the state relationships of the interviewees with other ethnic groups.

A lower interaction between ethnic groups is also observed in OAX with respect to NGHA by an increased "ethnic endogamy" in their group of usual cooperators (Tab. 22).

% In-group cooperation by ethnic groups						
OAX						
Chontal	Mestizo	Mixe	Mixtec	Zapotec Juchitán	Zapotec Teotitlán	Zoque
97,9%	90,9%	80,0%	52,4%	90,9%	100,0%	95,6%

% In-group cooperation by ethnic groups				
NGHA				
Bimoba	Kussasi	Mamprusi	Frafra	Konkomba
83,3%	51,4%	67,1%	47,7%	95,8%

Table 22. Proportion of in-group cooperation by ethnic groups in OAX and NGHA.

The greater interaction between ethnic groups in NGHA has to do with a higher proportion of people who declare trusting other ethnic groups in absolute terms. Although the percentage of people who declare not to trust other ethnic groups is also higher in NGHA respect to OAX, this mistrust is also implicit in the expression "it depends" that has a higher proportion in OAX (Tab. 23).

% Trust		OAX	NGHA
Other ethnic groups	Yes	35,29%	44,44%
	No	14,71%	22,22%
	It depends	38,24%	30,56%
	They don't know	8,82%	
	He doesn't mixes but trust the rest	2,94%	
	No trust people with power, traditional people		2,78%

Table 23. Proportion of interviewees' answers in relation to trust other ethnic groups.

4.3. Activities to foster trust

In reference to integrating new people to the group, the NGHA interviewees show an attitude more involved than those from OAX. In NGHA, there is a larger number of responses that refer to offering a special treatment to the newcomer –20.44%–, meet him and share activities –17.18%–, communicate with him –12.90%–, offer different types of donations to him –12.90%–, share with him what they have –2.14%–, and transmit the group values and norms to him –6.46%–. In the case of OAX, however, these differences in the percentages with respect to the above mentioned

answers are replaced by attitudes such as "do nothing" –7.53%–, the simple coexistence –4.30%– or simply to know the new person –7.53%– (Tab. 24).

	Ways of integration	
	OAX	NGHA
Treatment	9,67%	**20,44%**
Meetings & shared activ.	12,89%	**17,18%**
Communication	9,68%	**12,90%**
Give	12,90%	**16,14%**
Behavior	13,99%	8,60%
Introductions	11,84%	7,53%
Learn rules & values	1,07%	**6,46%**
Help	7,53%	7,53%
Nothing	**7,53%**	
Coexistence	**4,30%**	
Know the new person	**7,53%**	
Decide to accept	1,07%	
Trust		1,08%
Share		**2,14%**

Table 24. Ways to integrate new people to the own group, according to the interviewees.

With respect to the activities to foster trust, in both areas, meetings and shared activities have a great importance (Tab. 25, Fig. 41), as it is the case at time to integrate new people to the group.

	Activities to foster trust	
	OAX	NGHA
Meetings	**45,26%**	**43,65%**
Shared activities	**34,75%**	**29,58%**
Some behaviors	1,05%	8,46%
Help	2,10%	**7,04%**
Opportunities program	2,11%	
Nothing	9,47%	4,22%
To learn	1,05%	
Go out	1,05%	
Greetings	2,11%	
Introductions	1,05%	
Don't know		2,82%
Know each other		1,41%
Physical contact		1,41%
Share material things		1,41%
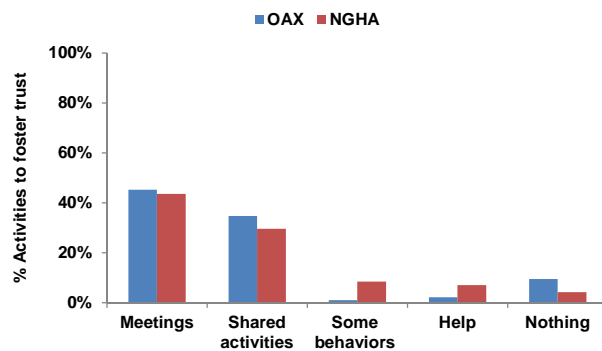
Table 25 and **Figure 41.** Detail and representation of the activities to foster trust, according to the interviewees.

However, with respect to the meetings to foster trust, festive meetings are mentioned more frequently in OAX, and religious meetings and rituals in NGHA (Tab. 26).

% Types of meetings		
	OAX	NGHA
Festive	26,31%	15,48%
Religious	5,27%	8,45%
Visits	2,11%	1,41%
Meetings	10,52%	12,67%
Sportive events	1,05%	
Ritual		5,64%

Table 26. Classification of the type of meetings to foster trust mentioned by interviewees.

4.4. Betrayal of trust and conflicts

In addition OAX, possessing a lower mean of usual cooperators and trustees, and lower levels of trust among usual cooperators than NGHA, also has a lower percentage of people who forget the betrayal of trust and a greater number of people who punish the betrayal of trust than NGHA (Tab. 27).

Comparison of trust						
	OAX			NGHA		
Number of cooperators (mean)	9.36			14.39		
Number of trustees (mean)	12.50			23.67		
Level of trust (mean of people)	Very high	High	In beween	Very high	High	In beween
	3.02	3.27	2.38	5.09	6.59	1.65
Forget betrayal of trust (% people)	20.00%			51.72%		
Punishment of betrayal of trust (% people)	86.35%			52.73%		

Table 27. Comparative summary between OAX and NGHA on the mean number of usual cooperators, trustees and usual cooperators distributed by trust levels. Also they are enclosed the percentages of respondents who are able to forget the betrayal of trust and those who punish the betrayal of trust.

NGHA shows a higher percentage than OAX of people who mentioned the lack of help as motive of betrayal of trust (Tab. 28) –in the table have been included only the most frequently mentioned responses.

% Ways of betrayal		
	OAX	NGHA
Lie	8,20%	6,38%
Gossip	**16,40%**	4,25%
Not to keep secrets	**18,02%**	21,28%
Not to like the behavior	6,55%	8,51%
Not to help	3,28%	**19,14%**
Break agreements		**8,51%**
Total percentage	52,45%	68,07%

Table 28. Comparison of the most frequently reasons of trust betrayal mentioned by interviewees.

However, trust betrayal has greater consequences in OAX than in NGHA, since both the direct punishment –18.17% and 9.10% respectively– and punishment by avoidance –68.18% and 43.63%– has higher percentages in OAX than in NGHA. On the contrary, in NGHA there are higher percentages of people who declare not to punish the betrayal of trust –25.46%–, and people who adopt measures of approximation, rather than avoidance –21.81%– (Tab. 29).

% Punishment of trust betrayal		
	OAX	NGHA
Ways of punishment	**18,17%**	**9,10%**
Send to authorities	6,82%	7,28%
If they are abusing, gun and kill them	2,27%	
Not to help	2,27%	
Criticize	2,27%	
Not to give work	2,27%	
Not to give nothing	2,27%	
Pay back		1,82%
Ways of avoidance	**68,18%**	**43,63%**
Avoid	15,91%	18,18%
Not to trust	25,00%	7,27%
Not to talk	15,91%	12,72%
No greetings		1,82%
Not to invite	2,27%	
Ignore	6,82%	
Don't keep relationship		1,82%
Not to invite home	2,27%	
No secrets		1,82%
No punishment	**4,55%**	**25,46%**
Approach measures	**9,10%**	**21,81%**

Table 29. Ways of punish trust betrayal adopted by the interviewees.

In fact, it is also observed more communication and less mediation at time to solve conflicts in NGHA than in OAX (Tab. 30).

% Ways of solve conflicts		
	OAX	**NGHA**
Communication	**42,97%**	**48,10%**
Mediations	**29,83%**	**15,19%**
Passive measures	8,77%	
Forgive and forget		10,12%
Blessing		1,27%
Good manners	4,39%	7,60%
Approach measures	11,40%	
Rectify		8,86%
Understand the problem		8,86%
Search for the guilty	0,88%	
Violence	1,76%	

Table 30. Ways to solve conflicts used by the interviewees.

4.5. *Level of trust toward usual cooperators related to reciprocity*

Higher trust levels toward usual cooperators also seem to go together with higher levels of reciprocity in their cooperative exchanges (Tab. 31, Fig. 42). However, in NGHA, although the proportion of reciprocity in the cooperative exchanges with usual cooperators is very similar to OAX for very high trusted cooperators, it is higher for high and middle trusted cooperators comparing them to OAX.

% Reciprocity by levels of trust					
	Very high	**High**	**In between**	**Low level**	**No trust**
OAX	77.3%	69.8%	66.3%	58.8%	64.3%
NGHA	76.9%	74.9%	69.7%	53.8%	55.0%
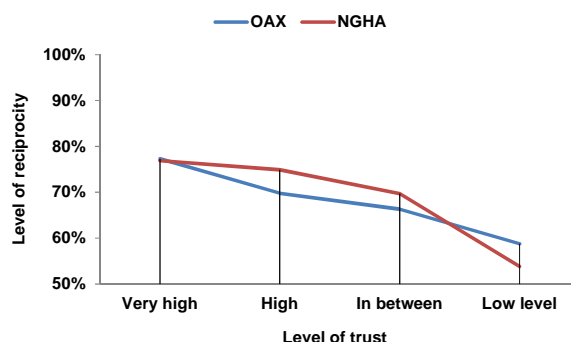
Table 31 and **Figure 42.** Detail and representation of the proportion of reciprocity in cooperative exchanges, according to the trust levels toward usual cooperators.

4.6. Feeling of insecurity and need levels

The different economic situation in both areas influences the basic needs in the two samples of people. In fact, this study shows that since in OAX only a 10.26% of participants feel insecure, in NGHA, this percentage increases to a 43.33% (Tab. 32). At the same time, since in OAX none of the participants mentioned among his fears the economic problems, in NGHA these problems are mentioned by a 29.40% of the interviewees. To the previous problems, inter-ethnic conflicts by differences of power are added in NGHA in the "conflicts" answer –11.77% of the total number of responses (Tab. 33).

% Feeling of security		
Security	OAX	NGHA
Yes	**89,74%**	**53,33%**
No	10,26%	**43,33%**
It depends		3,34%

Table 32. Interviewees' feeling of security in percentages.

% Fears				
OAX		NGHA		
Economic problems		**Economic problems**	**29,40%**	
		Problems with animals	5,88%	
		Problems with house	5,88%	
		Problems with farm	5,88%	
		Poverty	5,88%	
		Not having food	5,88%	
Security problems	50,00%	**Security problems**	**41,18%**	
To thieves	50,00%	Thieves at night	5,88%	
		Conflicts	11,77%	
		Not get to sleep	5,88%	
		Bimobas and chieftancy	5,88%	
		Be harmed by an unknown	11,77%	
Health problems	25,00%	**Health problems**	**29,42%**	
Children become sick	25,00%	Accidents	5,88%	
		To die and live	5,88%	
		Pains when sun is hot	5,89%	
		Mosquitos, snakes, scorpions	11,77%	
The unknown	25,00%	**The unknown**		
The unknown	25,00%			

% Fears		
	OAX	NGHA
Economic problems	0,00%	**12,73%**
Security problems	5,12%	**17,84%**
Health problems	2,57%	**12,75%**
The unknown	2,57%	0,00%
Total	10,26%	43,32%

Table 33. Detail of the causes of fears in the interviewees with feeling of insecurity.

On the other hand, in the NGHA groups the higher levels of needs also appears in the higher number of responses, regarding those from OAX, which mention the value of mutual help as a way to keep trust (Tab. 34).

	Keep trust	
	OAX	**NGHA**
Behavior	**42,26%**	**41,18%**
Communication	**25,34%**	17,64%
Help	5,63%	**29,42%**
Meeting and shared activities	5,64%	
Feel good with trustee	1,41%	
Trust reciprocity	**11,27%**	
Nothing	2,82%	
Coexistence	1,41%	
Interaction	4,22%	
Not to steal		1,96%
Keep promises		3,92%
Faith		3,92%
Unity		1,96%

Table 34. Reasons given by interviewees to keep trust along time.

The relation between trust and higher levels of needs in NGHA is also observed when the economic exchanges, which are the exchanges that require higher levels of trust mentioned by NGHA groups –22.85%–, are transformed into "feelings and concerns" responses in OAX groups –17.65%– (Tab. 35, Fig. 43).

% Trustful exchanges		
	OAX	**NGHA**
Secrets	13,23%	14,58%
Econ. exchanges	14,70%	**22,85%**
Help	23,54%	20,85%
Feelings & concerns	**17,65%**	8,34%
Respect & coexistence		6,24%
Meetings	5,88%	6,27%
Introduce people		2,09%
Donations	4,41%	4,18%
Personal or valuable objects	7,36%	
Time	1,47%	
Everything	8,82%	
Family	2,94%	
Family activities		2,09%
Marriage		4,15%
Travel exchanges		2,09%
Education		2,09%
Way of interactions		2,09%
Faith		2,09%
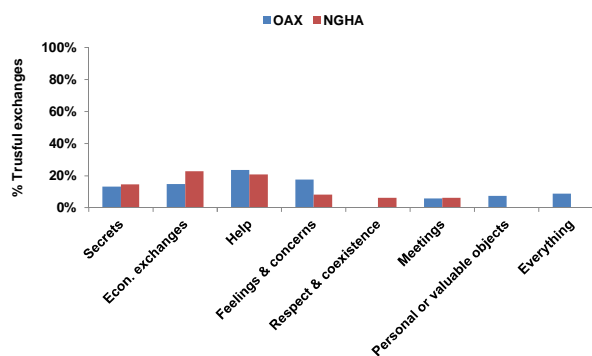
Table 35 and **Figure 43.** Detail and representation of the interviewees' answers on their most trustful exchanges.

Similarly, the different level of needs of each area is also reflected in the role of reputation. Since the importance of reputation is very similar in both countries (Tab. 36), the reasons to keep reputation respond to different goals, according to the context of each country. Since in OAX it is important to be considered a community member – satisfying regulatory obligations–, in NGHA, good reputation is associated with a

greater level of help received and with being respected and trusted –as a way for guaranteeing support (Tab. 37).

% Importance of reputation		
	OAX	**NGHA**
Yes	**97,14%**	**93,10%**
For others, not for him	2,86%	
No response		6,90%

Table 36. Importance of reputation for the interviewees.

% Consequences of reputation		
	Good reputation	
	OAX	**NGHA**
Help	9,09%	**27,10%**
Opportunities	18,18%	18,74%
Inside community	**34,10%**	12,50%
Position (respect & trust)	13,64%	**33,34%**
Relationships with others	6,81%	4,16%
Feelings	4,54%	2,08%
Attributions	4,55%	2,08%
No matter	6,82%	
Benefits to the community	2,27%	

Table 37. Consequences of having good reputation according to the interviewees.

4.7. Influences on cooperation

Additionally, in NGHA a higher percentage than in OAX of participants who think that religion influences the level of cooperation among people is found. Similarly, there is a higher perception in NGHA than OAX of a positive influence of Government on the level of cooperation between citizens (Tab. 38).

% Influences on cooperation (Participants' perception)		
Religion	**OAX**	**NGHA**
Yes	**47,06%**	**89,65%**
No	47,06%	10,35%
Sometimes	2,94%	
It depends	2,94%	
Government	**OAX**	**NGHA**
Yes	**51,61%**	**91,67%**
No	25,81%	8,33%
Don't know	6,45%	
It depends	16,13%	

Table 38. Comparison of interviewees' perception of religion and Government influence in people's cooperation.

5. <u>Discussion and conclusion</u>

In short, two different models of trust networks have been observed in these countries:

1. In OAX, participants have a lower number of people in their trust circle. They cooperate with fewer people. Their cooperators mostly belong to the nuclear family, among which there is a higher proportion of relatives with middle trust level, although it is observed a higher level of "embeddedness" between them. The rest of cooperators enjoy from lower trust levels compared to those in NGHA. There is also more distance with the rest of the participants' closest network of people and with the other ethnic groups.

    Additionally, people in OAX are more passive at the time to integrate new people to the group, forget trust betrayal in a lower level and punish trust betrayal in a higher level than NGHA. Also, they use less communication and more intermediaries to solve conflicts.

2. By contrast, in NGHA, both trustees and cooperator groups are larger, with a higher proportion of cooperators whom people have higher trust levels with, regarding those of OAX. Cooperation ties also extend to a greater number of people, coming from the participants' nearest circles outside the nuclear family – lineage and same clan. There is also a greater interaction with other ethnic groups, which makes extending the trust levels among them more than the mistrust levels.

    Even people from NGHA get more involved in integrating new people in the group, and forget in more occasions and punish less the trust betrayal than people from OAX. They also use approach measures in conflicts by means of more communication and less intermediaries.

These models are inserted in two different economic contexts: the context with fewer resources of NGHA, and the context of OAX, with higher economic levels. Thus, it is observed how in NGHA, where the environmental conditions are harder, there are social networks of trust extended to a higher number of individuals, as a strategy that fosters greater cooperation and hence, guarantees greater chances of survival. Trust networks of type 2 are particularly effective in this sense. In addition to contain a higher number of members, both the trust and cooperation networks are composed of individuals with higher levels of trust across their trust circles. These higher trust levels ensure, as it has been shown in this work, more frequent reciprocal relationships. Such persons in NGHA are also more willing to increase trust circles –more active behavior

to integrate new people– and to decrease the chances of bonds rupture –greater willingness to forget the betrayal of trust and less willingness to punish it. It might be interesting to analyze in future works if the trust level might be related to the attitude towards punishment and to the ability to forgive the betrayal of trust.

In addition, it has also been shown that groups from NGHA have more internalized the assistance to other group members in their system of values –they mentioned more frequently "help" as a necessary requirement to keep and don't betray the trust relationships and as well as a beneficial effect of having a good reputation.

It is also observed in NGHA that, outside the strict nuclear group of relatives, culturally concepts as lineage and clan have developed, which could be seen as analogous to those of extended family, community and municipality, and the "*compadres*" in the case of OAX. The "*compadres*" is a notion that emerged within the Catholic religion to refer to those people who were elected to serve as godparents at baptism, related with a way to sponsor children if necessary. In Mexico, this figure has been extended to other types of sponsorship and occasionally has acquired a broader meaning as a special tie related to the respect toward some people.

In NGHA, people have more contact and a higher percentage of good relationships with the clan than people in OAX with the other groups before mentioned. The figures of lineage and clan are very attached to the values of belonging, identity and groups of support. These groups thus bonded, show greater cohesion than the OAX groups, tied through regulatory obligations. This fact shows how the emotional ties, culturally assigned to the figures of lineage or clan, have a greater impact on trust and cooperation than the normative measures. In this way, the emotional mechanism of personal trust at an individual level might be extended to a collective level, increasing in both cases the bond strength.

It is also remarkable, with respect the ethnic diversity:

1. In OAX, ethnic diversity is accompanied by a history in which different groups created their cultural identities over centuries, in spite of having contact and periods of conquest or migratory movements. With the Spanish Colonization and Republic, the groups strengthened cultural identity as a way to protect their territorial rights and survival face to the marginalization from the established powers. In OAX, cultural differentiation is also closely related to the natural orographic mountainous separation between villages and an expression of the commonality of the municipality as a group hallmark (Guerrero, 2013; Nava, 2013), allowing them to create an association to defend the territory and organize themselves internally (Aquino, 2013).

2. NGHA, on the other side, also has a long history of cultural settlements outside its borders and continuous commercial migratory movements. However, in this

case, the groups have interacted to a greater extent both during the English Colonization and after the Independence. Conflicts among the existing groups were intense during the English rule and this fact also led to the intensification of ethnic diversity to defend,, territories and administrative powers, similarly as in OAX.

Therefore, these examples show how the unity and association in smaller groups, as it's the case of the ethnic groups is effective when necessary to face contexts of scarcity and lack of power. The cultural identity of these groups allows them to create again some way of "emotional" ties that drives them to act together more intensely.

But at the level of relationships among ethnic groups, there are differences between OAX and NGHA. Despite in NGHA there are more conflicts among ethnic groups than in OAX, a greater interaction also causes higher levels of trust among them than in the case of OAX, where contact between ethnic groups is lower.

The previous claim is not surprising if it is considered that trust requires previous shared experience among individuals. In this work, interviewees already referred to the meetings and shared activities as ways to build trust among people. Nevertheless, even in this respect, some differences between the groups from OAX and NGHA can be found. In NGHA, there are less purely festive meetings and more meetings for religious and ritual reasons than in OAX. Perhaps the ties created through beliefs could be stronger than those based purely on amusing.

However, there is another difference between OAX and NGHA to take into account. In NGHA there seems to be a greater number of interviewees that concede influence of religion and Government in the cooperative attitude of individuals. This result could be interpreted from different points of view. On the one hand, it could be interpreted that the NGHA participants trust is based more on religion and Government than the OAX participants, and this circumstance grounds the attitude of trust and cooperation among individuals, i.e., that religion and the measures taken by the Government will serve to improve the level of trust among individuals. However, it is questionable whether this fact by itself is enough affect the closest relationships, such as family relationships.

In general, it is difficult to infer what is the causal relationship of both facts: if the possession of higher levels of trust leads to trust more on the influence of religion and Government in the individuals' cooperative behavior, or if the influence of religious beliefs and the Government measures adopted might be able to boost trust levels. However, it seems questionable if these networks, built through a long time, as well as the concepts of lineages and clan, might have an influence on current governments. The role of beliefs has already been mentioned before related to bond creation.

Thus, different levels of needs of the two samples of individuals might explain the most relevant role played by trust in NGHA societies. The highest levels of trust may be associated with a way to better adapt to difficult environments. This can be interpreted as follows: reaching high levels of trust guarantees greater faithful cooperation, greater reciprocity and commitment between the parties involved. However, cooperation among individuals with a low level of trust often arises because a party gets some profit, but this type of relationships seems not to last for long. In conclusion, this study supports the hypothesis that small groups are the common trait of the organization of networks of trust and cooperation –and that that this social unit seems to be universal. It also supports the hypothesis that the efficacy of the small group is related to the environmental demands the group faces. This link accounts for the strengthening of ethnic diversity in these areas with respect to its historical context. This capability can be explained by the emotional dimension involved –obtained through values such as identity, belonging to the group and mutual assistance granted by cultural figures as the clan, lineage and ethnicity– rather than normative and authority factors. In this way, it also supports the hypothesis that trust performs its important role in fostering cooperation through its emotional dimension –feature that can also be considered as universal.

This work also supports the idea that the mechanism of personal trust is modulate collectively by means of cultural tools. In general, it seems that in more developed societies, where the economic levels allow acquiring certain security –absence of concern for survival– humans can become more individualistic because they don't have the same need of others for vital support. Culturally, this it is made manifest by reinforcing of family bonds around the nuclear family. Not being so necessary reinforcing the values of unity and trust, more ties arise with lower trust levels that serve to some specific interests and in the short term. Maybe, this is the reason because there doesn't appear such so-rooted sense of identity in these contexts (Aguiar et al., 2010).

In the end, NGHA people showed higher levels of trust, both with respect to personal trust and general trust, than OAX people.

Discussion, conclusions and future work

Although each of the works exhibited in each chapter has a detailed explanation of its main conclusions and points for discussion, a general summary is detailed in this chapter and some of the dissertation main contributions are highlighted. Subsequently some of the possible future studies arisen from these works are outlined.

1. <u>Discussion and general conclusions</u>

This dissertation provides support to the hypothesis that the psychological mechanisms acquired during human evolution, such as trust, is crucial to the current social dynamics. This goal is achieved through the analysis that has been carried out about trust and several empirical studies using experimental games and naturalistic fieldwork. The main conclusions are the following:

- **With regard to cooperation**

  The groups with whom usually people cooperate are composed by a small group of especially trusted people, which allows having more chances to keep a commitment to reciprocity.

  In societies with less economic development and harder environmental conditions, there are a larger number of cooperators jointed by strong emotional ties. Thus, they get a greater resistance to free-ride reciprocity in more difficult situations.

  As societies grow and create more complex groups, with higher levels of economic development, new types of bonds appear, and cooperation with lower levels of trust is made possible, to get adapted to the greater complexity of the social networks. However, although areas of social interaction are more numerous, individuals need to continue interacting within small groups. Within these groups they continue using the psychological mechanism of trust, although it is based on weaker previous experiences. Therefore, at times of crisis and in hardest environments, a revival of the diversification of groups is expected – ethnic or cultural groups, identity associations, etc.

The work has also shown that many of the social structures that are created are closely tied to economic constraints that make cooperation more valuable.

Finally, people cooperate more with trustees, despite the costs they incur, even when they have the option of defecting at no cost, such as when they decide anonymously. In this sense, it can be said that trust fosters altruism.

- **With respect to trust**

Trust is a good example of a psychological mechanism evolved for living within small groups, as a way to make cooperation possible. Personal trust requires positive experiences in close interaction and keeping their memory. These experiences sustain an expectation of positive reciprocity, which drives an unconscious reciprocity commitment and a decreased risk in social exchanges.

In addition, trust is linked to unconscious emotional mechanisms, which is further evidence of its evolutionary origin. Emotions are the most effective mechanisms to promote certain actions, even if one is to incur a cost. However, this cost in the short term is overcome in the long term by the increase in mutual benefits as a result. Therefore, trust is cost-effective in the long run and cooperation evolves.

Circles of trustees are not very large, given the high effort of maintaining close relationships with many people –both in cognitive and temporal terms. The highest the trust, the more time to interact required. In addition, individuals don't need many trustful relationships to ensure their wellbeing. In complex societies, in which wider and multiple social networks appear, trust networks tend to expand, but in such a way that trust bonds are not so strong, since these networks serve more ephemeral and specific goals. In this way, such ties tend to be weak and temporary. It is therefore foreseen that the measures taken to increase general trust levels in a broad sense, tend to have a limited and weak effect, i.e., that faced with obstacles, the personal trust system can collapse easily, as it has been verified in recent times in large societies.

Certain topologies in trust networks and certain levels of personal trust among the trust circles within these groups can influence the levels of general trust in the whole group, even between members of different trust circles. These networks might be defined as "indirect trust networks". One of these topologies might have been identified in this work, but it is premature to generalize from one case study.

- **Regarding the role of culture**

  In these studies has shown how culture serves as a tool to connect larger groups. The adopted cultural forms are appropriated to the needs of group cohesion. This is shown both in the Ghana study as in the comparative analysis between Northern Ghana and Oaxaca.

  Both of these areas are characterized by a rich ethnic diversity. In both cases this cultural diversity has allowed promoting bonds and creating groups necessary to face dire situations.

  Cultural tools, as it has been observed in the fieldwork, are adapted to the specific group conditions. In the case of Ghana and other African areas, the cultural concepts of lineage and clan can be assimilated to cultural support groups, which operate effectively. Help is present in the group values and it is necessary to keep trust and a result of having good reputation. In the case of Oaxaca, the concepts of family, community and municipality have also served this purpose.

  Comparing the both previously mentioned areas, it is concluded that the cultural tools used are adapted to the needs of group cohesion. According to the results of these studies, cohesion based on values, identity, group belonging and common beliefs seem to create stronger bonds than those based on regulations or occasional festive meetings.

2. <u>Main contributions</u>

Among the main contributions to highlight of this dissertation are:

- The need of using experimental games in a way that's closer to the social reality of individuals –especially cooperation games.

- The relevance of contrasting data using a multidisciplinary methodology. Some works presented here are good examples of the benefits of such an approach.

- The interest of using network analysis to investigate trust and cooperation.

- The contribution of tools for measuring certain relevant indicators of trust levels. The methodology combining questionnaires, experimental games and analysis of networks in the study are instruments that provide insight on the dynamics of group cohesion, through the knowledge of the levels of trust and cooperation of its members. This methodology can be used in different fields: companies, education, etc. In short, in any group in order to know the internal bonds of its members, which can have a critical role for the better management of groups.

- The relevance of including the evolutionary perspective to understand individual behaviors, dynamics of groups and some cultural manifestations within groups.

- The interest to take into account the evolutionary tracks of human psychology and cognition, and the relevance of the emotional element, to further understand social dynamics, and and vice versa.

- The usage of knowledge from this work about the pillars that sustain social bonds, in order to improve the social dynamics in times of crisis and at time to predict social change.

3. <u>Future work</u>

There are many and very interesting challenges to be conducted in the future in order to advance our conclusions, such as:

- Investigate the topology of those networks that maximize cooperation, by means of simulation and agent-based modelling methodologies.

- Progress in the improvement of the tools used to measure the levels of trust.

- Expand the samples to other cultural groups, both in order to contrast the previous conclusions and incorporate new knowledge.

- Similarly, in order to contrast the previously mentioned results and get more information, it could be interesting to continue using experimental games, either in different situations, with other game versions or changing some conditions. In fact, in this sense, there are already data for future analysis.

ANNEX 1. Generalized trust questionnaire of chapter 4.

Do you think most people would try to take advantage of you if they got a chance or would try to be fair?	Take advantage	Try to be fair	

Have you the inclination to try new activities, visit new places, and try new foods?	Little	Normal	A lot
Do you enyoy being the center of attention?	Little	Normal	A lot
Are you careful, thorough, organized, perfectionist?	Little	Normal	A lot
In general are you a scary person, sad, nervous, lonely?	Little	Normal	A lot
In general are you a positive person, who cares about the problems of others and likes to help and cooperate?	Little	Normal	A lot
Have you ever benefitted from generosity of someone you never knew before?	Never	Sometimes	Often
Have you ever lived any really bad experience with a stranger?	Never	Sometimes	Often
How often do you lend personal possessions to other people?	Never	Sometimes	Often
How often do you leave another person caring for your pets, children or sick relatives? (answer only if you have)	Infrequently	Sometimes	Often
How often do you share secret or embarrasing information with others?	Infrequently	Sometimes	Often
How often do you risk losing something precious for you to earn trust from others?	Infrequently	Sometimes	Often
Telling a lie can be justified depending on the circumstances?	Infrequently	Sometimes	Often
How much trust do you have in parliament?	Little	Neutral	Quite
How much trust do you have in public authorities?	Little	Neutral	Quite
How much trust do you have in large companies?	Little	Neutral	Quite
How much trust do you have in churches?	Little	Neutral	Quite
How much trust do you have in schools and educational system?	Little	Neutral	Quite
How much trust do you have in press?	Little	Neutral	Quite
How much trust do you have in labour unions?	Little	Neutral	Quite
How much trust do you have in police?	Little	Neutral	Quite
Generally, a person with whom you have had a longer relationship is likely to help you when you need it.	Agree	Neutral	Disagree
When negotiating over an important issue with a total stranger, it is very important to have a personal introduction by someone you know well.	Agree	Neutral	Disagree
A person's reputation is not very useful to judge its trustworthiness.	Agree	Neutral	Disagree
Most people refrain from dishonest conduct to avoid getting a bad reputation.	Agree	Neutral	Disagree

ANNEX 2. Personal trust questionnaire of chapter 4.

	Yes	No	
Would you borrow from XX money or other valuable objects?			
Would you lend to XX money or other valuable objects?	Yes	No	
Would you leave care of XX children or sick relatives?	Yes	No	
Would you trust XX personal secrets or valuable information for you?	Yes	No	
Would you ask to XX for assistance in moving?	Yes	No	
Do you consider that XX could die, do any unjust act or betray you under any circumstances?	Yes	No	
Do you think XX would help you even at a great personal effort?	Yes	No	
What type of relationship you maintain with XX?	Friend	Collegue	Acquaintance
Your meetings with XX are…?	Common	In between	Rare
Your communications with XX without being both of you in the same place are… ? (Phone calls, internet, etc…)	Common	In between	Rare

ANNEX 3. General trust questionnaire of chapter 5.

Indicate with a cross on a scale of 1 to 5 the degree of your response to the following questions:

		Take advantage				Be fair
1	Do you think most people would try to take advantage of you if they got a chance or would try to be fair?	1	2	3	4	5
		a	b	c	d	e
		Total Agree				**Total Disagre**
2	Generally, a person with whom you have had a longer relationship is likely to help you when you need it.	1	2	3	4	5
		a	b	c	d	e
		Sure not				**Sure yes**
3	Would you lend some of your property to an unknown person?	1	2	3	4	5
		a	b	c	d	e
		Sure not				**Sure yes**
4	Would you leave the care of someone important to you to a stranger person?	1	2	3	4	5
		a	b	c	d	e
		Sure not				**Sure yes**
5	Would you share personal information with stranger people?	1	2	3	4	5
		a	b	c	d	e

ANNEX 4. Personal trust questionnaire of chapter 5.

For each of the people mentioned above (XX), please answer to the following questions:

Indicate with a cross on a scale of 1 to 5 the answer to the following questions:
1= Sure not
5= Sure yes

	Sure not				Sure yes
1. Do you think that XX would you lend you a large sum of money if he/she had so much?	1	2	3	4	5
	a	b	c	d	e
2. Do you think that XX would return you a loan of a large sum of money?	1	2	3	4	5
	a	b	c	d	e
3. Would you leave to XX the care of something very valuable for you?	1	2	3	4	5
	a	b	c	d	e
4. If you had a secret that could be very harmful for you if it did become public, would you feel safe to share it with XX?	1	2	3	4	5
	a	b	c	d	e
5. Do you think that XX would provide help to you in a move?	1	2	3	4	5
	a	b	c	d	e
6. If XX had to defend you hurting himself, do you think he/she would do?	1	2	3	4	5
	a	b	c	d	e

ANNEX 5. Personal network of usual cooperators in Oaxaca.

	NOMBRE Y APELLIDO	GRUPO ÉTNICO	TIPO DE RELACIÓN: **F**: familiar (especificar) **A**: amigo **V**: vecino **COMP**: compañero trabajo **C**: conocido **D**: desconocido	**D:** Cooperador me da **R:** Cooperador recibe de mi **DR:** Cooperador me da y recibe de mi	TIPO DE COOPERACIÓN: **O**: préstamo objetos **D**: préstamo dinero **S**: compartir secretos **AS**: ayuda con servicios **I**: Conseguir información útil **C**: consejos **E**: enseñar **CI**: contactos e influencias **OP**: oportunidades de trabajo o mejora social **O**: otros (especificar)	NIVEL DE CONFIANZA: **MA**: muy alto **A**: alto **M**: medio **B**: bajo **NC**: ninguna confianza
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Header fields: REDES DE COOPERACIÓN — NOMBRE Y APELLIDO: _____ GRUPO ÉTNICO _____ / Género _____ Población _____ Edad _____

ANNEX 6. Personal network of usual cooperators in Northern Ghana.

	EGO'S NETWORK NAME & SURNAME:				ETHNIC GROUP:	
	Gender	Place			Age	

	NAME & SURNAME	ETHNIC GROUP	**RELATIONSHIP TYPE**: **RT**: relative type (put) **F**: friend **N**: neighbor **CW**: co-worker **A**: acquaintance **U**: Unknown	**G**: cooperator GIVES **R**: cooperator RECEIVES **GR**: cooperator GIVES AND RECEIVES	**COOPERATION TYPE**: **O**: Objects loan **M**: Money loan **S**: share secrets **HS**: Help with services **I**: Get useful information **A**: Advices **T**: Teach **CI**: Get contacts and influences **OP**: Get work or social advancement opportunities **OT**: Other answer (Especify)	**TRUST LEVEL**: **VH**: very high **H**: high **IB**: in between **L** : low level **NT**: no trust
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

ANNEX 7. Interview in Oaxaca.

1. **¿Qué tomas en cuenta a la hora de depositar tu confianza en personas que no conoces?**
2. **¿Qué necesitas para mantener en el tiempo tu confianza en personas que conoces?**
3. **¿Se puede confiar siempre en la familia? ¿Por qué?**
4. **¿En qué personas confías más? Número aproximado.**
5. **¿Cuándo consideras que una persona en la que confiabas te ha traicionado?**
6. **¿Realizan actividades que fomenten un ambiente de mayor confianza/acercamiento entre vosotros? ¿Cuáles?**
7. **¿Qué tipo de intercambios requieren para ti un mayor nivel de confianza?**
8. **¿Cómo castigáis a las personas que traicionan vuestra confianza?**
9. **¿Es importante en tu comunidad tener buena reputación? ¿En qué afecta tener buena o mala reputación?**
10. **¿Qué formas tienen ustedes de fomentar la reconciliación de los individuos que tienen conflictos entre sí?**
11. **¿Es posible olvidar la traición de la confianza? ¿Por qué?**
12. **¿Cuál es la visión de ustedes de los otros grupos étnicos? ¿Se puede confiar en ellos? ¿Por qué? ¿Tienen una buena relación con ellos? ¿En qué se basa esta relación? ¿Ha sido siempre así?**
13. **¿Cómo es necesario ser y cómo ha de comportarse un individuo para ser considerado un buen zapoteca/mixteca/etc…?**
14. **¿Tus creencias religiosas te hacen relacionarte más y cooperar más con los demás, incluso con extraños? ¿Por qué motivo?**
15. **Cuando alguien nuevo entra a formar parte del grupo, ya sea en un contexto familiar o de trabajo, o en la comunidad, ¿existen actividades, costumbres o actitudes compartidas para facilitar esta nueva integración? ¿cuáles son?**
16. **¿Te sientes protegido en donde vives o trabajas o tienes miedo de algo?**
17. **¿Qué piensas del Gobierno, ayudan con sus políticas o su ejemplo a fomentar la cooperación entre los ciudadanos mexicanos?**
18. **¿Qué significa la familia para ti? ¿Cómo son las relaciones entre los miembros de tu familia? ¿Por qué?**
19. **¿Cómo son las relaciones entre los miembros de un misma familia extensa (tíos, primos, sobrinos…), y entre los miembros de diferentes grupos familiares y entre los miembros de diferentes grupos étnicos? ¿Por qué?**
20. **¿Con qué personas confías tus secretos o asuntos personales?**
21. **¿Has trabajado alguna vez en un mercado? ¿Cuál? ¿Existe confianza y cooperación entre los trabajadores del mercado? ¿En qué crees que se basa esta confianza o desconfianza?**

ANNEX 8. Interview in Northern Ghana.

1. **What do you have in mind when you decide trust people that you don't know?**
2. **What you need to keep your trust in people you know?**
3. **It is possible to trust always the family?**
4. **Which people do you trust more? Number.**
5. **When do you consider that one of your trustees has betrayed you?**
6. **Do you perform activities to foster an atmosphere of greater trust and rapprochement among you?**
7. **What kind of exchanges requires a higher level of trust?**
8. **How you punish people who betray your trust?**
9. **Is it important here to have good reputation? What implications have a good or a bad reputation?**
10. **What forms you have to encourage reconciliation of individuals with conflicts?**
11. **Is it possible to forget the betrayal (of trust)?**
12. **What do you thing about the other ethnic groups? Can you trust them? Do you have a good relationship with them? This relationship is based on what? This relationship has always been this way?**
13. **How should an individual behave to be considered a good kusasi, mamprusi, etc...?**
14. **Your religious beliefs do make you interact and cooperate more with others, even with strangers?**
15. **When somebody became part of a new family or begins to work in a new market, there are activities, customs or shared attitudes to facilitate this new integration?**
16. **Do you feel protected where you live or work, or you are afraid of something?**
17. **What do you think about Government authorities, they help with their policies or their example to facilitate the lives of citizens and promote coexistence among all?**
18. **What does family mean to you? How are the relationships within family members?**
19. **How are relationships between members within a same clan, between members of different clans and between members of different tribes?**
20. **Which people you trust your secrets or personal issues?**
21. **Is there trust and cooperation among workers in the market? What do you think this trust or distrust is based on?**

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