Modeling the Cultural Subjectivity: Towards Computational Critique? *

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Abstract

In this paper we use a computer model of social capital to explore and develop a computational social theory of the anthropological or interpretive notion of the sub jectivity (Ortner 2005). The cultural sub jectivity is a social theory of the reflexive actor that is historically situated in a material and cultural context. It is important for computational social science to begin developing tools to represent the dimensions of the actor in terms of the sub jectivity because it recognizes and seeks to explain the complexity of human feelings and fears in creating meaning and in taking action. Theories of sub jectivity also offer a model of human action and play that is neither universal nor individual. Developing a computational social theory of the sub jectivity is an impossible and improbable task, however, in seeking to develop this theory in code we might be able to posit clearer questions in social research regarding the sub jectivity and explore the operational limits of computational social science, which is a theory in itself. Also accounting for how complex structures of feeling and experienceanxieties, fears, dreams, hopes and the likedevelop as a component inside complex social organizations, ones that can be rigorously explored with computational methods, a foundation can be created for a critical computational social science.

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One of the main problems in computational social science, and in the human sciences in general, is to realistically and practically model human agency and the various biological, physical, social, and cultural formations that compel and impede this agency. Already this conversation has been extended to practitioners interested in studying the dynamics of human activity via the use of computation in discussions over complex versus simple agents (Billari, Fent, Prskawetz & Scheffran 2006) and over the difference between a focus on developing individual agent models versus learning parameters that guide interaction among homogenous agents (Chattoe 2002). It is worth extending this conversation by developing models that explicitly attempt to make anthropologically informed theories of subjectivity (Lave, Duguid, Fernandez & Axel 1992, Ortner 2005, Weber 1958, Geertz 1973, Marcus & Fischer 1986) into computer codes. As such it should be stated that modeling *cultural subjectivity*[1] is an ambitious task, which can likely never be achieved. Although much is left out in our specifications, working out different possible approaches to the subjectivity—especially approaches that tease out new ways of visualizing and conceptualizing how different levels and scales of human existence come to interact with micro and macro entities—is a critical theory-building activity for computational social scientists. In seeking to develop this theory in code we might be able to posit clearer questions in social research regarding the subjectivity and explore the operational limits of computational social science. Also accounting for how complex structures of feeling and experience—anxieties, fears, dreams, hopes and the like—develop as a component inside complex social organizations, ones that can be rigorously explored with computational methods, a foundation can be created for detailed analysis and assessment of how subjects negotiate social complexity.

In this paper we specify two different subjectivity configurations that represent an ethic of civic, or community-based, and manager, or professional, social interaction. We use these configurations to test Robert Putnam's hypothesis that social capital has decreased in the United States as (1) American Culture has transitioned from civic to manager-professional minded and (2) the introduction of new tools and technologies have given more energy and time to individuals and made more opportunities for social interaction (Putnam 2000). Both social capital and the corresponding subjectivity configurations are modeled using Virtual Simulation and Analysis of Group Evolution (ViSAGE), which is a general architecture for modeling the dynamic formation of social groups through statistical agent membership processes.

1 What is Subjectivity?

In our view *subjectivity*—which is similar to *identity*, *personhood*, *standpoint*, and *figurations* (Haraway 1997)—signifies the manner in which individuals are driven to make meaning and take action through the manipulation and negotiation of feeling or emotion. Such processes are inherently cultural (Marcus & Fischer 1986) and therefore require an analysis of how these 'inner states' of individuals are shaped by cultural and social structures. Sherry Ortner defines the subjectivity as "the ensemble of modes of perception, affect, thought, desire, fear, and so forth that animate acting subjects ...as well [as] the cultural and social formations that shape, organize, and provoke those modes of affect, thought and so on" (Ortner 2005, pg. 31). It is through an analysis of how subjects make meaning and become animated that the social scientist explores social reality and the many cross-cutting dimensions and levels of social order that are often implicated in any human activity. Thus the common (cultural) strategies and resources that subjects use to make decisions and generate alternatives in everyday life is a methodological entry point into larger social phenomenon.

A short example of subjectivity may be found in the field of Science Studies (Hess 1997), which takes as its focus the rise of modern scientific institutions. One of the prominent questions in this field is to

[1] We use the term *cultural subjectivity* here to distinguish the technical usage of *subjectivity* in historical and anthropological discourse from that of the common individualistic usage. From here on we use the word *subjectivity* in the technical manner.

understand how the identity of the scientist, as objective and reserved, formed and, also, how that identity is deployed today to make modern scientific projects. In the book *The Leviathan and the Airpump* Shapin and Schaffer describe the historical, social, and material conditions that gave rise to the modern experiment. By analyzing a philosophical and political dispute between Thomas Hobbes and Robert Boyle, which concerned the nature of truth and natural knowledge, Shapin and Schaffer show the genesis of the modern scientific subjectivity that has come to be called the "modest witness" (Shapin & Schaffer 1989, Haraway 1997). It was the political, cultural, economic, material, and social circumstances in mid-17th century England and Europe that gave rise to an elite class of humans who could validate the facts of an experiment as true. These individuals were male, wealthy, but, most importantly, they had an ethic of separating emotion from their testimony. Donna Haraway says that in order for this seperation of the self to be visible, for modesty to be visible in the production of scientific knowledge, "the man—the witness whose accounts mirror reality—must be invisible, that is, an inhabitant of the potent 'unmarked category,' which is constructed by the extraordinary conventions of self-invisibility" (Haraway 1997, pg. 23). The new experimental spaces that were developed during the time of Boyle and Hobbes could have either been open to the public and put under the scrutiny of diverse sets of people (i.e. women and the poor) or closed, allowing only allowing certain kinds of people in. *The Leviathan and the Air-Pump* illustrates that these experimental spaces were not constructed for democratic purposes but rather to cater towards the construction of a new class of human and validator of knowledge. These were individuals who seemed to have no culture, to have moved passed personal and political investment, the modest witness.

Subjectivity is more emergent, distributed, and deeply held by individuals than a social role (i.e. a scientist that inhabits a specific community of scholars and a specific institution and who thus has duties and obligations associated with these relationships) and it is more precise and general than an identity (i.e. a white anglo-saxon protestant male scientist). Claims about subjectivity say something about the historical and cultural nature of an identity and how normative duties and obligations of individuals on a daily basis coincide and, oftentimes, clash with these historical and cultural formations. Understanding the tension between structure and agency, as it is known, is both fundamental to the idea of subjectivity and critical for understanding the development of society.

2 The Social Capital Generating Subjectivity

There are two generally accepted methodologies for explicating and specifying subjectivities. First is to gather ethnographic data through observations and interviews of people going through change, social trauma, or new resolving some new material or cultural forms. Sharon Traweek calls these critical methodological locations "faultlines" (Traweek 2000). It is at these faultlines where subjectivity becomes visible to the observer because actors must resolve contradictions in their worldviews and to do so develop a language for expressing this resolution. The second way to analyze subjectivity is through historical and discursive analysis. Here sense-making is written and achieved through participation of subjects in written forums such as journals, books, newspaper ..etc. For our purposes we take claims made from observations of historians, sociologists, and anthropologists about social capital in the United States as well as the general beliefs about social capital posited in academic forums to formalize instances of a cultural subjectivity.

We view social capital as a modern belief about the value of building and maintaining relationships with other humans. It is believed that by making "connections" or "links" to other people one can generate wealth in a measurable form. In more vernacular settings social capital is understood simply as "where there's a contact there's a contract," which is to say that the more people you know the more opportunity you have to achieve goals. In academic discourse, however, the concept of social capital becomes more sophisticated and precise (Borgatti, Jones & Everett 1998, Flap & Volker 2004, Burt 1997).

Generally there are two views of social capital that are distinguished by a dedication to two different units of analysis: the community and the individual. Robert Putnam sees social capital as something that a community has (Putnam 2000) while Nan Lin, for example, sees social capital as something that an individual possesses (Lin 2001). We account for these two views by implementing two notions of social capital into the model: bonding and bridging social capital.

2.1 Bonding and Bridging Social Capital

Borgatti et al. (1998) formalize social capital as a series of standard social network measures across three different dimensions of analysis; external actor, internal group, and external group. For external measures, increasing degree, the number of relationships an entity has with other similar entities, adds to social capital while increasing density, a measure of how related an entity's relatives are, takes away from social capital. Internal measures are the inverse of external; increasing the density of actors within a group increases social capital while increasing the degree of actors within a group decreases social capital. Using ViSAGE we distinguish between bridging and bonding as two different forms of social capital (Putnam 2000) along the dimensions specified by Borgatti et al. (1998). In this case, degree describes bridging social capital, while lack of degree describes bonding social capital. Similarly, density describes bonding social capital, while lack of density describes bridging social capital. Hence we specify four different measures of social capital in our model:

- *Individual-level bonding social capital* (C_i^{bo}), which is the sum of the ranks, r_k^i, of actor i for every group, k, i is a member, $\sum r_k^i$. Here *rank* is a measure of how long actor i has had membership in a group in comparison to other members. The higher proportion of time the higher the rank.
- *Individual-level bridging social capital* (C_i^{br}), which is the number of groups actor i is a member, $\sum |G_k|$.
- *Local-level bonding social capital* (C_j^{bo}), which is the *density*—the proportion of links between alter groups, j, over the number of total possible links—of a group k.
- *Local-level bridging social capital* (C_j^{br}), which is the *degree*—the total number of alter groups, j—of a group, k.

2.2 Excess Energy

The social capital model uses the ViSAGE variable *energy*, E_i, to designate the physical, mental, and emotional capacity an agent has to engage the community. The social configuration an agent resides in at each time-step depletes the agent's store of energy. The two aspects of the social configuration that factor into energy depletion are individual-level bridging social capital and individual-level bonding social capital. The left over energy is excess energy, which is calculated with the equation $E_i^E = E_i - \phi_i * C_i^{br} - \psi_i * C_i^{bo}$, where ϕ_i is the *group cost*, the cost of maintaining membership of a group independent of rank, and ψ_i is the *rank group cost*, the cost of being part of the group that scales with rank.

The ViSAGE variable C_i^S is designated as *emotional energy*—the feelings an actor experiences of elation or anxiety (Collins 2004)—and it affects the productivity of an individual in maintaining a specific social configuration, a number of member groups and the associated distribution of ranks in each group. This is formalized in ϕ_i and ψ_i. Here the more emotional energy actor i has (C_i^S), the less amount of energy actor i spends for each group and for maintaining the rank in each group: $\phi_i = \frac{\phi_{max}}{1+C_i^S}$ and $\psi_i = \frac{\psi_{max}}{1+C_i^S}$, where ϕ_{max} is the maximum amount of energy spent in a group, and ψ_{max} is the maximum amount of energy spent maintaining the rank in a group.

2.3 To Join, Leave, or Stay

In our model for every timestep each agent is forced to assess their social and personal situation, which results in the return of feelings of anxiety or elation. We represent with the variable, following Randall Collins' notion, "emotional energy" C_i^S (-1:1) (Collins 2004). This assessment is animated by the properties of a specific subjectivity that combines an agent's own volition and social norms concerning what action is to be taken: to attempt to gain membership in a new group, to leave a current group, or to maintain all current memberships as is. A three-by-three table is used to combine the agent's choice (rows) and the socially normative action (columns), see table 1–table 6. Furthermore, agent choice and the normative action are determined by differently assessing an agent's *excess energy*, E_i^E. For the remainder of this section we specify two tables of the civic minded subjectivity and the manager-professional subjectivity.

The **civic social capital subjectivity** (civic class) is specified in table 3 and is derived from adding table 1 and table 2 together element-by-element. If an actor chooses to stay in a group this adds to a feeling of elation, which is given by returning a positive number, and if this actor chooses to leave a group the actor will become distressed and a negative number is returned to indicate this (see table 1). This represents the fact that there is a perceived value in sticking with your existing social groups as would be an ethic observed in a community-oriented culture. Also as there is value in loyalty to existing groups there is also an ethic of following social norms, of maintaining coordination with the communities values. This is represented in table 2.

		Norm		
		join	*stay*	*leave*
Act	*join*	0	0	0
	stay	1	1	1
	leave	-1	-1	-1

Table 1: Stay is Valued

		Norm		
		join	*stay*	*leave*
Act	*join*	1	0	-1
	stay	0	1	0
	leave	-1	0	1

Table 2: Accordance Valued

		Norm		
		join	*stay*	*leave*
Act	*join*	1	0	-1
	stay	1	2	1
	leave	-2	-1	0

Table 3: Civic Class

The **manager-professional social capital subjectivity** (manager class) has two specifications similar to the civic class. If an actor joins a new group they become exhilarated or elated and if they leave they are emotionally deflated (table 4). Again this follows a modern ethic of "networking" or "building social capital." Second the manager works in his or her own self interest. Therefore actors break norms when it is in their interest and coordinate with norms when it is in their interest. If an actor leaves when the norm says to leave then a benefit is missed and if the actor leaves when the norm says to join an unnecessary cost is incurred (table 5).

		Norm		
		join	*stay*	*leave*
Act	*join*	1	1	1
	stay	0	0	0
	leave	-1	-1	-1

Table 4: Join is Valued

		Norm		
		join	*stay*	*leave*
Act	*join*	0	0	1
	stay	0	0	0
	leave	-1	0	0

Table 5: Self-Interest Valued

		Norm		
		join	*stay*	*leave*
Act	*join*	1	1	2
	stay	0	0	0
	leave	-2	-1	-1

Table 6: Manager Class

3 Experiment and Discussion

Robert Putnam claims that communities in the United States have lost place-based social capital while gaining function-based social capital (Putnam 2000). Place-based social capital is characterized by the presence of many small groups, such as a card game group or a dinner party, that function to bridge across a community and the presence of many larger groups, such as town hall meetings or volunteer groups or community work groups, that function to bond a community. In this view small groups, which we define to be between two (2) and seven (7), will have a relatively high degree and low density and large groups, which we define to be eight (8) to twenty (20), will have a relatively high density and low degree. Small groups bridge and large groups bond.

To test the hypothesis that social capital has decreased from mid-century to late-century American communities we ask if a civic class community generates social capital in the manner discussed above while the manager class community does not. We also test to see if by simulating the introduction of opportunity-expanding and efficiency-making technologies have an effect on the performance of each subjectivity to generate social capital. To model the introduction of technology we (1) test different *opportunity values* (OV), which is a variable in ViSAGE that gives agents more opportunities to form new groups, and (2) increase the energy of every actor by 0.01 at every timestep for 100 timesteps. We ran a total of twelve

Parameters				*Results*					
Name	Class	OV	ΔE_i	C_j^{br} Small	C_j^{br} Large	C_j^{bo} Small	C_j^{bo} Large	Small	Large
c1	Civic	250	0	2.5	5.5	0.26	0.28	60	155
m1	Manager	250	0	1.8	3.0	0.28	0.32	90	115
c4e	Civic	250	0.01	7.5	24.0	0.51	0.50	0	180
m4e	Manager	250	0.01	6.0	15.0	0.39	0.34	0	205
c2	Civic	1000	0	2.4	3.4	0.28	0.30	110	135
m2	Manager	1000	0	1.9	1.7	0.30	0.29	100	90
c5e	Civic	1000	0.01	7.0	16.5	0.40	0.35	20	250
m5e	Manager	1000	0.01	4.5	8.0	0.31	0.25	45	230
c3	Civic	2000	0	2.5	2.8	0.30	0.30	80	125
m3	Manager	2000	0	1.8	1.1	0.30	0.25	70	85
c6e	Civic	2000	0.01	7.0	10.0	0.44	0.40	95	215
m6e	Manager	2000	0.01	5.0	4.5	0.40	0.31	115	175

Table 7: Results from twelve social capital subjectivity experiments

simulations with specifications outlined in table 7. We classified the output into the number of small and large groups (column 9 and 10 in table 7) and by the local-level bridging social capital and the local-level bonding social capital of large and small groups.

The simulation did not generate the results we expected where the manager class community produced more large group local-level bridging social capital and more small group local-level bonding social capital than the civic class community and the civic class community should have generated more small group local-level bridging social capital and more large group local-level bonding social capital. The results instead show that the civic community outperformed the manager in every social capital measure and experiment except for in the local-level bonding social capital of both large and small groups of $c1$ and $m1$.

What did emerge from our simulations was the varied presence of the number of groups, which we added as a third dimension to social capital that was not present in the literature we reviewed. While the civic community usually generated more bridging and bonding social capital as specified in our model, the performance of each subjectivity in generating groups between manager and civic classes tells a more interesting story. The data shows the manager class might be better at generating new and small groups in the face of technological change (see $c5e$, $m5e$, $c6e$, and $m6e$), which is unexpected since the civic class performs better on all social capital measures.

4 Conclusion

Since the strategic importance of understanding social capital is to understand the capacity individuals and groups have to achieve their goals it is particularly important to think through the different ways in which culture factors into this process. This happens namely through the sense-making cultural subjectivity. Do particular subjectivities generate "wealth" better than others? Under what conditions do these cultural modes of sense-making perform well and in what situations do they perform poorly? Social capital is but one way to gauge such questions.

Understanding and modeling subjectivity is a critical practice because it helps us to think about two interrelated processes. First, if there is a top-down change, such as a policy change, an introduction of a new set of technologies, or the establishment of an entire technological system, how is the ability of a culture to generate wealth (social capital) affected? Second, how do our models help us to think about how cultures (can) adapt to these top-down changes? How do our notions of culture and subjectivity imply the possibility of a "cultural fix" (Layne 2000) over a top-down fix? The ability to think through these problems in a robust and systematic manner can possibly be a powerful tool for cultural critique in the future and enhance the ability for realizing the different dimensions and locations of intervention that often go invisible.

References

Billari, F., Fent, T., Prskawetz, A. & Scheffran, J. (2006), *Agent-based computational modelling: applications in demography, social, economic and environmental sciences*, Physica-Verlag Heidelberg.

Borgatti, S. P., Jones, C. & Everett, M. G. (1998), 'Network measures of social capital', *Connections* **21**(2), 10.

Burt, R. (1997), 'The contingent value of social capital', *Administrative Science Quarterly* **42**(2), 339–365.

Chattoe, E. (2002), 'Review: computational techniques for modelling learning in economics', *Journal of Artificial Societies and Social Simulation*.

Collins, R. (2004), *Interaction ritual chains*, Princeton University Press, Princeton, N.J.

Flap, H. D. & Volker, B. (2004), *Creation and returns of social capital: a new research program*, Routledge, London; New York.

Geertz, C. (1973), *The interpretation of cultures; selected essays*, Basic Books, New York,.

Haraway, D. J. (1997), *Modest-Witness@Second-Millennium.FemaleMan-Meets-OncoMouse: feminism and technoscience*, Routledge, New York.

Hess, D. J. (1997), *Science studies: an advanced introduction*, New York University, New York.

Lave, J., Duguid, P., Fernandez, N. & Axel, E. (1992), 'Coming of age in birmingham: Cultural studies and conceptions of subjectivity', *Annual Review of Anthropology* **21**, 257–82.

Layne, L. L. (2000), 'The cultural fix: an anthropological contribution to science and technology studies', *Science, Technology, and Human Values* **25**(3), 352–379.

Lin, N. (2001), *Social capital: a theory of social structure and action*, Cambridge University Press, Cambridge, UK; New York.

Marcus, G. E. & Fischer, M. M. (1986), *Anthropology as cultural critique: An experimental moment in the human sciences*, University of Chicago Press, Chicago and London.

Ortner, S. B. (2005), 'Subjectivity and cultural critique', *Anthropological Theory* **5**(1), 31–52.

Putnam, R. D. (2000), *Bowling alone: the collapse and revival of American community*, Simon and Schuster, New York.

Shapin, S. & Schaffer, S. (1989), *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life*, Princeton University Press, Princeton, N.J.

Traweek, S. (2000), Faultlines, *in* R. Reid & S. Traweek, eds, 'Doing science + culture', Routledge, New York.

Weber, M. (1958), *The Protestant ethic and the spirit of capitalism*, Scribner, New York,.