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Computer-assisted theorizing of interaction rituals: Simulation by using Stella

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In this paper, I modified the model suggested by Collins and Hanneman(1998) and compared their results with new ones. In Section 1, I reviewed the existing model shortly and brought up some problems with it. I proposed two different models of interaction ritual chains in Section 2. One is based on simple adjustment, while the other includes the reciprocal effect between common mood and common focus as well as emotional energy equality besides cultural capital similarity to incorporate status and power dimensions. In the following section, I translated it into the models for simulation by employing Stella (www.iseesystems.com) that has became one of the popular tools for dynamic modeling at the system level over the past years. Conclusion and discussion about the problem of macro-micro link and causality in simulation approach to system dynamics was made in the last section.

1. Interaction ritual chain model revisited

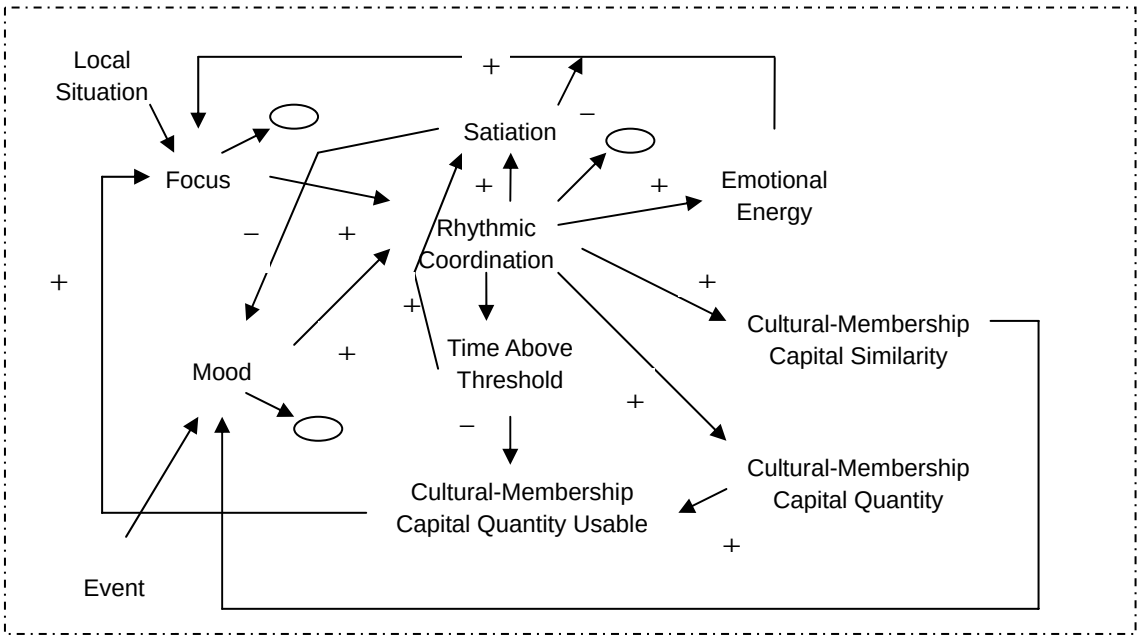
Turner(1998: 432-435) concisely introduced Collins' ideas about interaction ritual chains as follows. First of all, interaction rituals contain 1) a physical assembly of co-present individuals, 2) mutual awareness of each other, 3) a common focus of attention, 4) a common emotional mood among co-present individuals, 5) a rhythmic coordination and synchronization of conversation and nonverbal gestures, 6) a symbolic representation of this group focus and mood

with objects, persons, gestures, words, and ideas among interacting individuals, and 7) a sense of moral righteousness about these symbols marking group membership. Secondly, cultural capital and emotional energy as outcomes are two basic types of resources to understand interaction rituals. Therefore, these nine elements can be expressed as variables in a causal diagram. Taking a closer look at the diagram suggested by him, there is another variable, "Rhythmic Exchange of Talk and Nonverbal Gestures," however. Although this rhythmic exchange is distinctive from rhythmic synchronization and coordination, rhythmic exchange could be excluded for the sake of parsimony.

When some differences in the number of casual paths are ignored, the causal diagram without the variables, "Rhythmic Exchange" and "Sense of Moral Righteousness about Group Symbols," is not that different from the model proposed by Collins and Hanneman (1998: especially, Figure 7.2). So, let me begin discussion with the formulation of interaction rituals in their article. I do not mean to criticize Turner's diagram since any researchers at the beginning of formalizing the model do not need to consider it in details, but, unlike his model, Collins and Hanneman include some other important factors besides basic variables. The first one is the effect of "Satiation" on one feedback loop: Emotional energy, argue they, raises the common "Focus of attention," but this process cannot continue to escalate. Secondly, they inserted "Time above threshold" as another variable in the model. In other words, the initial levels of "Common mood" and "Focus of attention" should be strong enough to cross the barrier restricted by the time above a certain threshold. Next, it is also reasonable to take into account two exogenous variables, "Local situation" and "Event," because any type of interaction rituals cannot take place in a vacuum, as they pointed out. These two exogenous variables alone cannot reflect in their model what Turner called "embedded encounters," though. Lastly but not least, they added what is called "sinks" for three variables, "Focus," "Mood," and "Rhythmic coordination,"

because they dissipate over time if they are not sustained by inflows. Eventually, they formulated the interaction ritual chains as follows.

Figure 1. Interaction ritual: Basic micro-model (Collins and Hanneman, 1998: 221)



2. Two Modified versions

There might have been not a few critical comments on Collins' model of interaction rituals. Even Collins admits that the definitions of emotional energy and cultural capital still remains imprecise even though those two resources have a central explanatory role in his theory (Rosell and Collins, 2001). Besides, it leads me to have some basic questions just to look at the diagram: why is there no feedback from "Emotional energy" to "Mood?" In other words, what theoretical propositions support that emotional energy is related only to focus, not mood? Similarly, why is it that Cultural capital quantity has something to do with only Focus, while Cultural capital similarity with only Mood? Besides, the model does not seem to take into

account the fact that there might be different types of interactions. One could be what is called "preferential interaction" although this analogy does not sound appropriate in the sense that interactions in the literatures of interaction ritual theory are somewhat different from network formation and its reproduction in social network theory. This type of interaction is predicated on the assumption that the number of participating actors increases the chance of stratification in the network, and then this increases the propensity of their preferential interaction which again enhances the level of stratification at the global level through the positive feedback. The other type of interaction could be based on "homophily." The number of participating actors increases the diversity of the network, that is, the number of niches in Blau space, and then this negatively affects the chance of homophily-based interaction. This tendency of segregation again lowers the diversity through the feedback.

Above all, even to my meager knowledge, there seems to be some inconsistency in their article, or they are not that clear about some other things. First of all, there was one line from "Satiation" to "Mood" in the original model, but they did not include this effect when making equations and doing simulation later on. Hence, I got rid of this path for the sake of parsimony, so the level of "Mood" is not affected by "Satiation" directly or by its relatedness with other variables indirectly, while the level of "Focus" is via the interaction between "Satiation" and "Emotional energy."

Secondly, they hypothetically argued that the degree of "Satiation" increases exponentially with the duration of sustained "Rhythmic coordination" as the equation $S_{t+1}=S_t+T_t^{(e)}$ implies, but this equation does not include any sorts of exponential function that should have been governed by the parameter 7[1]. They actually used the table function with

[1] This parameter should have been set as 1.05. "The exponential rate at which duration affects the effect of rhythmic activity on satiation. In the code, this is done by a table." (p.232) This table is as follows: A FDUR,K=TABXT(FDURTAB, DUR.K, 0, 10, 1) T FDURTAB=0/.1/.21/.32/.43/.54/.66/.77/.89/1.00/1.12 (p.235) Like this, the table they presented

values that are increasing linearly. However, recalling the law of diminishing marginal returns in economics or Homans' proposition of deprivation and satiation, I do not think there is a good reason for the exponential increase of satiation with the time of sustained rhythmic coordination. Rather, the total level of satiation might decrease gradually with that time. For this reason, I used a square root function, neither an exponential function nor a simple linear function.

Next, they did not count the effect of "Cultural membership capital quantity" on "Cultural membership capital quantity usable" both in the equation[2] and in the simulation(i.e., Dynamo syntax)[3], even though there is one path between the two variables in the diagram. Relatedly, there is no equation expressed by Dynamo languages about "Cultural membership capital quantity" in the article[4]. However, there is no point of keeping another variable, "Cultural membership capital quantity usable," separately from the variable, "Cultural membership capital quantity," because these two variables can be merged into one, "Cultural membership capital quantity (usable)." Those problems mentioned above could be solved if the two variables were merged into one.

In Figure 2, I suggested another causal diagram more parsimonious, albeit not much different, that does not have anything problematic found out in the existing model. Figure 3 shows what I translated the causal diagram with help of Stella.

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is not based on an exponential function.

[2] Exactly saying, they did count the effect of Cultural capital quantity on Cultural capital usable in the equation like this: $CU_{t+1}=CQ_t-hT_t$. I do not think CQ is a typo. However, according to this equation, CU at the time point of t+1 is not affect by CU at the previous time point of t. This is not reasonable. For instance, look at another equation about Cultural capital quantity: $CQ_{t+1}=CQ_t+gR_t$. In this case, the current state of CQ is dependent on the previous state of CQ.

[3] Look at the three equations about Cultural membership capital quantity usable in 6.5.8 (p.235).

[4] 6.5.7 is about Cultural membership capital similarity, and 6.5.8 about Cultural membership capital quantity usable. (p.235)

Figure 2. Modified model of interaction rituals (Causal Diagram 1)

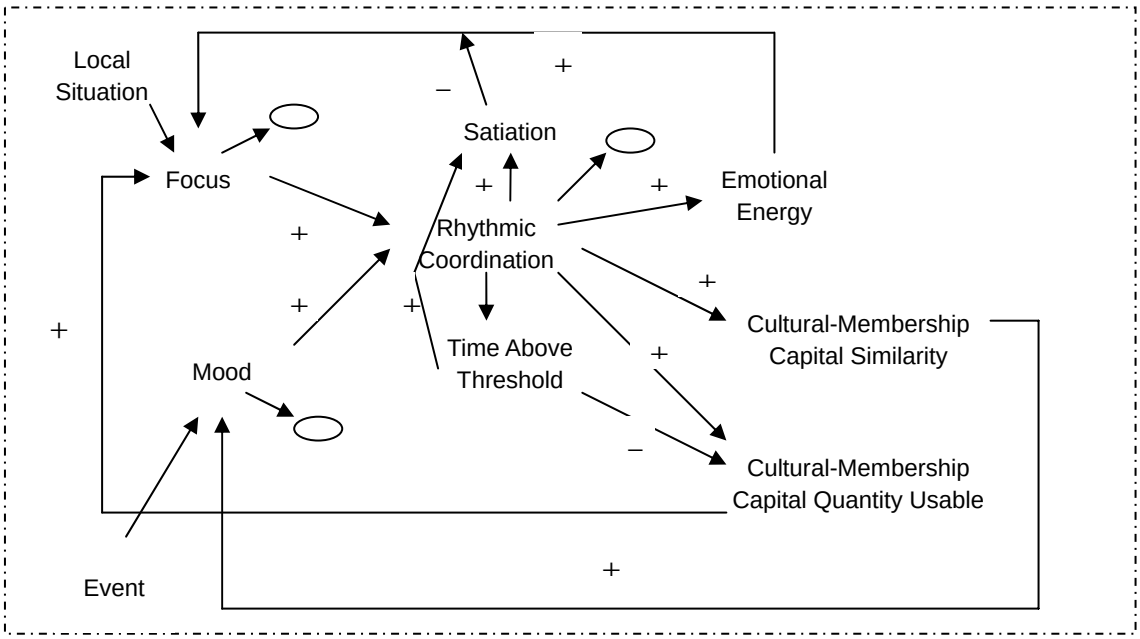
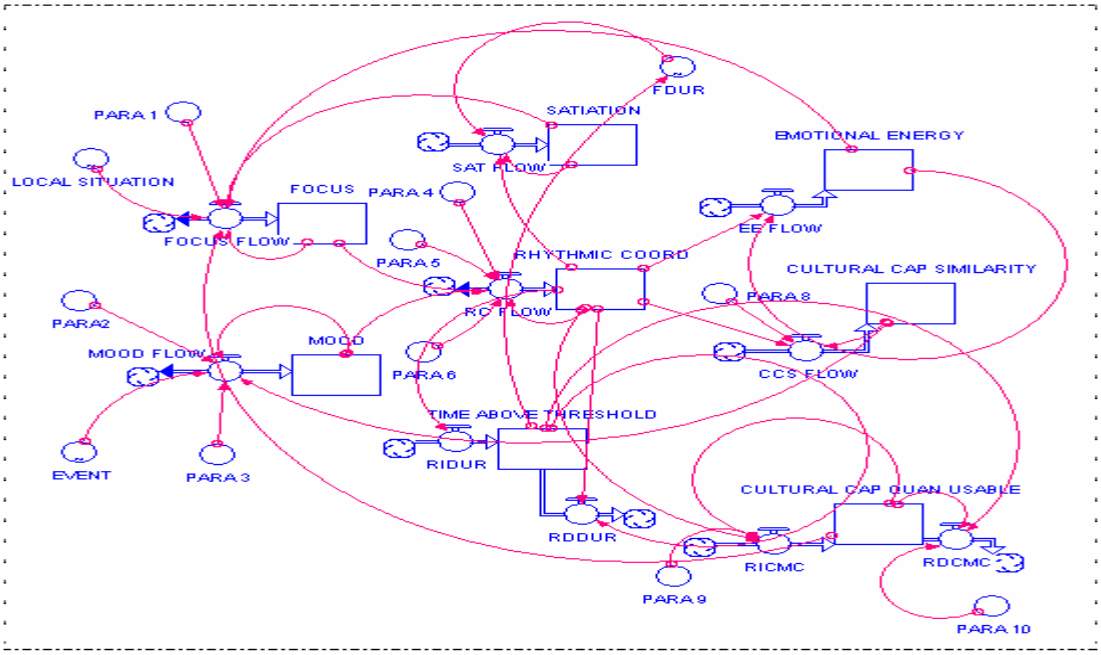


Figure 3. Causal Diagram 1

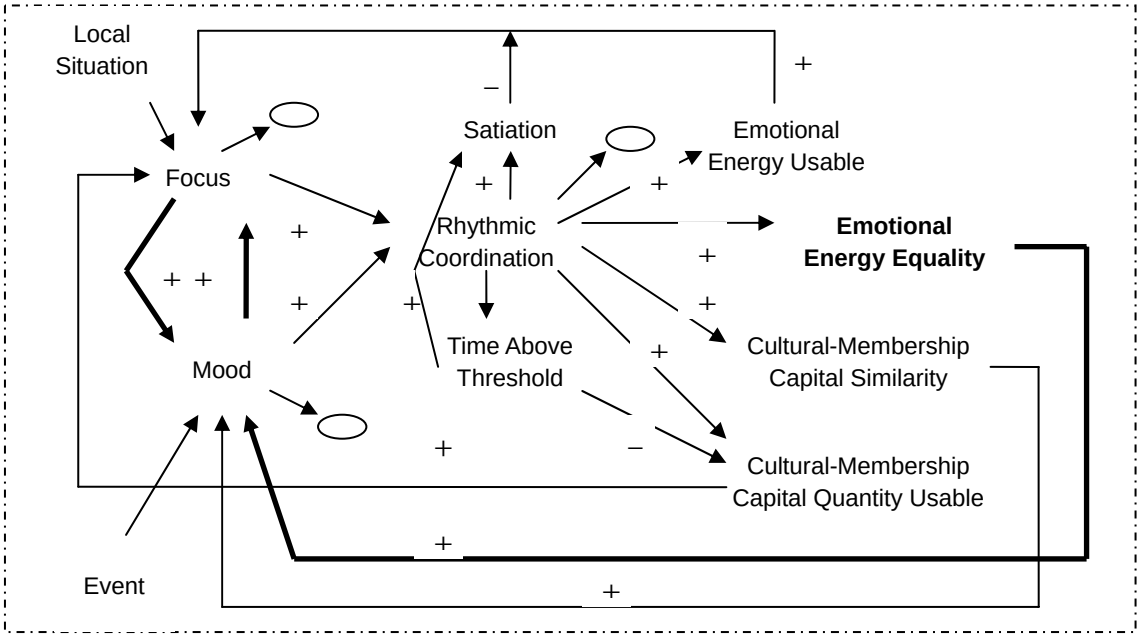


However, this model is still problematic for the following reasons. As I mentioned shortly, following Turner's perspective, they do not pay enough attention to the nestedness of

interactions in corporate and categoric units although the two exogenous variables, “Local Situation” and “Event,” were inserted. Another related problem is that they did not fully consider the effects of status and/or power on the process of interaction rituals. As Turner(1998) stated while reviewing Kemper’s social interactional theory of emotions, status and power is another important dimension in interaction rituals. Similarly, Rosell and Collins(2001) also suggested that the next step of theorizing of the microfoundations of conflict theory should be to explain the differing distributions of those two resources to various persons. This reminds me of two things. One is the effect of the distribution of parameters in Blau space on interpersonal relations. The other is Bourdieu’s theory of the distribution of various types of capitals in social space and its impact on people’s interactions. In this aspect, Collins and Hanneman could have included another variable that measures the degree of the inequality of emotional energy distribution as they did with Cultural capital similarity.

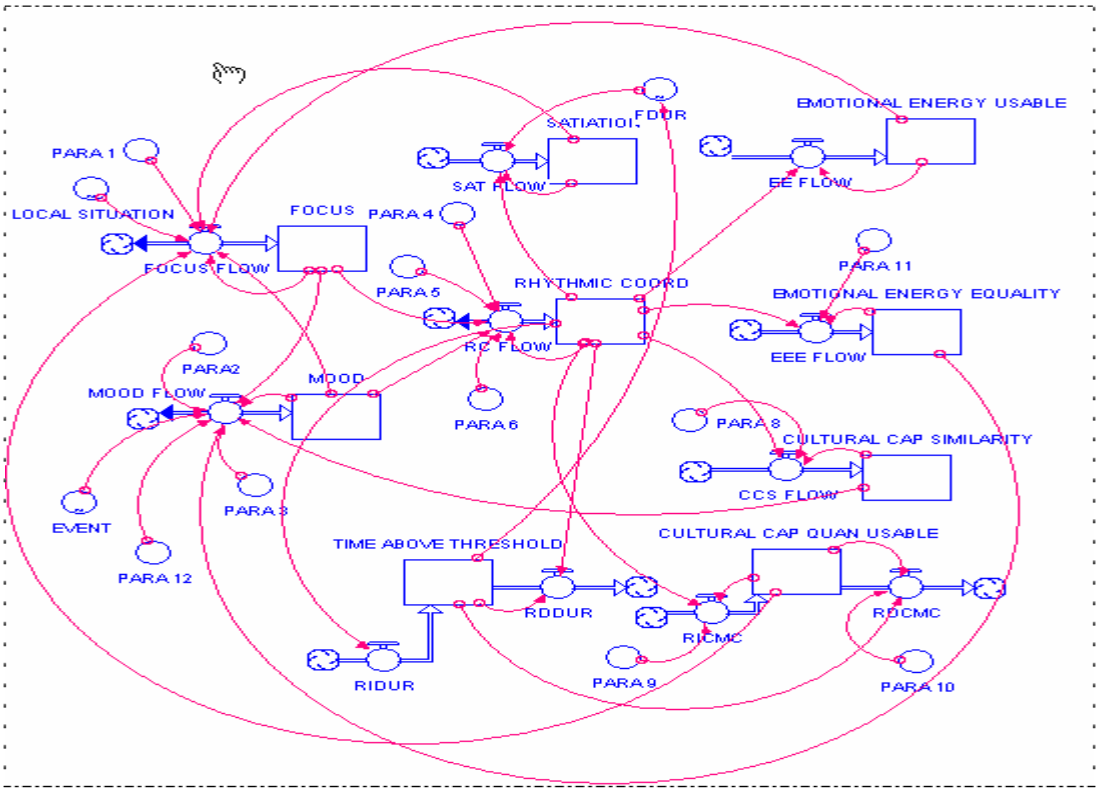
In sum, in order to incorporate the effect of status or power dimension in the model of interaction ritual process, I proposed to put two variables about “Cultural capital heterogeneity” and “Emotional energy inequality” in Causal Diagram 1. Cultural membership capital similarity was given in their original model, so I let it stay put there. But, I added “Emotional energy equality” that influences the level of common mood as “Cultural capital similarity” does. Secondly, following another point in Turner’s causal diagram, I think that it is more reasonable to add the path about the interaction between “Focus” and “Mood,” i.e. direct feedback based on reciprocal effect. Next, concerning the directions of paths, given the interaction between “Focus” and “Mood,” it can be assumed that both “Emotional energy usable” and “Cultural capital usable” affect only “Common focus,” while its equality and its similarity have impacts only on “Common mood.” Figure 4 is the summary of what I discussed thus far, and Figure 5 is again its translation by using Stella.

Figure 4. Modified model of interaction rituals (Causal Diagram 2)



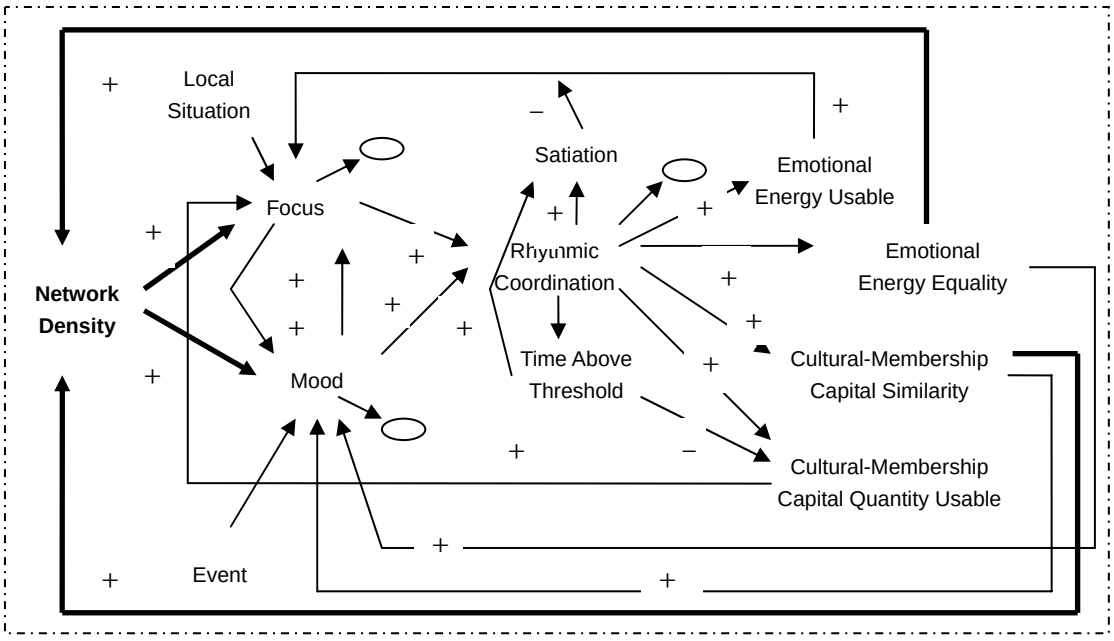
* Emotional energy equality and bold lines were added newly in the causal model 2.

Figure 5. Causal Diagram 2



Before moving on to the next section, I would like to suggest another model that is more complicated although I did not try to do simulation with this model. Given that the process of interaction rituals is affected by global parameters, it seems to be a good idea to include such variables at the system level that are able to conceptualize the effect of the cohesion (e.g. density), degree inequality (e.g. centralization), homophily (e.g. transitivity), and so on. As the model in Figure 5 implies, it could be hypothetically suggested that the density of network, that is, the number of actors who participate in the interaction, affects the level of common focus and common mood, and its size is, through the feedback, influenced by the outcomes of interaction rituals, especially the level of cultural capital similarity and emotional energy equality here.

Figure 6. Causal diagram including network density



* Network density and bold lines were inserted in a new model.

3. Mathematical expression[5]

A. Causal Model 1

1) Cultural capital quantity usable (Its initial value is set as 0.0)

The amount of cultural capital available to serve as a resource for producing common focus accumulates at the rate proportional (parameter 9; its magnitude is set as 0.05) to the level of rhythmic activity. It dissipates at the rate proportional (parameter 10; 0.10) to the duration of rhythmic activity, if the predicted decline is less than the amount available, else the amount available is taken. The amount of cultural capital that is common to group members ranges from zero to unity:

```
CULTURAL_CAP_QUAN_USABLE(t) = CULTURAL_CAP_QUAN_USABLE(t - dt) + (RICMC - RDCMC)
* dt
INFLOWS:
RICMC = MAX(IF(CULTURAL_CAP_QUAN_USABLE)>=1 THEN 0 ELSE
(PARA_9*RHYTHMIC_COORD),0);
OUTFLOWS:
RDCMC =IF(CULTURAL_CAP_QUAN_USABLE)>=(TIME_ABOVE_THRESHOLD*PARA_10) THEN
(TIME_ABOVE_THRESHOLD*PARA_10) ELSE CULTURAL_CAP_QUAN_USABLE
```

2) Cultural capital similarity (0.0)

The similarity of capital accumulates at the rate (parameter 8; 0.05) proportional to the level of rhythmic coordination occurring:

```
CULTURAL_CAP_SIMILARITY(t) = CULTURAL_CAP_SIMILARITY(t - dt) + (CCS_FLOW) * dt
INFLOWS:
CCS_FLOW = IF CULTURAL_CAP_SIMILARITY>=1.00 THEN 0 ELSE
(PARA_8*RHYTHMIC_COORD)
```

3) Emotional energy (0.0)

[5] Most of explanations about variables in this section are the same with what Collins and Hanneman posited in their article. There is almost nothing original in this part.

The emotional energy of the group ranges from zero to unity. Emotional energy accumulates at the rate proportional to the level of rhythmic coordination occurring:

```
EMOTIONAL_ENERGY(t) = EMOTIONAL_ENERGY(t - dt) + (EE_FLOW) * dt
INFLOWS:
EE_FLOW = IF EMOTIONAL_ENERGY>=1.00 THEN 0 ELSE RHYTHMIC_COORD
```

4) Common focus (0.26)

The degree of common focus of attention ranges from zero to unity. The parameter 1 set as 0.01 means that this variable dissipates at the constant rate proportional to the current level of common focus:

```
FOCUS(t) = FOCUS(t - dt) + (FOCUS_FLOW) * dt
INFLOWS:
FOCUS_FLOW = MAX(0, (IF FOCUS>=1.00 THEN 0 ELSE
(CULTURAL_CAP_QUAN_USABLE+LOCAL_SITUATION)*(EMOTIONAL_ENERGY-SATIATION)))-
(PARA_1*FOCUS)
```

5) Common mood (0.0)

The degree of common mood among group members has the same range. Similarly, the parameter 3 set as 0.10 here tells that this variable depletes at the constant rate proportional to the current level of common mood, while another parameter set as 0.50 controls the inflow of common mood:

```
MOOD(t) = MOOD(t - dt) + (MOOD_FLOW) * dt
INFLOWS:
MOOD_FLOW = MAX(0,(IF MOOD>=1.00 THEN 0 ELSE
(PARA2*CULTURAL_CAP_SIMILARITY)+EVENT))-(PARA_3*MOOD)
```

6) Rhythmic coordination (0.0)

The degree of rhythmic coordination among group members also has the same range. This variable is consumed at the rate (parameter 4; 0.05) proportionate to its current level, on the one

hand. On the other hand, its inflow is governed by the multiplicative interaction between common mood and common focus. Both of them can contribute to increased rhythmic coordination to the degree that common mood exceeds one threshold (parameter 5; 0.20) and common focus passes another threshold (parameter 6; 0.20):

```
RHYTHMIC_COORD(t) = RHYTHMIC_COORD(t - dt) + (RC_FLOW) * dt
INFLOWS:
RC_FLOW = IF RHYTHMIC_COORD>=1.00 THEN 0 ELSE ((IF MOOD-PARA_5>=0.0001 THEN
(MOOD-PARA_5) ELSE 0)*(IF FOCUS-PARA_6>=0.0001 THEN (FOCUS-PARA_6) ELSE 0)) -
(PARA_4*RHYTHMIC_COORD)
```

7) Satiation (0.0)

Satiation accumulates as a function of the current level of rhythmic coordination times a function of the length of time that rhythmic activity has been continuously occurring. The next syntax is about the table function for FDUR that is added newly on the top of both models (Figure 3 and 5). This table is expressed by the square root function of sustained time:

```
SATIATION(t) = SATIATION(t - dt) + (SAT_FLOW) * dt
INFLOWS:
SAT_FLOW = IF SATIATION>=1.00 THEN 0 ELSE (RHYTHMIC_COORD*FDUR)
FDUR = GRAPH(TIME_ABOVE_THRESHOLD)
(0.00, 0.00), (1.00, 1.00), (2.00, 1.41), (3.00, 1.73), (4.00, 2.00), (5.00, 2.24), (6.00, 2.45), (7.00, 2.65),
(8.00, 2.83), (9.00, 3.00), (10.0, 3.16), (11.0, 3.32), (12.0, 3.46), (13.0, 3.61), (14.0, 3.74), (15.0, 3.87),
(16.0, 4.00), (17.0, 4.12), (18.0, 4.24), (19.0, 4.36), (20.0, 4.47), (21.0, 4.58), (22.0, 4.69), (23.0, 4.80),
(24.0, 4.90), (25.0, 5.00), (26.0, 5.10), (27.0, 5.20), (28.0, 5.29), (29.0, 5.38), (30.0, 5.48), (31.0, 5.57),
(32.0, 5.66), (33.0, 5.75), (34.0, 5.83), (35.0, 5.92), (36.0, 6.00), (37.0, 6.08), (38.0, 6.16), (39.0, 6.25),
(40.0, 6.33), (41.0, 6.40), (42.0, 6.48), (43.0, 6.56), (44.0, 6.63), (45.0, 6.71), (46.0, 6.78), (47.0, 6.86),
(48.0, 6.93), (49.0, 7.00), (50.0, 7.07)
```

8) Time above threshold (0.0)

The magnitudes of two feedback effects depend on how long non-zero rhythmic activity has been occurring. This duration is calculated using integration of duration of one unit per unit time if rhythmic activity has been occurring, and emptying the level if there is no rhythmic activity:

TIME_ABOVE_THRESHOLD(t) = TIME_ABOVE_THRESHOLD(t - dt) + (RIDUR - RDDUR) * dt
INFLOWS:
RIDUR = IF(RHYTHMIC_COORD)>=.0001 THEN 1 ELSE 0
OUTFLOWS:
RDDUR = IF(RHYTHMIC_COORD)>=.0001 THEN 0 ELSE TIME_ABOVE_THRESHOLD

9) Event

Event is exogenous shock that simulates the creation of shared mood among group members. For experimentation, this shock is read by the use of a table function that describes the value of this variable for each of the first 50 time points.

EVENT = GRAPH(TIME)
(0.00, 0.00), (1.00, 0.00), (2.00, 0.00), (3.00, 0.00), (4.00, 0.5), (5.00, 0.5), (6.00, 0.5), (7.00, 0.5), (8.00, 0.5), (9.00, 0.00), (10.0, 0.00), (11.0, 0.00), (12.0, 0.00), (13.0, 0.00), (14.0, 0.00), (15.0, 0.00), (16.0, 0.00), (17.0, 0.00), (18.0, 0.00), (19.0, 0.00), (20.0, 0.00), (21.0, 0.00), (22.0, 0.00), (23.0, 0.00), (24.0, 0.00), (25.0, 0.00), (26.0, 0.00), (27.0, 0.00), (28.0, 0.00), (29.0, 0.00), (30.0, 0.00), (31.0, 0.00), (32.0, 0.00), (33.0, 0.00), (34.0, 0.00), (35.0, 0.00), (36.0, 0.00), (37.0, 0.00), (38.0, 0.00), (39.0, 0.00), (40.0, 0.00), (41.0, 0.00), (42.0, 0.00), (43.0, 0.00), (44.0, 0.00), (45.0, 0.00), (46.0, 0.00), (47.0, 0.00), (48.0, 0.00), (49.0, 0.00), (50.0, 0.00)

10) Local situation

This variable is also another exogenous variable that contributes to increasing the focus of group members on a common object. Similarly as above, researchers can give a series of shocks for each of the first 50 points of time.

LOCAL_SITUATION = GRAPH(TIME)
(0.00, 0.00), (1.00, 0.00), (2.00, 0.00), (3.00, 0.00), (4.00, 0.00), (5.00, 0.00), (6.00, 0.00), (7.00, 0.00), (8.00, 0.00), (9.00, 0.00), (10.0, 0.00), (11.0, 0.00), (12.0, 0.00), (13.0, 0.00), (14.0, 0.00), (15.0, 0.00), (16.0, 0.00), (17.0, 0.00), (18.0, 0.00), (19.0, 0.00), (20.0, 0.00), (21.0, 0.00), (22.0, 0.00), (23.0, 0.00), (24.0, 0.00), (25.0, 0.00), (26.0, 0.00), (27.0, 0.00), (28.0, 0.00), (29.0, 0.00), (30.0, 0.00), (31.0, 0.00), (32.0, 0.00), (33.0, 0.00), (34.0, 0.00), (35.0, 0.00), (36.0, 0.00), (37.0, 0.00), (38.0, 0.00), (39.0, 0.00), (40.0, 0.00), (41.0, 0.00), (42.0, 0.00), (43.0, 0.00), (44.0, 0.00), (45.0, 0.00), (46.0, 0.00), (47.0, 0.00), (48.0, 0.00), (49.0, 0.00), (50.0, 0.00)

B. Causal Model 2

Except the following three, the equations for the rest of variables are basically the same as those in the previous Causal Model 1.

1) Common focus (0.25)

The level of common focus has the same range, and the parameter 1 set as 0.01. However, given that the reciprocal effect by common mood, it could be expressed by addition(+), not multiplication(*), as the following equation shows:

```
FOCUS(t) = FOCUS(t - dt) + (FOCUS_FLOW) * dt
INFLOWS:
FOCUS_FLOW = MAX(0, (IF FOCUS>=1.00 THEN 0 ELSE
(MOOD+(LOCAL_SITUATION+CULTURAL_CAP_QUAN_USABLE)*(EMOTIONAL_ENERGY_USABL
E-SATIATION))))-(PARA_1*FOCUS)
```

2) Common mood (0.0)

The degree of common mood is based on the same range. Also, the parameter 3 is set as 0.10, and the parameter 3 set as 0.50 points to its controlling the inflow of common mood. However, the two effects are considered newly, one from common focus and the other from emotional energy equality which is constrained by another parameter 12. The former can be expressed by additional relation(+), while the latter by multiplication(*) in relation to cultural capital similarity:

```
MOOD(t) = MOOD(t - dt) + (MOOD_FLOW) * dt
INFLOWS:
MOOD_FLOW = MAX(0,(IF MOOD>=1.00 THEN 0 ELSE
(FOCUS+(EVENT+(PARA2*CULTURAL_CAP_SIMILARITY))*(PARA_12*EMOTIONAL_ENERGY_EQ
UALITY))))-(PARA_3*MOOD)
```

3) Emotional energy equality (0.0)

Like Cultural capital similarity, the equality of emotional energy accumulates at the rate (parameter 11; 0.05) proportional to the level of rhythmic coordination occurring:

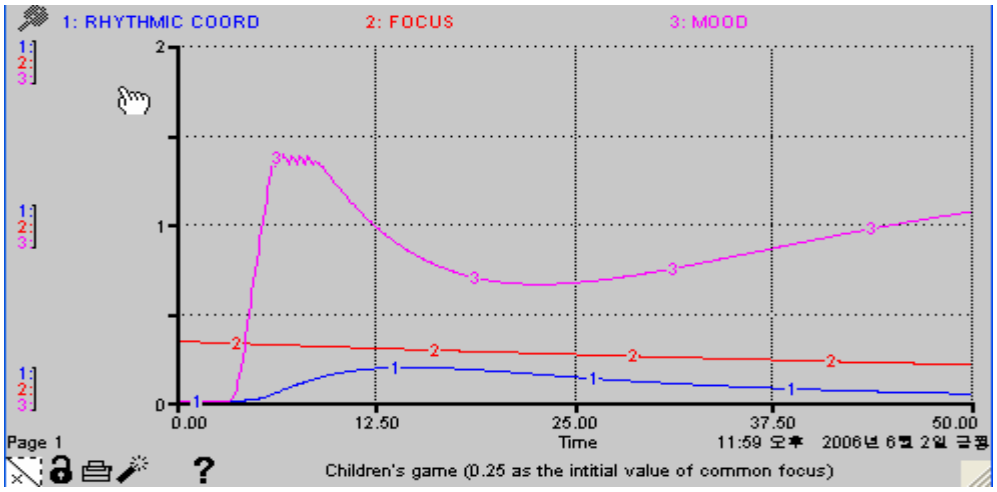
```
EMOTIONAL_ENERGY_EQUALITY(t) = EMOTIONAL_ENERGY_EQUALITY(t - dt) + (EEE_FLOW) * dt
INFLOWS:
EEE_FLOW = IF EMOTIONAL_ENERGY_EQUALITY>=1.00 THEN 0 ELSE
(PARA_11*RHYTHMIC_COORD)
```

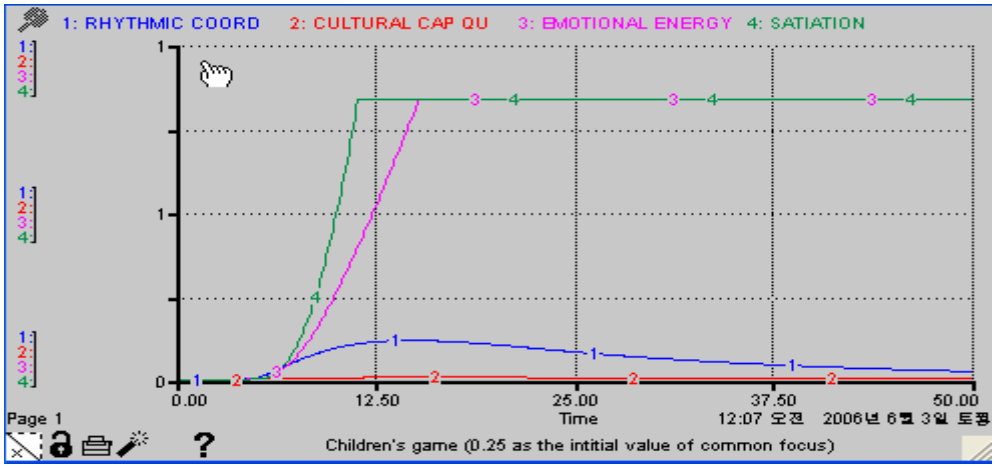
4. Results and Discussion

Collins and Hanneman did simulation experiments in two different contexts. One is what is called external event scenario (e.g. children's game), and the other is the scenario with moderate similarity (e.g. cocktail party). For the same scenario with an external event like children's game, I compared the results (Figure 7.4 in Collins and Hanneman, 1988: 228) with the outputs from the casual model 1, and then with the outputs from the causal model 2. In both of causal models, following their setting of initial values, I gave 0s for "Cultural capital quantity usable," "Cultural capital similarity," "Emotional energy," "Rhythmic coordination," "Common Mood," and "Satiation." Needless to say, in the causal modeling 2, I used 0 as the initial value of a new variable, Emotional Energy Equality. As they did, in both models, I gave "Common Focus" 0.25 as its initial value, while I made an event that begins at the 5th time point and continues for the next five time points so that it could increase the level of common mood.

A. Casual Model 1

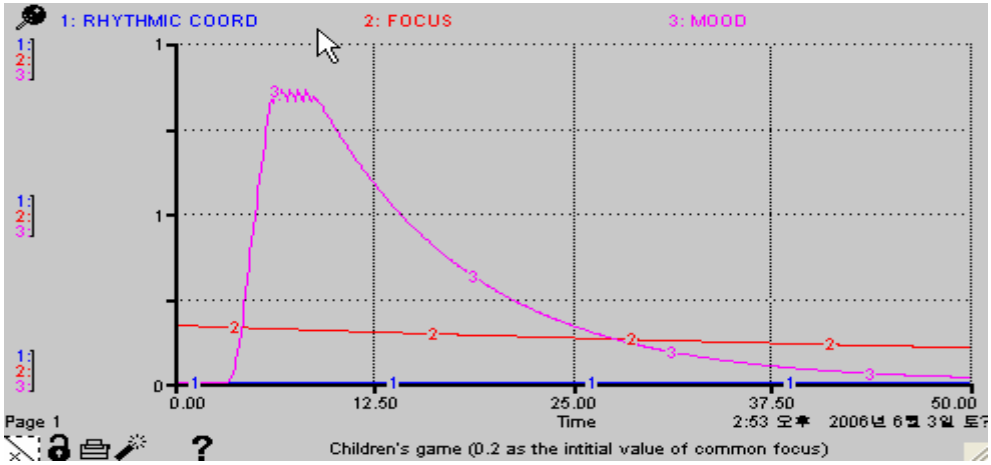
Figure 7. External event scenario: Children's game





Overall, there does not seem to be much difference between the results Collins and Hanneman got and the results the causal model 1 yielded. For example, common mood, emotional energy, and satiation reach at their equilibriums around almost the same time points in both results. The change in the slope of rhythmic coordination and common focus is very similar as well. Another, as they wrote down in the footnoot 4, cultural capital quantity in the new model also reaches its maximum around the similar time point and decreases slowly. Therefore, although they were not clear about some problems, whatever they are mistakes or misprints, the model they finally used for simulation seems to be almost the same with the causal model 1 I proposed.

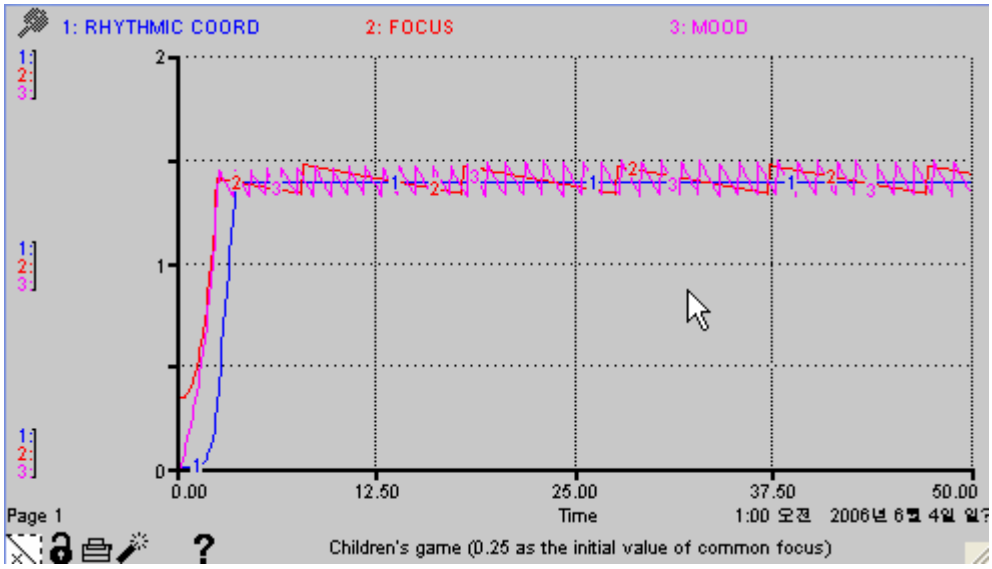
Figure8. The same children's game, but initial value set as 0.2 for common focus



There are two points they did not emphasize, however. The first point is about the effect of the size of initial values of Common focus on the rate at which a new equilibrium of Common mood is achieved. As Figure 8 shows, even a little bit smaller initial value of Common focus (e.g. 0.2) than 0.25 cannot induce Common mood to reach a new equilibrium. Instead, it simply decreases with time. Not surprisingly, Rhythmic coordination is not activated in this condition. Besides, the bigger the initial value of Common focus, albeit not presented here, the shorter of the time it takes to reach a new equilibrium, and the slower the level of Rhythmic coordination decreases. Another point is about effect of diminishing returns of satiation I argued on the outcomes. Although I did not show the result, it was revealed that the rate at which Satiation reaches at a new equilibrium becomes faster if a square root function was used than when a simple linear function was employed.

B. Causal Model 2

Figure 9. External event scenario: Children's game



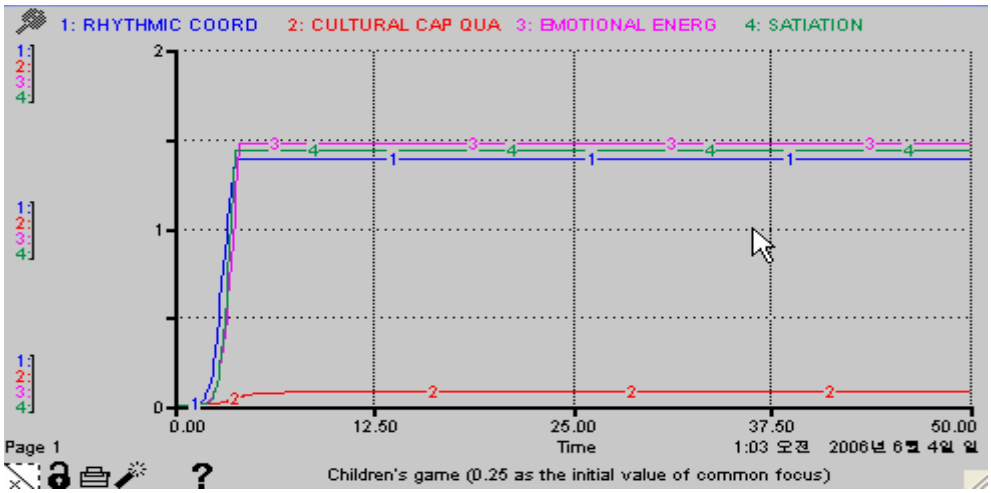
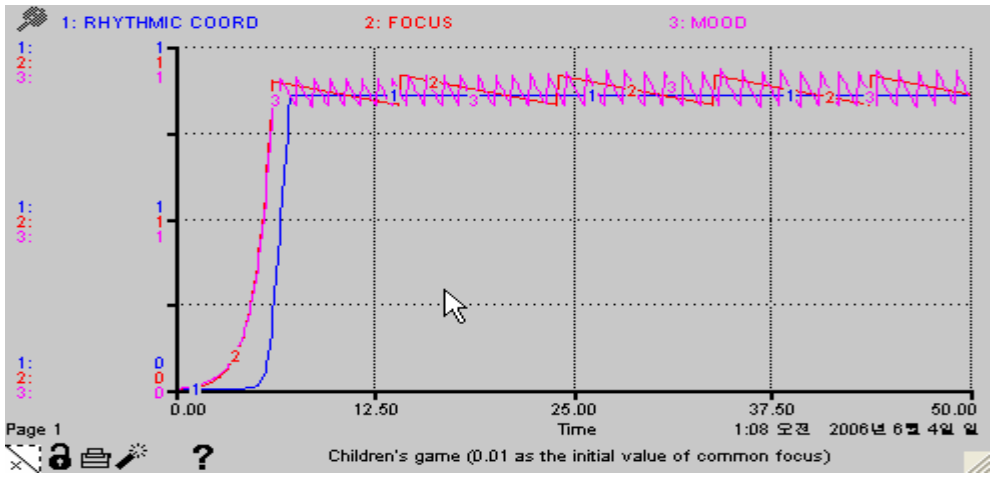


Figure 10. The same children's game, but initial value set as 0.01 for common focus



The first result in Figure 9 basically tells that common focus, common mood, and rhythmic coordination reach at their equilibriums in shorter time compared to the result the causal model 1 brought about. This result is also the case with emotional energy and satiation. Another interesting finding is that common focus has continued at the same level during the rest of time since the equilibrium, unlikely the previous model. This holds for the level of rhythmic coordination as well. Especially, it was uncovered that the synergy effect between common focus and common mood via their reciprocal relationship helps interaction rituals take place

with even a tiny initial value, for example 0.01. (See Figure 10) All of these contrasting results come from the direct feedback based on the reciprocal effect I inserted newly.

Figure 11. The change of cultural capital similarity and emotional energy equality.

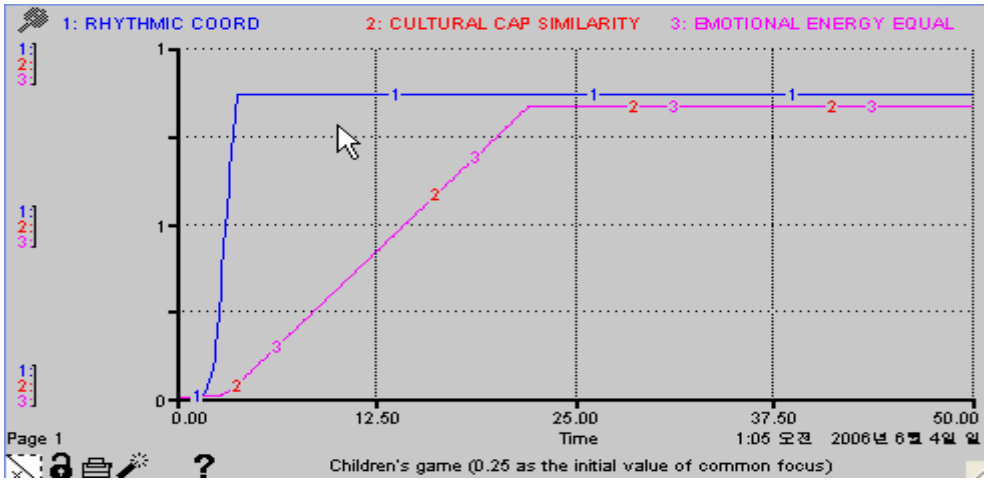
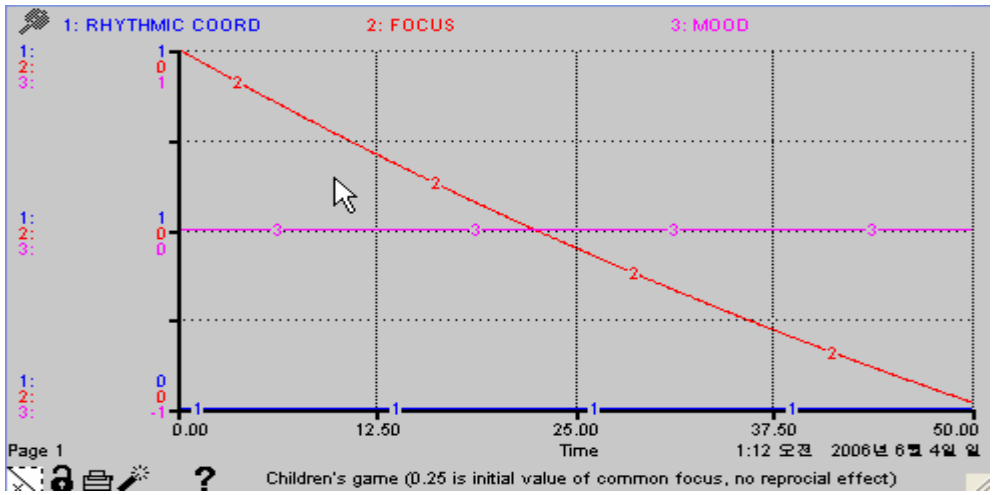


Figure 12. What if no reciprocal relationship between common focus and common mood?



Concerning emotional energy equality included newly, its behavior is the same with cultural capital similarity. This result in Figure 11 is not that surprising. However, the mere inclusion of emotional energy equality that influences the level of common mood in the causal model 1, as long as there is no reciprocal effect, gave very significant changes in the process of interaction

rituals. As Figure 12 shows, common mood could not be activated in the situation where both cultural capital similarity and emotional energy equality at the same time constrain its level. Finally, in contrast to the simple decrease in common focus, the level of rhythmic coordination is still staying at 0 with time.

5. Causality, totality, and simulation of dynamics

Why sociologists should care about computer simulation? There might be a lot of good answers to this question (See Collins, 1988; Hanneman; 1988), but let me think about its potentials and limitations in this section, especially with regards to the problem of the micro-macro link and the investigation of causal processes.

I agree with Turner in a sense, but with Collins in another sense, although their final destinations are quite different and furthermore might be incompatible with each other: First, Turner emphasizes, “Understanding of any one level will not be adequate to a grand theory; a grand theory must somehow connect them together conceptually, seeing the dynamics of one level as embedded in and affecting the dynamics of the other two levels.” (Turner, 2001: 358-9) As Collins sees it, although his works actually have focused more on the micro-foundations of social phenomena at the meso or macro level, “the issue, ultimately, is not whether what is smaller is more fundamental, but what level of time and space contains the substantive mechanisms which drive the others.” (Collins, 1988: 389)

In this way, the micro-macro link, or methodological holism versus methodological individualism is all about what is called “totality,” but the concept of causality is another important issue for theory construction both of them have rarely discussed. As Blalock rightly pointed out, there has been considerable confusion of terminology and almost a conspiracy of

silence in dealing with the problems of causality in social sciences (Blalock, 1964: 38). In this regard, what they do not say much about is how totality is intertwined with causality.

I do not want to bring up some old debates about the concept of causality and positivistic interpretation of it, but I would like to make clear what I questioned at the first two classes this quarter. Let me begin with Elster(1986, 1989), although he is not one of sociologists that advocate middle-range theory explicitly, since he surely has some important points regarding what it does mean by scientific explanation of causal processes. First, his preference for methodological individualism should be understood in the context of what level is the most appropriate for causal explanation. He emphasizes why social scientists need to reduce the time-span between explanans and explanandum as much as possible. “The latter (spurious explanations) arise in two main ways: by the confusion of explanation and correlation, and by the confusion of explanation and necessitation… Both of these risks are reduced when we approach the ideal of a continuous chain of cause and effect, that is when we reduce the time-lag between explanans and explanandum.” (Elster, 1986: 5) For this reason, he are very cautious about the pitfalls of explanations which still remain at the system level such as functionalism or teleology more frequently found in some particular traditions of sociological theorizing.

There is another virtue of methodological individualism or middle-range theory, although I do not fully agree with either of them, which methodological holism or ‘macro-chauvinism’ in Turner’s usage cannot have. My impression is that either methodological holism or macro-chauvinism has the tendency to attribute causal power or forces to social structures (e.g. the contradiction between the force of production and the relations of production) separately from actors’ practices (e.g. class struggles or corporate behaviors). This sort of critique could hold for propositions composed of variables about causal forces such as the size of population, the level of production, the level of distribution and so forth. In other words, it

seems to me that there are no agencies or actions in Turner's propositions about macro-dynamics, unlikely propositions about meso-dynamics and micro-dynamics.

Furthermore, Elster goes on to contend that causal explanations must be distinguished from assertions about correlation as well as statements about necessitation. To explain an event is to give an account of why it happened as it happened. He, objecting to Hempel's argument that explanation amounts to logical deduction to the event to be explained with general laws and statements of initial conditions as the premises, underscores the distinction between laws and mechanisms because general laws might reflect correlation not causation, and they, even if genuinely causal, might be preempted by other mechanisms. "What they (social sciences) are more rarely able to do is to state necessary and sufficient conditions under which various mechanisms are switched on. This is another reason for emphasizing mechanisms rather than laws. Laws by their nature are general and do not suffer exceptions. One cannot have a law to the effect that 'if p, then sometimes q.' Mechanisms, by contrast, make no claim to generality." (Ibid: 9-10) In this aspect, I understand the importance of his ambitious projects and his points about the harmful effects of middle-range theory, but there might be some problems with his pursuit of an overarching grand theory in the sense that his main goal is to establish universal laws that can apply to all social phenomena: "We need laws of such forces; and with these laws, we can explain virtually any substantive social phenomenon at any place and time. Thus, the goal of grand theory is to 1) denote the key forces that are always operative when humans behave, interact, and organize; 2) uncover the dynamics of these forces; and 3) explain their relationship to each other." (Turner and Boyns, 2001: 359)

However, I do not agree with Elster in another sense that he is skeptical about causal inferences based on statistics: "When opposing explanation by mechanisms to explanation by laws, I have assumed that the latter is invariably deterministic. Much social science, however,

relies on statistical explanation, a procedure notoriously plagued by many conceptual difficulties. One cannot use statistical explanation to account for individual cases, although it is often used in that way. Also, in this mode of analysis, it is particularly difficult to distinguish causation from correlation. I believe the mechanism approach provides yet another reason why statistical explanations tend to be weak and unreliable." (Elster, 1998: 69) He would be right only if he meant that mathematics is an acausal language as some sociologists have emphasized[6]. To my knowledge, most of questions about causality boil down to the problem of controlling for all other variables that might be sources of extraneous forces. The problem is: "Isolation is an unobtainable ideal. Isolation exists when y and x are in a 'vacuum' that excludes all other influences… Various experimental, quasi-experimental, and observational research designs attempt to approximate isolation through some form of control or randomization process. Regardless of the technique, the assumption of isolation remains a weak link in inferring cause and effect." (Bollen, 1989: 41) For these reasons, most of scholars including even positivists would willingly acknowledge that there are still tough problems with investigating causal mechanisms by employing statistics.

However, if one can never prove causation with any methods and the only thing one can do is see if the causal inferences of a researcher are consistent with the data, what can social scientists do, who still believe that accepting postmodern critiques of any version of scientific

[6] For instances, Blalock, accepting Bunge's arguments about causality, points out, "this notion of a cause as a producing agent makes it difficult to translate the concept into abstract logical or mathematical languages. Producing refers to an ontological process, i.e., to what exists in the real world. It is something over and above what can be expressed in formal languages. Likewise, it has a reality apart from the observer and his perceptions." (Blalock, 1964: 9) Similarly, Sayer(1992: 179) as one of the famous critical realists contends, "y=f(x) say nothing about what makes y or x, only that quantitative variation in y is formally (not substantially) related in some way to quantitative variation in x." Put together, it is harder than expected to represent structural relations and forces in them with mathematics, no matter how sophisticatedly the concept of causality in positivism has been transformed from the deterministic view of causality predicated on Hume or Mill's arguments (i.e., y=ax: this means that x as cause is necessary and sufficient condition for y as effect) to probabilistic view of causality (i.e., y=ax+e: e is disturbance).

knowledge is going too far? Some scholars (e.g. critical realists) overemphasize the importance of constructing causal mechanisms with "qualitative" methods, but I do think that they are necessary but not sufficient, especially when social scientists have to infer causal mechanisms that can be generalized in many other cases. (e.g. many cases with few variables as opposed to few cases with many variables in Ragin's term)

There might be some other methods to investigate casual processes, but computer simulation, unlikely structural equation modeling to which longitudinal designs are difficult to apply for some reasons (e.g. cost, subject attrition), has been regarded as one of the promising methods of theory building over the past decades. Following Collins(1988) and Hanneman(1988), let me summarize implications of simulation methods for theory construction of causal mechanisms again: 1) In contrast to semi-mathematical languages used in simulations, theoretical statements in everyday languages tend to fail to precisely specify the relations among concepts, and it is hard to conceptualize both the material and cultural aspects of social action with mathematical languages, besides the fact that most social scientists are not familiar with them; 2) Computer-simulated theory shows a two-level reality: the set of general processes lying beyond empirical realities, and the specific historical instances which are generated by them; 3) Computer simulation is very powerful to conceptualize social dynamics including time as well as causes and effects (e.g. "an increase in centralization produces an increase in formalization" rather than "the greater the centralization, the greater the formalization."); 4) The very fact that simulation methods do deal with artificial data, not real data, make it possible for researchers by changing the data (e.g. parameters) to investigate, I think, what Cohen(1989) called scope conditions and initial conditions that are statements defining a set of circumstances in which a universal knowledge claim is applicable.

Nonetheless, there are still some problems with the usage of simulation in sociology. As Collins addresses, computer simulations are not empirical studies. They do not reveal anything about the world, but only about the implications of theories although this drawback, I think, can be regarded as its advantage in another sense that we rarely have different sets of data that are enough to test a theory. Additionally, just as all structural equation models might have equivalent versions that produce the same predicted correlations and co-variances, so theoretical grounds for the validity of simulation are still weak. Arguably but most importantly, simulation methods and its software programs have been developed in two ways, agent-based modeling and system modeling, but it seems like at the incipient stage to develop what could be called multi-level simulation methods (like multi-level structural equation modeling) that are critical to test theories (e.g. embedded encounters) in which there are one set of variables at the macro level and the other set of variables at the micro level. Accepting that interaction rituals do not take place in a vacuum without ongoing social relations and they cannot be initiated, propagated, and terminated in a random way, it could be supposed that they are affected by network embeddedness in terms of "dynamics on networks" on the one hand and they do not result in random networks in terms of "network dynamics" on the other hand. To put it another way, for example, the effect of a particular property at the system level, say the number of participating actors, on the interaction between two actors, A and B, might depend on how differently they are embedded in their own neighborhood at the local level. This is more reasonable given that actors cannot perceive parameters at the global level for some reasons (e.g. bounded rationality, the lack of information, the limited capacity of cognition…). Also, global parameters as emergent properties reproduced at the system level are the aggregated outcomes of different interactions (e.g. homophily-based interaction, preferential interaction) at the micro level. In this

aspect, developing multi-level simulation is a cutting-edge issue for the purpose of modeling social processes in more realistic way.

<References>

Turner, Jonathan H. 1995. *Macrodynamics: Toward a Theory on the organization of Human Populations*. Rutgers University Press.

Turner, Jonathan H. 1998. *The Structure of Sociological Theory*. 6th Edition. Wadsworth Publishing Company.

Turner, Jonathan H. 2000. "Theory of Embedded Encounters." *Advances in Group Processes*. Vol.17.

Turner, Jonathan H and David E. Boyns. 2001. "Return of Grand Theory." in Jonathan H. Turner ed. *Handbook of Sociological Theory*. Kluwer Academic/ Plenum Publishers.

Turner, Jonathan H. 2002. *Face to Face: Toward a Sociological Theory of Interpersonal Behavior*. Stanford University Press.

Rossel, Jorg and Collins, Randall. 2001. "Conflict Theory and Interaction Rituals: The Microfoundations of Conflict Theory." in Jonathan H. Turner ed. *Handbook of Sociological Theory*. Kluwer Academic/ Plenum Publishers.

Collins, Randall. 1998. *Theoretical Sociology*. Harcourt, Brace, Jovanovich.

Collins, Randall and Hanneman, Robert A. 1998. "Modeling Interaction Ritual Theory of Solidarity." in Patrick Doreian and Thomas J. Fararo. eds. *The Problem of Solidarity: Theories and Models*. Gordon and Breach.

Hanneman, Robert A. 1988. *Computer-assisted Theory Building: Modeling Dynamic Social Systems*. Sage Publications.

Hannon, Bruce and Ruth, Matthias. 1994. *Dynamic Modeling*. 1st edition. Springer-Verlag.

Blalock, Hubert M. 1964. *Causal Inferences in Non-experimental Research*. University of North Carolina Press.

Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables*. Wiley.

Elster, Jon. 1989. *Nuts and Bolts for the Social Sciences*. Cambridge Univ. Press.

Elster, Jon. 1998. "A Plea for Mechanisms". in *Social Mechanisms: An Analytical Approach to Social Theory,* edited by Peter Hedström and Richard Swedberg. Cambridge Univ. Press.

Sayer, Andrew. 1992. *Method in Social Sciences*. Routledge.

Cohen, Bernard P. 1989. *Developing Sociological Knowledge*. Nelson Hall.

Ragin, Charles C. 1994. *Constructing Social Research: the Unity and Diversity of Method*. Pine Forge Press.