One for all, all for one: Agents with social identities

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Abstract

One of the challenges in developing multi-agent systems is the creation of agents able to exhibit human-like behaviours in complex social situations. In order to do so, agents need to be socially aware of their environment and perceive other agents not only as individuals but also as social group members. Following Social Identity and Self-Categorization theories, we developed the Dynamic Identity Model for Agents that provides agents with the ability to adapt their identity and behaviour to the social context. We then implemented it in a social dilemma scenario where different situations were explored.

Keywords: Identity; Social Identity; Social Dilemmas; Context-Situated Agents.

Introduction

With virtual worlds' increasing complexity, where agents and players are exposed to different scenarios and social contexts, it has become even more important to develop agents whose identity does not remain unaffected, and in turn reacts to its environment in a believable way.

Although some works have been done on agent's identity adaptability, either through the agent's personality (Tan & Cheng, 2007) or by their culture's background (De Rosis, Pelachaud, & Poggi, 2004; Mascarenhas, Dias, Afonso, Enz, & Paiva, 2009), these are adaptations to the player's traits, and does not address the influence of the social context. Moreover, each approach alone did not encompass both individual and social concepts of identity working together and dynamically.

In real life a person's identity is not static and free of influences (Turner, Oakes, Haslam, & McGarty, 1994; Hogg & Williams, 2000; Smith & Mackie, 2000). Instead, several social context factors (Smith & Mackie, 2000) are known to have an impact on an individual's identity and behaviour, with one of the most studied factors being the presence of in-group or out-group members. In fact, Social Identity (Tajfel, 1972) and Self-Categorization (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987; Turner et al., 1994) theories explained this process postulating that one's identity can both be personal and social. When in the presence of members of a person's in-group, the individual's behaviour is going to be determined by its personal identity, and one will relate to others in an interpersonal manner, dependent on his or her personality traits and close personal relationships with others. However, when in the presence of an out-group, a social identity becomes salient, and the perception as group member strengthens, as a person tends to focus his or her perception on the shared features with other in-group members. Consequently, there is a shift of a person's own motives and values from self-interest to group interests (Brewer, 1991). When a social identity emerges, people are more likely to see themselves and others as interchangeable components of a larger social unit rather than unique individuals.

According to (Tajfel, 1972; Turner et al., 1987, 1994), this psychological process of social identification constitutes the basis for in-group cooperation. Because in-group members share the same attributes, they become part of a person's identity and due to this, a person will want to treat all in-group members as he or she would like to be treated. In fact, several studies have already demonstrated that social identity has a positive effect in in-group cooperation and negative effect in out-group cooperation (Goette, Huffman, & Meier, 2006; McLeish & Oxoby, 2007), but more specifically that it has an important role in eliciting cooperative behaviour in social dilemmas (Wit & Wilke, 1992; Kollock, 1998; Weber, Kopelman, & Messick, 2004). Social dilemmas are, in broad terms, social situations of individual rationality conflict where group interests are at odds with individual ones (Dawes, 1974), and thus making them an interesting application for agents with social identities.

Nonetheless, while some authors have already been modelling the concept of social identity and used it on simulations of crowd behaviour (Fridman & Kaminka, 2009) or opinion dynamics, such political views (Grier, Skarin, Lubyansky, & Wolpert, 2008; Lustick, 2002; Salzarulo, 2006), they still did not handle the dynamics of identity, nor have worked on its impact in social dilemmas situations. As such, we developed the Dynamic Identity Model for Agents (Dimas & Prada, 2013) and implemented it in a social dilemma scenario in order to evaluate it in a game environment.

The paper is organized as follows. Next section we introduce the model, followed by the description of the model's implementation and the platform used to demonstrate the example scenarios we present on the following section. Finally we present some conclusions and future work.

Dynamic Identity Model for Agents

The Dynamic Identity Model for Agents (DIMA) aims at providing agents with a dynamic identity that is determined by the social context.

Agent's Identity

In DIMA, the agent's identity is not fixed, instead the agent features a sub-set of characteristics that represents the part of the identity that is currently salient on the agent. So in the model each *agent* has a salient identity that will filter the characteristics that will determine the agent's decision, and also a set of social groups that are known by the agent.

- **Salient Identity:** representation of the agent's active identity that is going to influence the agent's decision making;
- **Social Groups' Knowledge Base:** representation of the agent's known social groups (aggregation of agents that share the same characteristics) and its prototypical characteristics (characteristics that represent the typical agent of that group).

While *personal identity* is the part of the self-concept defined in terms of idiosyncrasies derived from the intra-group differentiation (Tajfel, 1972), *social identity* refers to the aspects of a person's self-concept that are derived from the knowledge and feelings about his or her in-group (Tajfel, 1972). As such, the agent is not only going to be able to express its individual identity, but also, for each social group it belongs, the agent will hold a social identity that can be expressed if the situation leads it. In DIMA, an agent's *salient identity* can have two different levels. It can be social, if an agent's group membership becomes salient trough intergroup differentiation, or it can be personal when no social identity is salient. Thus, the agent's salient identity can be:

- **Social:** a set of characteristics that the agent shares with the other members of the in-group;
- **Personal:** a set of characteristics that distinguishes the agent from it's in-group.

In order to represent these two levels, both social and personal identities are defined by:

- **Characteristics:** representation of the agent's attributes or features that are going to be taken into consideration on the agent's decision making, defined by a name and value.

When an agent's salient identity is personal, the agent's decision will be determined by its personal identity characteristics values, but when the salient identity is social, i.e., then the agent's expressed characteristics' values are going to shift towards the values of the prototypical characteristics of that specific social group.

Characteristics

Each characteristic is defined in DIMA by a name and a value:

- **Type:** a label used to identify the characteristic;
- **Value:** measurable attribute or feature.

Characteristics can be one of the two types: explicit or implicit. Whereas explicit characteristics can be easily observed and obtained by other agents (e.g. skin or clothes colour, symbols, skills and gender), implicit characteristic are gleaned indirectly by observing the agent's behaviour and expressions, requiring agents with inferring mechanisms. Implicit characteristics can be social values, norms, interests or goals (Hofstede & Hofstede, 2001; Schwartz, 1992)

Social Context

The social context the agent is in will have a great influence on how the agent will perceive itself and others. It will increase the likelihood of the agent behave according to its personal identity or to its social identity, and will also determine which type of identity is going to be salient and influencing the agent's behaviour.

In DIMA, two aspects from the social context are represented:

- **Agents Present:** agents that share the same space and agents that are not in the space but are referenced in a conversation or by an event.
- **Theme:** set of characteristics that are relevant in the context, and can be manifested by a place, a talk or an event;

When a specific theme is introduced on the social context, either by a place (e.g. a university), by a topic of a conversation (e.g. a talk about politics), by an event (e.g. travelling outside), or by a task (e.g. cleaning the classroom), the theme will bring out the characteristics that are relevant in that specific social context, and then this set of relevant characteristics is going to be processed by the agent.

It is while looking at each other agents' characteristics that the theme defines as relevant to the current situation, that the agent calculates and perceives if it is in the presence of members with which it shares the same social group (*in-group*) or not (*out-group*). If the agent perceives itself as in the presence of only in-group members, its identity is going to be determined by its personal identity. But if the agent is in the presence of out-group members, its identity can be determined by a social identity, according to a formula that we will see next.

Identity Salience

Fundamentally, the identity that the agent is going to take in account when processing its decision-making and to generate its behaviour, is going to be determined by the presence or not of the the out-group (Brewer, 1979) but also by several other aspects inherent to the social identity itself. These factors are going to have an impact on the social identity salience strength, and the more salient a social identity is, more is its influence on the agent's behaviour.

According to Social Identity and Self-Categorization theories (Tajfel, 1972; Turner, 1985; Turner et al., 1987), the salience of a particular social identity is determined by the interaction between how accessible in memory that social identity is to an individual (accessibility), as well as how well it fits the social context (fit) (Turner et al., 1987, 1994). Following (Oakes, 1987), in this model a social identity salience is the product of fit and accessibility (see equation 1).

$$Salience_{(Social\,Identity)} = Fit * Accessibility \tag{1}$$

Fit between a social identity and the context where the agent is situated is composed by two aspects: comparative fit and normative fit. Comparative fit is defined by the principles of the Meta-Contrast theory (Turner et al., 1987), which states that:

> "any collection of people will tend to be categorized into distinct groups to the degree that intra-group differences are perceived as smaller, on average, than inter group differences within the relevant comparative context", p.455, (Turner et al., 1994)

Normative fit refers to the content of that categorization and how well does it match with the characteristics of a social group from the agent's knowledge base.

In order to determine the fit of a social identity with DIMA, first the agent needs to define the social groups present in the context given the actual theme.

All agents present in the social context are going to be clustered into categories, according to the relevant characteristics given by the theme. For this to be possible, all characteristics must have a numeric comparative function which returns the distance between two vectors ranging from 0 to 100, where 0 means the absence of that characteristic and 100 means that it highly represents the agent.

According to the clustering algorithm results, the agent might perceive as being in the presence of one or more social groups. If the number of clusters is one, that means that the agent is in the presence of one social group. In this case, because of the absence of an out-group the salience of a social identity does not apply, and the agent will use its personal identity. Only in the presence of two or more groups, the agent proceeds in calculating the fit.

In this situation, through *normative fit*, the agent will be able to determine if it is in the presence of a social group that it already knows and had experience with. So for all social groups in the agent's knowledge base that has those relevant characteristics, the fit is computed by comparing them to all the clusters resulted from the previous clustering process. If no match is found, its because the agent is in the presence of ad-hoc groups (groups who the agent does not have previous knowledge or past experiences with). In those situations the prototypical member, or centroid (*Ct*), of each social group that is going to be used later by the fit is going to be determined by the prototypical member of the present clusters. If there is actually a match between the social groups found by the clustering algorithm, the agent will use the centroid from the normative social groups that it already knows. The process for computing the value of the normative fit is similar to the comparative fit described bellow.

Calculating the *comparative fit* of a social identity (SI_i) is going to be done according to the equation 2 where the distance between the agent's in-group (SG_i) and any other group (SG_o) is going to be calculated (inter group differences), and the dispersion of its own social group is measured (intra-group differences). Alfa (α) and Beta (β) are weighting values for both distance and dispersion, and since we want to attribute more weight to the distance than to the social group's dispersion, we set the default of α as 0.8 and β as 0.2.

$$ComparativeFit_{(SI_i)} = \alpha(distance_{(SG_i,SG_o)}) + \beta(1 - dispersion_{(SG_i)}) \tag{2}$$

The *distance* between the agent's group and another group present in the social context is going to be measured by calculating the difference between the out-group centroids ($Ct_{(SG_o)}$), that represent the group's prototypical members, and the in-group centroids ($Ct_{(SG_i)}$) (see equation 3). If the agent recognizes the groups through the normative fit process then the group's centroids used will be the prototypical members' characteristics from the social groups from the agent's social group's knowledge base, if not, it will be the prototypical members' characteristics of the clusters found trough the clustering algorithm.

$$distance_{(SG_i,SG_o)} = \frac{\left|Ct_{(SG_o)} - Ct_{(SG_i)}\right|}{Kmd} \tag{3}$$

The *dispersion* of the agent's social group is measured by calculating the average of absolute differences (*MD*) of all its members from the prototypical member of the social group (see 4).

$$dispersion_{(SG_i)} = \frac{MD_{(SG_i)}}{Kmcw} \tag{4}$$

Both distance and dispersion are normalized, using the constants *Kmd* and *Kmcw*, where:

- **Kmd:** is the maximum distance two clusters can hold, and can be calculated according to the equation 5, where *N* is the number of characteristics used for clustering and *MAX* is the maximum value a characteristic can have;

- **Kmcw:** is the maximum distance between the centroid member and another member for it to be considered as member of that group. It is a parametrizable value, which is currently set to 50.

$$Kmd_{SG_i,SG_o} = \sqrt{N} * MAX \tag{5}$$

Social groups with higher fit are the ones with less clustering dispersion and higher distance from the other social groups.

Accessibility of a particular social group, reflects a person's past experience with that group (Turner et al., 1994). Identities have higher or lower accessibility depending on how accessible is that specific categorization in a person's memory. Identities that have been used more times and displace more emotional valence are more accessible.

The accessibility from new social identities, as the ones from ad-hoc social groups, is implied by the distance between the agent values ($< c_1, ..., c_n >_{Ag}$) and the centroid from its in-group. As such, agents that are closer to the centroid have higher accessibility while agents further from it have lower accessibility, translating this way the connection strength between a agent and that ad-hoc social group (see equation 6).

$$Acc(SI)_{t=0} = 1 - \frac{\left| < c_1, ..., c_n >_{Ag} - Ct_{(SG_i)} \right|}{Kmd} \quad (6)$$

In the presence of normative groups the agent's social identity can have an accessibility value determined by the emotional memory and the easiness of bringing that social identity into the agent's mind (Turner et al., 1994). The emotional valence of a memory is defined by the emotional impact of the actions taken by the agent supported by that identity.

For every time a social identity is salient its accessibility is updated according to the equation 7. The sum of all agent's identities is normalized so when one identity accessibility increases all the others suffer a decay.

$$Acc(SI)_{t+1} = Acc(SI)_t + Salience(SI)_t * EmotionalValence(SI)_t \quad (7)$$

The salience of a social identity will be highest if both accessibility and fit are high. The higher a social identity, more impact that will have on the agent's behaviour.

Implementing DIMA

For the purposes of experimentation and analysis, DIMA was implemented. The agent behaviour generation system consists of three components: *The Characteristic Archetype*, *The Clustering Algorithm*, *The Social Identity Calculation*.

The Characteristic Archetype consists of an abstract class, which allows the representation of multiple types of characteristics within the system.

In order to calculate the comparative fit and accessibility we used as a clustering algorithm the K-Means algorithm with a few modifications. The clustering algorithm takes into consideration all of the players characteristics values. First it will kick start itself with one K cluster, if there is at least one point who's distance is farther from the distance constraint X, the algorithm will increment K adding one more cluster, forcing the optimization process to restart. The algorithm finishes when the distance constraint heuristic is satisfied.

Figure 1 represents the program pipeline, which starts by assembling a list of the other players known by the agent and their characteristics. Using this list the agent will create a K-Means cluster containing a list with centroids and points. The number of centroids will be a direct representation of the number of clusters in the agent's K-Means algorithm. The comparative fit and accessibility are then calculated using this K-Means as an input parameter. Finally the salience is obtained through both the comparative fit and the accessibility value.

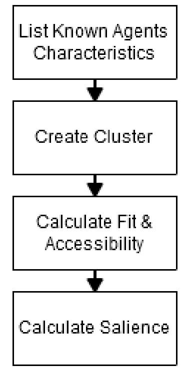

Figure 1: The Salience Calculation Pipeline.

Platform

To explore the above, we used a multi-player game within the Project INVITE [1] (social Identity and partNership in VIrTual Environments) (Prada et al., 2012) where both humans and virtual agents can participate. The game begins with players stranded on an island due to a plane crash, where an active volcano threatens their lives at any moment. Each player's personal objective is to obtain the largest amount of gold, while at the same time help their campsite members collect wood to build a raft (the team objective) so as to get off the island. The players are faced with the dilemma of either helping their team by collecting wood or gathering gold and thus become rich when saved. If everyone collects mainly gold then the raft will not be built in time and everyone will loose when the volcano erupts. The player who can get off the island with the most gold is the winner.

Although this project aims at exploring the role of social identity and social dilemmas in mixed motive tasks, this platform is fully parametrized and allows the exploration of different scenarios and case studies. Some of the parametrizable variables are: the number of turns until the volcano erupts (end-game condition); number of campsites or teams; number of players per team (that could be a mix of humans and agents); visual characteristics for each player; total wood necessary to finish the raft; number of resources (wood and gold) each player can collect; among others.

Example Scenarios

For experimentation purposes a simulation of the game was created. In our scenario the game was limited to 1 turn, 2 teams and 4 players for each of the both campsites, A and B. Players were controlled by virtually intelligent agents. Since different uniform colour has been known to prime differences

[1] http://project-invite.eu/

in social group perceptions (Frank, Gilovich, et al., 1988; Peña, Hancock, & Merola, 2009), it was used a form of differentiation of the two teams, in form of characteristics. In that order players were characterized by a shirt characteristic with the values 0 (red) or 100 (blue), and a campsite characteristic (A and B). Because this work's intentions is the study of the effects of an out-group, each player's K-Means algorithm was limited to a maximum of 2 clusters (i.e. the player's in-group and out-group). Due to the theme of the problem, the campsite will be the most influential characteristic of the clustering algorithm.

The total wood collected by agents is obtained by multiplying the salience value by the total carrying weight, which is 10. The gold is the difference of the obtained wood value by the total weight. It is expected that agents with a higher salience identity with the campsite (common coloured shirt), will cooperate with more wood.

Red versus Blue

In this scenario all campsite A members wear blue shirts while all campsite B members wear red shirts. Because both campsites have members with identical characteristics (i.e. no dispersion) the salience value will be 1, it's maximum value (see table 1).

Table 1: Red versus Blue Scenario - Campsite A

	Agent 1	Agent 2	Agent 3	Agent4	Total
Colour	Blue	Blue	Blue	Blue	
Accessib.	1	1	1	1	
Comp. Fit	1	1	1	1	
Salience	1	1	1	1	
Wood	10	10	10	10	50
Gold	0	0	0	0	0

Unbalanced Teams

In this scenario, campsite A has one member wearing a red shirt while the others wear blue shirts, as opposed to campsite B, where one member wears a blue shirt and the others wear red shirts. Although both campsites are similar in their shirt colour distribution, in the perspective of campsite A, the presence of the out-group (campsite B) will be weaker for the red shirt member than for the rest of its members (and vice versa for campsite B). Still, because three of the other members are similar, their salience identity values are strong enough to bias their behaviour to help their team (see table 2).

Table 2: Unbalanced Teams Scenario - Campsite A

	Agent 1	Agent 2	Agent 3	Agent4	Total
Colour	Blue	Blue	Blue	Red	
Accessib.	0.82	0.82	0.82	0.47	
Comp. Fit	0.68	0.68	0.68	0.68	
Salience	0.56	0.56	0.56	0.32	
Wood	6	6	6	3	21
Gold	4	4	4	7	19

Equal Mixed Teams

In this scenario all campsite A and B members are equally divided between red and blue shirts (i.e. two blue and two red). From the perspective of one campsite, the presence of the out-group will be particularly weak, resulting in a low social identity salience. As such all members are going to behave a little more greedily than in the previous scenarios (see table 3).

Table 3: Equal Mixed Teams Scenario - Campsite A

	Agent 1	Agent 2	Agent 3	Agent4	Total
Colour	Blue	Blue	Red	Red	
Accessib.	0.65	0.65	0.65	0.65	
Comp. Fit	0.57	0.57	0.57	0.57	
Salience	0.37	0.37	0.37	0.37	
Wood	4	4	4	4	16
Gold	6	6	6	6	24

One Team Only

In this scenario there is only one campsite as such all four agents are in the presence of in-group members. In this situation all agents share the same coloured shirt. Because there is no presence of an out-group, the social identity salience value is 0, and all members behave accordingly to their personal identity (see table 4).

Table 4: One Team Only Scenario - Campsite A

	Agent 1	Agent 2	Agent 3	Agent4	Total
Colour	Blue	Blue	Blue	Blue	
Wood	0	0	0	0	0
Gold	10	10	10	10	40

Conclusion and Future Work

Because social identity has a great impact in a wide range of fields and settings such as group formation, cohesiveness, prejudice, conformity, social influence and crowd behaviour (Turner et al. 1994; Hogg, 2003), we believe the study of this other phenomena could also benefit from DIMA.

Running the simulation we found that, as expected, agents whose t-shirt colour matches the majority of their campsite, expressed higher salience identity, cooperating with more wood, while the opposite situation had reverse results. However, in the extreme situations such as Red versus Blue Scenario, or One Team Only Scenario, it was quite evident that agents did not act rationally and presented extreme behaviour (collecting all wood or all gold). In these situations, it looked like they did not care about winning or surviving, respectively, as it would happen in a real situation with humans. As such, for future work, we intent to introduce rational thinking on agent's decision-making in which the influence of social identity salience will work upon. We are also, currently extending DIMA to calculate social identity salience in situations where three or more groups are present, as well as introducing the dynamics of the salience of multiple identities and relations among themselves.

Acknowledgements

This work was partially supported by the INVITE project (ref. UTA-Est/MAI/0008/2009) funded by FCT under the UT-Austin/Portugal cooperation agreement and by national funds through FCT Fundação para a Ciência e a Tecnologia, under project PEst-OE/EEI/LA0021/2011, the PIDDAC Program funds.

References

Brewer, M. (1979). In-group bias in the minimal intergroup situation: A cognitive-motivational analysis. *Psychological Bulletin*, *86*(2), 307.

Brewer, M. (1991). The social self: On being the same and different at the same time. *Personality and Social Psychology Bulletin*, *17*(5), 475.

Dawes, R. (1974). *Formal models of dilemmas in social decision-making.* (Tech. Rep.). DTIC Document.

De Rosis, F., Pelachaud, C., & Poggi, I. (2004). Transcultural believability in embodied agents: a matter of consistent adaptation. *Agent Culture: Human-Agent Interaction in a Multicultural World*, 75–106.

Dimas, J., & Prada, R. (2013). You are who you hang out with: Agents with dynamic identity. In *Proceedings of the 11th international conference on autonomous agents and multiagent systems (aamas 2013).*

Frank, M. G., Gilovich, T., et al. (1988). The dark side of self-and social perception: Black uniforms and aggression in professional sports. *Journal of personality and social psychology*, *54*(1), 74–85.

Fridman, N., & Kaminka, G. (2009). Comparing human and synthetic group behaviors: A model based on social psychology. In *International conference on cognitive modeling (iccm-09).*

Goette, L., Huffman, D., & Meier, S. (2006). The impact of group membership on cooperation and norm enforcement: Evidence using random assignment to real social groups. *The American economic review*, *96*(2), 212–216.

Grier, R., Skarin, B., Lubyansky, A., & Wolpert, L. (2008). Scipr: A computational model to simulate cultural identities for predicting reactions to events. In *Proceedings of the second international conference on computational cultural dynamics* (pp. 32–37).

Hofstede, G. H., & Hofstede, G. (2001). *Culture consequences: Comparing values, behaviors, intitutions, and organizations across nations.* SAGE Publications, Incorporated.

Hogg, M., & Williams, K. (2000). From i to we: Social identity and the collective self. *Group Dynamics: Theory, Research, and Practice*, *4*(1), 81.

Kollock, P. (1998). Social dilemmas: The anatomy of cooperation. *Annual review of sociology*, 183–214.

Lustick, I. (2002). Ps-i: A user-friendly agent-based modeling platform for testing theories of political identity and political stability. *Journal of Artificial Societies and Social Simulation*, *5*(3).

Mascarenhas, S., Dias, J., Afonso, N., Enz, S., & Paiva, A. (2009). Using rituals to express cultural differences in synthetic characters. In *Proceedings of the 8th international conference on autonomous agents and multiagent systems-volume 1* (pp. 305–312).

McLeish, K., & Oxoby, R. (2007). *Identity, cooperation, and punishment*. IZA.

Oakes, P. (1987). The salience of social categories. *Rediscovering the social group: A self-categorization theory*, 117–141.

Peña, J., Hancock, J. T., & Merola, N. A. (2009). The priming effects of avatars in virtual settings. *Communication Research*, *36*(6), 838–856.

Prada, R., Raimundo, G., Baptista, M., Dimas, J., Santos, P. A., Martinho, C., et al. (2012). The role of social identity, rationality and anticipation in believable agents. In *Proceedings of the 11th international conference on autonomous agents and multiagent systems (aamas 2012).*

Salzarulo, L. (2006). A continuous opinion dynamics model based on the principle of meta-contrast. *Journal of Artificial Societies and Social Simulation*, *9*(1), 13.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, *25*(1), 1–65.

Smith, E., & Mackie, D. (2000). *Social psychology*. Psychology Pr.

Tajfel, H. (1972). La catégorisation sociale (social categorization). *Introduction à la psychologie sociale*, *1*, 272–302.

Tan, C., & Cheng, H. (2007). Personality-based adaptation for teamwork in game agents. In *Proceedings of the third conference on artificial intelligence and interactive digital entertainment* (Vol. 37).

Turner, J. (1985). Social categorization and the self-concept: A social cognitive theory of group behavior. *Advances in group processes: Theory and research*, *2*, 77–122.

Turner, J., Hogg, M., Oakes, P., Reicher, S., & Wetherell, M. (1987). Rediscovering the social group: A social categorization theory. *B. Blackwell, Oxford, UK*.

Turner, J., Oakes, P., Haslam, S., & McGarty, C. (1994). Self and collective: Cognition and social context. *Personality and social psychology bulletin*, *20*, 454–454.

Weber, J., Kopelman, S., & Messick, D. (2004). A conceptual review of decision making in social dilemmas: Applying a logic of appropriateness. *Personality and Social Psychology Review*, *8*(3), 281.

Wit, A., & Wilke, H. (1992). The effect of social categorization on cooperation in three types of social dilemmas. *Journal of Economic Psychology*, *13*(1), 135–151.