

Organisational Plasticity: A Community Modelling Experience

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Abstract. This article is concerned with an attempt to provide a conceptual definition of *organisational plasticity* together with the means to operationalise it. Broadly speaking, this is the ability to implement or to divest change through a fluid adaptation that connects together the micro (behavioural) and macro (strategic) aspects of organisational life. To achieve these goals, the article presents an experiment in community modelling using the innovative PhiloLab technique. Through open discussions on how to create an agent-based simulation model, we could identify some of the characteristics of *organisational plasticity* and start structuring some of the parameters for the computational simulation.

Keywords: plasticity, disorganisation, PhiloLab, community modelling, agent-based modelling

1 What is plasticity and why it matters

Claims that the external environment of organisations is turbulent, unpredictable, unstable or, in one word, complex have been made since the sixties and repeated ever since [4, 19, 6]. Supporting theories and approaches usually have a macro or strategic take on how organisations adapt in the face of environmental turbulence [17]. Within this domain, a relatively overlooked area of enquiry pertains to the study of how internal organisational processes react, modify, adapt, and evolve as a result of pressures to sudden, unexpected, or continuous change. In other words, adaptation to an external stimulus may bring consequences for organisational internal processes, procedures, working relations, behaviours, structures, and norms, for example. What are the characteristics of these internal aspects that allow organisations to be malleable enough and adapt to a turbulent environment? How are the macro aspects of strategic adaptability affected by and how do they affect the micro elements within organisations? These questions are at the core of this paper.

To better specify the nature of our enquiry, two assumptions are to be considered. The first assumption is that there is a connection between micro and macro levels. In fact, we interpret this relation between levels—macro, micro, and various intermediate levels [27]—in a way such that one shapes and/or affects the other. This does not mean that we are making any claim about the direction

of causality, whether it is top-down or bottom-up. Instead, the organisation is intended as a system [24] where its parts are interconnected in a way such that a *trigger* of change may appear at any level. Whether this trigger transforms into an *enabler* (a change-provoking event) depends on the conditions in which the system (i.e. the organisation) finds itself. The extent to which these conditions are in place is referred to as *organisational plasticity*. And the definition, understanding, and impact of these conditions are the focus of this study.

Organisational change and adaptation require that some aspects of the working environment modify, are dropped, or created anew [6, 30]. A *plastic* organisation is capable of stretching or reducing aspects of its operations with ease, so to adapt both in a timely fashion and repeatedly over time. In addition to that, the depth of change that a plastic organisation can handle may be either large or small. An example could be a business start-up, where urgency and necessity make effectiveness—e.g., “getting the job done”—preferred to efficiency—e.g., optimise operations. Also, in a business start-up most processes, operations, and even roles and responsibilities are unstable. Under these circumstances, learning and adaptation are a key component of what “makes or breaks” the enterprise [21]. The systemic nature of fluid interactions between the position of an organisation in the market or society, and the various aspects of individuals who cope with complexity is the key to define *organisational plasticity*. Due to the nature of the problem and to the lack of techniques apt to the task, these connections have been vastly overlooked in the literature, to the point that we do not have a theoretical nor an operational definition of this ability organisations may show to practice fluid adaptability within and outside of their boundaries. In other words, the conditions and components of *organisational plasticity* are yet to be isolated, understood, and defined.

The second assumption is that *organisational plasticity* requires a loosely structured and less formal way of organising [11, 16]. The literature on the connection between disorganisation and adaptability [16, 15] as well as on disorganisation in general [1, 2] is particularly slim. However, it is intuitive enough to state that an organisation with fewer (or more relaxed) formal norms, flat hierarchy, and distributed responsibilities may be more able to confront and manage sequences of change-provoking events. To this, one may add also size and geographical location, together with time in which some events occur, for example, to indicate the fact that we are dealing with a complex system [9].

These two assumptions—namely, the connection between micro and macro aspects of adaptation, and the relationship between plasticity and disorganisation—constitute the backbone of our approach to this topic.

From this brief introduction, we are left with two major points of enquiry. On the one hand, there is still a need to define *organisational plasticity*; on the other hand, its impact and effects are yet to be explored. Due to the nature of this research, we decided to define plasticity’s characteristics by means of an experiment in community modelling, that would then feed an agent-based computational simulation [9, 8]. In the following, we briefly describe the methodology, then highlight some of the findings, and end with a few concluding remarks.

2 A community modelling experiment with PhiloLab

2.1 Methodological basis

The idea for this experiment stems from an ESSA@work workshop where PhiloLab was proposed [28]. PhiloLab is a concept based on the Engineering Agent-Based Social Simulation (EABSS) framework and its purpose is to stimulate and formally support discussions about philosophical questions of future societal models. In the PhiloLab experiment we wanted to see how the idea presented in ESSA@work could be executed to help better understand what organisational plasticity is, how it is embedded in organisational processes, and how we can model it. Here we feed back our experience on using the PhiloLab concept as an idea generator for novel research on organisational plasticity.

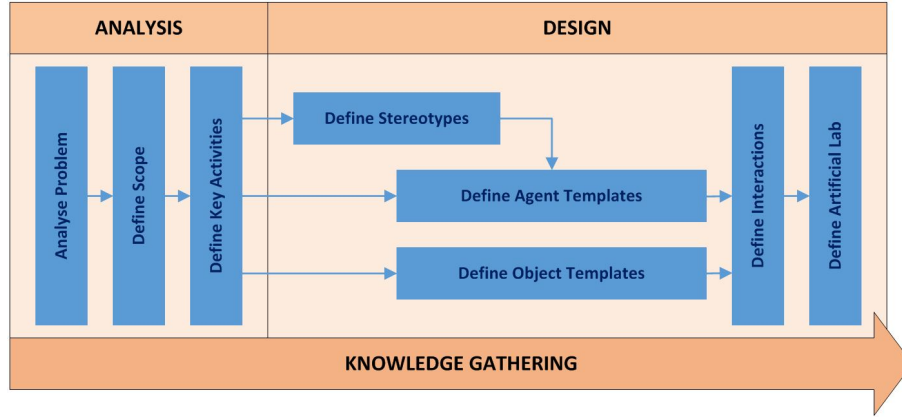
The EABSS framework PhiloLab is based on an agent-based modelling framework, designed to support the model development and documentation of human centric and human-natural systems. Full details can be found in Siebers and Klügl [29]. It is grounded on the concept of co-creation [20] and ideas from software engineering. It uses focus group discussions, predefined table templates, and UML [13] (a graphical notation used in software engineering to conduct system analysis and design) as main forms of stimulating and documenting contributions during problem analysis and model development. The EABSS framework, depicted in Figure 1 consists of three components: “Analysis”, “Design”, and “Knowledge Gathering”. The Analysis component is split into three main steps: problem analysis (consisting of defining the purpose of the model, objectives + hypotheses, experimental factors and responses), model scope definition, and the definition of key activities to be considered. The Design component consists of four main steps: defining stereotypes (attributes and habits of agents), defining agent and object templates (to capture states, behaviours, and decision making processes), defining the interactions amongst agents and between agents and objects, and defining an artificial lab (i.e. the infrastructure for conducting the experiments). Knowledge gathering happens throughout the model development, potentially prior or after a specific step (from the literature or through qualitative data collection) but definitely during a specific step through focus group brainstorming.

The EABSS framework is designed with the aim to look at a system in more detail with every further step. There is always information from previous steps that can be used to get started with the next step. This principle serves validation, as getting stuck in the current step is a good indicator that something in previous steps is not quite right and needs to be amended.

2.2 The experiment

The PhiloLab experiment was a live experiment carried out during the Agent-Based Models of Organisational Behaviour 3 (ABMO3) Workshop in January 2018¹, involving all 14 participants of the workshop, with the goal of building

¹ Details on the workshop are available here:
<https://sites.google.com/view/abmworkshops>

Fig. 1. The EABSS framework

multidisciplinary agent-based models together. At the workshop we ran two focus groups. We provided the same aim to both groups: “To investigate what differentiates a plastic organisation setup from a conventional organisation setup”. The purpose of the exercise was to start getting a multidisciplinary group of people to talk about the topic and to come up with some interesting research ideas. We had some time constraints. Overall we had four hours spread over two consecutive days. There was an initial presentation to explain the idea behind PhiloLab (30 min), two focus group sessions (90 min each), and a final session to present preliminary results (30 min). From previous experience we knew that it requires about eight hours to comfortably go through the complete process described in the EABSS framework, so with the given time constraints we did not expect to make it through all the steps defined in the framework. After the first focus group session both groups ended up with an initial scope table and after the second focus group session both groups ended up with an initial design of agent and object templates. It was interesting to see that both groups ended up at the same step, although no pressure was put on the focus group moderators to reach a specific step.

In order to interpret results, we collected the notes from facilitators and audio recorded all the sessions. The final 30 minutes discussion was also a way to assess whether the summary was consistent with group members’ recollections of the work in the focus groups.

From the engagement and atmosphere during the sessions one could see that people were enjoying the exercise and the overall feedback from the participants after each of the two main sessions was consistently positive. After a short learning period (participants needed some time to understand the fact that the initial focus is on information gathering rather than on debates), all participants contributed equally, and no fights over decisions occurred. From time to time the moderators had to gently move participants to the next step, or remind them on the goals agreed in the problem analysis step, to make sure the resulting

modelling activities were in line with the modelling aim, but this all went quite smoothly.

After the exercise we ended up with two completely different models, which we expected as we initially provided a very broad aim. The first group used a “concrete” route of exploration and adopted a comparative case study approach, juxtaposing two hypothetical restaurant chains, one that adopted the ideas of organisational plasticity and one that worked with a more traditional organisational setup. Using a case study made it easy for everyone to relate to something more realistic and to contribute own experiences and innovations during information collection. Furthermore, this group decided to focus on operational plasticity as a subset of organisational plasticity, to deal with the limited time that was available. The second group used an “abstract” route of exploration, looking at the system from a more theoretical and highly abstract perspective. The idea was that of interpreting plasticity qua adaptability, hence starting from an external “shock” or stimulus that would impact an organisation. This macro event’s effects would then be absorbed differently depending on organisational characteristics (e.g., internal structure, role distributions, norms, culture). The group also assumed that the external shock event would evolve while the organisation attempts at dealing with it. This implies that a plastic organisation is the one where some workers are capable of diagnosing the implications of a shock and of monitoring its potential future impacts. The discussion also indicated that the network of formal and informal relationships within an organisation might play a significant role in identifying degrees of plasticity. A preliminary attempt to understand how discussions from the two groups could be put to work on an agent-based model are provided in the section below.

3 Feeding an agent-based model

Through the discussions in the PhiloLab sessions it was determined that, when considering how a model based on organisational plasticity is built, there are few key questions that need to be answered. These are: (a) what differentiates plastic organisations from other organisations? (b) What elements need to be considered when making an organisation “plastic”? Both of these questions are highly relevant when considering the heightened dynamism required by modern organisations to deal with both internal and external pressures [10]. Evidence shows that such complexities, if unaddressed, invariably lead to a high rate of business mortality [23]. One of the root causes for this increase in organisational mortality is the inability of organisations and managers alike to adapt to these highly demanding complexities [22]. Therefore, through this model we attempt to explore how plasticity may lead to higher organisational adaptability.

In tackling the first question (a), we used the formalisation continuum by Cohen, March and Olsen [7] and its subsequent adaptations [12, 16] as a starting point.

As depicted in Figure 2, one end of the spectrum (A) constitutes complete anarchy while the other end depicts complete hierarchy (B). Both the extremes

Fig. 2. Formalisation Continuum

A and B are logical end points in the continuum but are not representative of the modern world. For instance, an organisation cannot function with complete anarchy, where all workers' goals are completely mutually exclusive, with no organisational boundaries or cohesion [7]. Likewise a completely formal organisation is equally unlikely, especially when considering that there are no organisations' where every employee's goals are aligned directly with the organisation's goals. In reality, modern organisations fall somewhere in between the two extreme ends of the spectrum. In this continuum the level of formalisation is based on *structural* and *functional* elements of the organisation [15]. The structure in this case refers to the manner in which the organisation is set up in terms of lines of command, information flow and power dynamics. Function in this case refers to the rules of interaction the workers within the organisation have to abide by.

Even though Figure 2 provides some insight on how a plastic organisation can be differentiated from other organisations through the formalisation dimension (a possible parameter in a model) it is not sufficient in encapsulating the concept of plasticity fully. Therefore, while a plastic organisation ought to be less formalised there are few other elements which need to be considered. Based on the extant literature [18, 14] one key facet of plasticity is an organisation's ability to adapt to both internal and external stimuli while preserving its core identity. The identity here refers to the core business functions of the organisation (another aspect of an ABM agent). It is also envisaged that plastic organisations are more explorative and opportunistic in dealing with stimuli than organisation's which are not plastic [3]. Based on this, the following starting axioms can be defined for a model of plasticity.

It should be noted the axioms discussed in Table 1 are non-exhaustive and more research is required in order to determine if the aforementioned axioms are sufficient for a comprehensive model of plasticity. Nevertheless, the axioms in Table 1 provide a starting point for developing an agent-based model of plasticity.

Upon defining the starting axioms, it could be then determined how best to model plasticity in an agent-based environment. Keeping in line with need for modern organisations to be adaptable to external and internal stimuli, we envisage a model which has two environmental conditions (namely, A and B). Condition A and condition B can be seen as two different organisations. A is more plastic than B, where A has all the axioms discussed in 1 operationalised while B does not. Each of the environments will have 2 types of agents, namely workers and tasks. The *workers* here refer to the employees within the organisation and can be differentiated based on job role (i.e. low level workers, middle

Table 1. Primary Axioms of a Plastic Organisation: Preliminary Sketch for a Model

Point	Characteristic	Description
A	Higher functional disorganisation	A plastic organisation has relatively low functional boundaries imposed on workers (in terms of rules and procedures) in seeking and engaging organisational tasks.
B	Higher structural disorganisation	The hierarchical set up of the organisation is relaxed to a point where works can easily interact between hierarchical levels and power structures, while having open access to all the relevant information required for effective task completion.
C	Preservation of its core identity while adapting to external and stimuli	While the organisation might change its operations and the level of formalisation, the core competencies of the organisation is preserved. The core competencies would be the values, vision and mission of the organisation.
D	Highly Opportunistic characteristics	Depending on the opportunities available plastic organisations will change its operations to engage with as many relevant opportunities as possible.
E	Highly Explorative characteristics	Plastic organisations will use explorative strategies throughout their operations in order to constantly asses opportunities available both internally and externally.

managers, top management). The *task* will be the internal and external stimuli which the workers will have to deal with. Each task will have a *time* element where there is a limited time when which workers can interact with the task, mirroring how real world tasks work. Each task will also have a level of *complexity*. Both conditions A and B will have the same set of tasks. The model then can be developed in a manner where it will provide the researchers the capability of observing the differences between condition A (plastic condition) and B (non-plastic condition). This also provides some insight into which condition is more adaptable to internal and external pressures.

4 Lessons learned and concluding remarks

At the current juncture, the model is at its most basic specification and has some unanswered questions. First, it is not clear if the axioms currently determined are enough to encapsulate organisational plasticity. It may be the case the more axioms are required. Second, while comparing two conditions as discussed above might provide some indication as to the differences of plastic and non-plastic systems, it does not clearly take context into account. Finally, through the PhiloLab

discussion there were a few key concepts such as docility [26, 5, 25] which were left out in the initial development of the model. It might be worth revisiting some of these concepts in order to improve the granularity of the agents within the model (i.e. workers and tasks). While there are many open questions still are unanswered, having a starting point akin to the model we have outlined here will be the next step in moving this research forward.

We have also learned some key lessons from the organisational plasticity experiment that will guide us and others who will want to use the PhiloLab framework in the future. They can be summarised as follows:

- Be aware that the main creative energy is unleashed in the problem analysis part. If you run parallel focus groups and provide only an aim to base the model development on you are very likely to end up with very diverse and innovative models. This is ideal when you are after innovative research ideas. If you provide a complete problem analysis (including everything from aim to responses) you are very likely to end up with similar models that are also in line with what you would expect as the moderator. This is ideal if you need in-depth understanding of a specific topic or if you need input for a specific model. It is also a strategy to consider if you have limited time, as problem analysis takes quite a substantial amount.
- In the workshop we had participants who could only stay for the first session and others who joined only for the second session. This did not cause any problems, as previous work could be easily explained thanks to the produced documentation (i.e. the tables and UML diagrams).
- When initially explaining the concept of PhiloLab to participants, one should use an example that is not directly related to the topic that is going to be discussed, so that people do not get mixed up later. Once the model development process has been completed, it would be good to show the participants some concrete output (so they can see some value in their participation). As it is often impossible to show an implementation of the model that was developed at the end of a workshop, it would be good to show them an implementation of the example you presented in the introductory session. In this way they get at least a feeling for how a potential implementation of their own model would look like, and are more likely to participate in following events.

This article presents some sketches for an exploratory agent-based model designed to understand and define organisational plasticity and its consequences. The work was conducted using an experiment in community modelling through the PhiloLab framework. Results indicate that the problem is rather complex but it also shows good potentials for a simulation model to tackle some of the key issues related to organisational plasticity.

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References

1. Abrahamson, E.: Disorganization theory and disorganizational behavior. *Research in Organizational Behavior* **24**, 139–180 (2002)
2. Abrahamson, E., Freeman, D.H.: *A Perfect Mess: The Hidden Benefits of Disorder*. New York: Little Brown (2007)
3. Andren, L., Magnusson, M., Sjolander, S.: Opportunistic adaptation in start-up companies. *International Journal of Entrepreneurship and Innovation Management* **3**(5-6), 546–562 (2003)
4. Ansoff, H.I.: *Corporate Strategy*. New York: McGraw-Hill (1965)
5. Bardone, E., Secchi, D.: Inquisitiveness: Distributing rational thinking. *Team Performance Management* **23**(1/2), 66–81 (2017)
6. Burnes, B.: Complexity theories and organizational change. *International Journal of Management Reviews* **7**(2), 73–90 (2005)
7. Cohen, M.D., March, J.G., Olsen, H.P.: A garbage can model of organizational choice. *Administrative Science Quarterly* **17**(1), 1–25 (1972)
8. Edmonds, B.: Different modelling purposes. In: Edmonds, B., Meyer, R. (eds.) *Simulating Social Complexity. A Handbook*, pp. 39–58. New York: Springer, second edn. (2017)
9. Edmonds, B., Meyer, R. (eds.): *Simulating Social Complexity. A Handbook*. Heidelberg: Springer, second edn. (2017)
10. Eller, F.J., Fischer, S., Diedrich, L.: Managing (in) times of uncertainty: The effects of leadership sensemaking on employee well-being in dynamic business environments. In: Wiencke, M., Cacace, M., Fischer, S. (eds.) *Healthy at Work*, pp. 127–137. Springer, Cham (2016)
11. Fioretti, G.: Two measures of organizational flexibility. *Journal of Evolutionary Economics* **22**(5), 957–979 (2012)
12. Fioretti, G., Lomi, A.: An agent-based representation of the garbage can model of organizational choice. *Journal of Artificial Societies and Social Simulation* **11**(1), 1 (2008)
13. Fowler, M.: *UML distilled: a brief guide to the standard object modeling language*. Addison-Wesley Professional (2004)
14. Frank, H., Güttel, W., Kessler, A.: Environmental dynamism, hostility, and dynamic capabilities in medium-sized enterprises. *International Journal of Entrepreneurship and Innovation* **18**(3), 185–194 (2017)
15. Herath, D., Costello, J., Homberg, F.: Team problem solving and motivation under disorganization – an agent-based modeling approach. *Team Performance Management* **23**(1/2), 46–65 (2017)
16. Herath, D., Secchi, D., Homberg, F.: Simulating the effects of disorganisation on employee goal setting and task performance. In: Secchi, D., Neumann, M. (eds.) *Agent-Based Simulation of Organizational Behavior. New Frontiers of Social Science Research*, pp. 63–84. New York: Springer (2015)
17. Levinthal, D.: Adaptation on rugged landscapes. *Management Science* **43**, 934–950 (1997)
18. Levitt, B., March, J.G.: Chester i. barnard and the intelligence of learning. In: Williamson, O.E. (ed.) *Organization Theory. From Chester Barnard to the present and beyond*, pp. 11–37. New York: Oxford University Press, 2nd edn. (1995)
19. Mintzberg, H.: *The Structuring of Organizations*. Englewood Cliffs, NJ: Prentice-Hall (1979)

20. Mitleton-Kelly, E.: Complexity research - approaches and methods: The LSE complexity group integrated methodology. In: Keskinen, A., Aaltonen, M., Mitleton-Kelly, E. (eds.) *Organisational Complexity*, pp. 56–77. Tutu Publications. Finland Futures Research Centre, Turku School of Economics and Business Administration, Turku, Finland (2003)
21. Murray, F., Tripsas, M.: The exploratory processes of entrepreneurial firms: The role of purposeful experimentation. In: Baum, J.A., McGahan, A.M. (eds.) *Business Strategy over the Industry Lifecycle*, *Advances in Strategic Management*, vol. 21, pp. 45–75. Emerald Group Publishing Limited (2004)
22. Reeves, M., Deimler, M.: Adaptability: The new competitive advantage. *Harvard Business Review* **89**(7-8), 134 (2011)
23. Reeves, M., Levin, S., Ueda, S.: The biology of corporate survival. *Harvard Business Review* **94**(1), 2 (2016)
24. Scott, W.R.: *Organizations. Rational, Natural, and Open Systems*. Englewood Cliffs, NJ: Prentice-Hall, 5th edition edn. (2003)
25. Secchi, D.: *Extendable rationality. Understanding decision making in organizations*. New York: Springer. (2011)
26. Secchi, D., Bardone, E.: Super-docility in organizations. An evolutionary model. *International Journal of Organization Theory and Behavior* **12**(3), 339–379 (2009)
27. Secchi, D., Cowley, S.J.: Modeling organizational cognition: the case of impact factor. *Journal of Artificial Societies and Social Simulation* **21**(1), 13 (2018)
28. Siebers, P.O.: PhiloLab: An artificial lab to investigate philosophical questions. In: *ESSA@work Simulation Workshop*, 23-24 Nov. Hamburg, Germany (2017)
29. Siebers, P.O., Klügl, F.: What software engineering has to offer to agent-based social simulation. In: Edmonds, B., Meyer, R. (eds.) *Simulating Social Complexity. A Handbook*, pp. 81–117. New York: Springer, second edn. (2017)
30. Van de Ven, A.H., Hargrave, T.J.: Social, technical, and institutional change: A literature review and synthesis. In: Poole, M.S., Van de Ven, A.H. (eds.) *Handbook of organizational change*, pp. 259–303. New York: Oxford University Press (2004)