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## MODELLING 'TRIPLE CONTINGENCY'

*Loet Leydesdorff*

In Chapter 3 of *Soziale Systeme*, Luhmann(1984) discussed 'double contingency' as central to the emergence of social systems. Borrowing the concept from Parsons, he provides it with a completely new solution. In my opinion, the simulations in terms of expectations accord with this solution. Paul Hartzog sent me a short piece in which he explains Luhmann's solution in English (Hartzog 1997). It made me aware that Luhmann moves fast in this chapter from 'double contingency' towards the emergence of social systems without a specification of the mechanism. Luhmann warns against Von Foerster's too fast movement (f/n 12: 157). According to Luhmann, the social system would 'emerge' from double contingency (in the singular!).

In a previous communication (cf. Leydesdorff 2008), I specified the interaction mechanism between two anticipatory systems contained in a double contingency as follows:

$$x(t) = a(1 - x(t + 1))(1 - x(t + 1))$$

The next state of the system is determined by the selective operation of expectations upon each other in a dyadic interaction. The simulations are robust and show that the system can move erratically from the one side to the other side. If one wishes, one can play with the parameters in the Microsoft Excel sheet and follow the consequences at <http://www.leydesdorff.net/temp/doublcont.xls>.

I guess that a double contingency can go on forever when no third party comes into play. Piet Strydom(1999) used the term 'triple contingency' for explaining the emergence of a modern communication society in the 16th and 17th century. The third

party becomes abstracted as a public. In principle, one could model a triple contingency analogously, using:

$$x(t) = a(1 - x(t+1))(1 - x(t+1)) (1 - x(t+1))$$

This leads to a cubic equation of  $x(t+1)$  as a function of  $x(t)$ . Cubic equations have analytical solutions (There is a freeware add-in in Microsoft Excel for solving them). The solutions may imply  $i = \sqrt{-1}$ , and thus be in the complex domain.

For all values of the bifurcation parameter  $a$  the system is highly unstable and quickly degenerates into a complex one. One interpretation would be that triple interactions provide a short-term window for organization (decision-making) to step into the system. The relation between interaction and organization would then be conditional for the emergence of the social system.

A formulation for organization could be:

$$x(t) = a(1 - x(t))(1 - x(t+1))(1 - x(t+1))$$

$$\frac{x(t)}{(1 - x(t))} = a(1 - x(t+1))(1 - x(t+1))$$

By replacing  $\frac{x(t)}{(1-x(t))}$  with  $y$ , the solution is similar to the one for double contingency, but *mutatis mutandis*:

$$x(t+1) = 1 \pm \sqrt{\frac{x(t)}{a(1-x(t))}}$$

This formula is in the simulation as stable as double contingency for values of  $a \geq 8$ , but I don't yet have an analytic solution for this. For lower values of  $a$ , the system vanishes. Using an internal degree of freedom, the system might be able to change its value of  $a$  endogenously and thus alternate between double contingency and its disappearance.

In summary, in the case of a triple contingency, the system can show the behaviour of a window for organization to step in by using three incursive terms (based on expectations), or bring a double contingency to an end by bringing a historical contingency (modelled as a recursive term) into play. Using the internal degree of freedom for changing the value of  $a$ , the social system would also be able to generate double contingencies (interactions) endogenously.

From entropy statistics, we know that a system with three dynamics can generate a negative entropy in the mutual information

among the three (sub)dynamics. (I use this as an indicator of self-organization in other studies). However, there is still a missing link between the above reasoning and the emergence of a social system as a possibility because the complex system is not yet generated. I suppose that I have to bring the social distribution into play and not write  $x(t)$ , but  $\sum_i x_i(t)$ .

This piece originated as a contribution to the online 'Diskussionsforum zur soziologischen Systemtheorie Niklas Luhmanns' in early April 2007. The title has been added here. The elaborated version, 'The Communication of Meaning in Anticipatory Systems: A Simulation Study of the Dynamics of Intentionality in Social Interactions', Vice-Presidential Address at the 8th International Conference of *Computing Anticipatory Systems (CASYS07)*, Liège, Belgium, 6-11 August 2007, to be published in the *Proceedings of the American Institute of Physics (2008)*, is available as a preprint version at <http://www.leydesdorff.net/casys07>

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